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Overreaction or Fundamentals: Some Lessons from Insiders' Response to the Market Crash of 1987

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ABSTRACT

This paper shows that i) the Crash was a surprise to corporate insiders; ii) insiders became buyers of stock in record numbers immediately following the Crash; iii) stocks that declined more during the Crash were also purchased more by insiders; and iv) stocks that were purchased more extensively by insiders during October 1987 showed larger positive returns in 1988. The overall evidence suggests that overreaction was an important part of the Crash.

THE DOW JONES INDUSTRIAL Average (DJIA) declined by 769 points (30.7%) from October 13 to 19, 1987 (Tuesday to Monday), with a record one-day drop of 508 points (22.6%) on October 19 alone. Similar declines occurred on other equity markets: the American Stock Exchange (ASE), the Over-the-Counter (OTC) market, and international stock markets. Various explanations have been offered to account for the October Crash.

One view relies on shifts in fundamental factors: Roll (1989) suggests downward revised expectations for the worldwide economic activity; Fama (1989) advocates sudden upward revision in equilibrium required stock returns as measured by the increase in dividend yields; and Black (1988) argues for sharply declining relative risk aversion, coupled with a sudden realization of lower future expected returns.

Another view is that stock prices can take swings from fundamental values because of trading activities of the uninformed (Shiller (1984) and De Long, Shleifer, Summers, and Waldmann (1989, 1990a,b)).¹ While this view does not identify what triggered the Crash, it predicts that the activities of noise traders contributed to an overreaction in market prices: an adjustment in stock prices occurred in reaction to a proposed tax legislation in mid-October. This adjustment was turned into a major crash, and stock prices were driven below the fundamentals as a result of positive feedback investment strategies by uninformed traders,

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¹ Also see Shiller (1981, 1987, 1988) and Summers (1986). Gennotte and Leland (1990) present a model where most investors react to liquidity shocks as if they were fundamental news. Consequently, relatively small liquidity shocks produce large swings in prices.

such as portfolio insurers, hedge funds, and pension and endowment funds.² This view implies that stock prices should have rebounded after the Crash since prices are determined by the fundamentals in the long run.

An analysis of insider trading can help to uncover the relative contribution of fundamental shifts and noise traders in pricing behavior around the time of the Crash. If stock prices during and after the Crash responded largely to shifts in fundamental factors, insider trading patterns during the Crash would not be expected to be informative for post-Crash stock price behavior since stocks were priced correctly during and after the Crash. Instead, stocks' sensitivity to movements in expected market returns, market risk, should be an important predictor of the stock price during and after the Crash. However, if overreaction was important, insiders should have been net purchasers of their own firms' stock during and after the Crash since stock prices were below their fundamental values. Moreover, insiders of firms whose stock prices moved relatively farther away from their fundamental values should have been the heaviest traders.

This paper examines insider trading activity around the Crash. Evidence indicates no increase in net insider selling activity immediately before the Crash, but, following the record decline in stock prices, insiders became buyers of their firms' stocks in record numbers. Moreover, stocks that fell more than average in October 1987 were also purchased to a greater extent by insiders, and those stocks purchased to a greater extent had greater subsequent positive returns. In contrast, pre-Crash market risk does not explain the post-Crash returns.

The evidence suggests that overreaction was an important part of the price behavior during the Crash. In contrast, the evidence provides little support for the view that fundamentals (i.e., future economic activity or required stock returns) influenced pricing around the time of the Crash. There can, of course, be other fundamental factors not examined here, such as a decline in expected future takeover activity or tax law changes, that may have influenced market pricing around the Crash.

The remainder of the paper is organized as follows. Section I explains how insider trading activity can be used to identify the relative contribution of overreaction and fundamentals to the Crash. Section II presents the empirical results. First, monthly and daily time series tests of insider trading are examined, followed by cross-sectional tests, predictive ability of insider trading activity around the Crash, sensitivity tests, and examination of the economic significance. Section III contains the conclusions.

² De Long, Shleifer, Summers, and Waldmann (1990b) refer to portfolio choices based on extrapolative expectations, use of stop loss orders, sales of margined stock when the price drops to a certain point, and portfolio insurance strategies as examples of positive feedback trading. Mitchell and Netter (1989) identify the news about pending legislation before the House Ways and Means Committee on October 13 that would have eliminated the current tax benefits with leveraged buyouts and imposed a tax on greenmail profits as the trigger for the Crash. The Brady Report (1988) states that, of the \$21 billion traded on the NYSE on October 19, portfolio insurers sold \$1.75 billion and bought \$0.45 billion, while index arbitrageurs sold \$1.42 billion and bought \$0.11 billion. In contrast, corporations purchased \$0.41 billion.

I. Insider Trading Activity

A. The Information Content of Insider Trading

Previous studies on insider trading document that insiders can predict firm-specific stock price movements in their own firms.³ Seyhun (1988, 1990), however, provides evidence that aggregate insider trading activity helps to predict future market movements. For example, past 12-month aggregate insider trading activity explains up to 40 percent of the variation in 6-month future stock market returns (Seyhun (1990)). The positive relation between aggregate insider trading activity and future market movements occurs because part of the mispricing insiders observe is due to economy-wide factors. Since firms' cash flows are affected by firm-specific, industry-wide, and economy-wide factors, insiders' transactions reflect the effects of economy-wide as well as firm-specific factors. Hence, aggregate insider trading can serve as an advance signal about movements in fundamental factors.

To identify the contribution of the fundamental factors to the Crash, one needs to identify the fundamental factors that shifted during the Crash. If expectations about future economic activity were suddenly lowered or the required stock returns were suddenly raised, then the firm's market risk should be an important predictor of the large stock price changes both during and after the Crash (Roll (1989)). Risky firms should have declined more during the Crash and benefited more from the subsequent recovery. Alternatively, if a sharply declining relative risk aversion contributed to the Crash, then a decline in stock prices would have resulted in lower wealth and made individual investors more risk averse and less willing to hold stock. Consequently, insiders should have been sellers of stock during the Crash since most insiders hold large undiversified positions in their own firms.⁴

Insider trading activity can also substantiate the importance of an overreaction effect. First, if prices on average declined below fundamental values as a result of the Crash, then insiders should have been net purchasers of stock immediately following the Crash. Second, corporate insiders should react to divergences between fundamental value and stock price: stocks that declined more should have been purchased more. Third, stocks that were purchased more on average during the Crash should have had greater post-Crash recovery.

If insiders behave as naive contrarians (i.e., simply buy stock following declines in price and sell stock following increases in price), then October 1987 stock returns should have as much or more predictive power for subsequent returns than the insider trading activity. However, if insiders use information in addition to the recent stock price changes, then the predictive ability of insider trading activity would not be dominated by stock returns in October 1987. Also, the overreaction view suggests that the post-Crash stock price recovery patterns can remain predictable even after the insider trading information becomes public.

³ See Lorie and Niederhoffer (1968), Jaffe (1974), and Seyhun (1986).

⁴ Benston (1985) reports that, when stock returns exceed 30 percent in either direction, the average officer/director gains or loses more than five times his or her annual (nonstock) remuneration from his or her stockholdings in his or her own firm.

To focus on insiders' response to the Crash, it is necessary to control for normal insider trading activity as well as any seasonal movements related to tax reasons. Normal insider trading patterns differ across firms depending on firm size. In large firms, corporate insiders are usually given stock options as part of their compensation. Selling the shares acquired by option exercises increases their normal sale activity. Also, the October 1987 crash was followed by announcements of stock repurchase programs by about 600 firms. However, insiders are not expected to purchase stock immediately ahead of their firms' repurchase programs and sell their shares back to their corporations at a profit, since Section 16(b) of the Securities and Exchange Act of 1934 requires that any profits made by insiders from a purchase and a sale, or a sale and a purchase, within a six-month period be returned to the corporation.⁵

B. Data

The insider trading data used in this study were compiled by the Securities and Exchange Commission (SEC). The file contains all reported insider transactions in all publicly held firms from January 1975 to November 1988. This study analyzes a sample of these transactions in 6,865 firms present on the NYSE, the ASE, and the NASDAQ files of the Center for Research in Security Prices (CRSP) during 1987 or 1988. This paper examines open-market sale and purchase transactions by insiders: other insider transactions such as exercises of options, shares acquired from a compensation plan, private transactions, etc., are excluded since open-market sales and purchases occur more frequently for information reasons.⁶

This paper focuses on the ratio of purchases to all insider transactions rather than net dollar volume, number of shares traded, or number of transactions. This ratio is not sensitive to changes in the number of firms or trading activity over time. Moreover, the ratio does not display heteroscedasticity or extreme outliers. Specifically, define

$$\text{PRAT} = \text{NP}/(\text{NP}+\text{NS}) \quad (1)$$

and

$$\text{SPRAT} = \text{SP}/(\text{SP}+\text{SS}). \quad (2)$$

⁵ Netter and Mitchell (1989) report that all repurchase programs at the time of the Crash amounted to less than one percent of all outstanding shares, and a majority of firms that announced share repurchases did not actually buy shares. Also, those firms that did buy shares had a smaller stock price rebound during the forty days following the Crash than those firms that did not buy back shares.

⁶ This assertion is empirically tested on a similar data set (not shown). The average abnormal price movement following insiders' private transactions is smaller. Other transactions by insiders such as exercises of options or redemptions are followed by insignificant abnormal price movements which at times are opposite of the predicted signs. Numerous consistency checks on dates, prices, and shares were performed to eliminate approximately 3,000 transactions containing apparent data errors. Also, approximately 200 firms with alphanumeric CUSIP numbers are excluded to identify potential typographical errors.

The term PRAT denotes the number of purchases as a fraction of all purchases and sales by insiders, NP is the number of purchases, and NS is the number of sales. Similarly, SPRAT denotes the number of shares purchased as a fraction of all shares purchased and sold by insiders, SP is the number of shares purchased, and SS is the number of shares sold.

II. Empirical Evidence

A. Monthly Insider Trading Activity

Table I, Panel A, displays the monthly insider trading activity from January 1987 to November 1988. Panel B shows the sample characteristics of the

Table I
Monthly Insider Trading Activity in 6,865 Firms Between January 1987 and November 1988 and Selected Sample Statistics from January 1975 to November 1988

NP denotes the number of purchases, NS denotes the number of sales, and PRAT equals $NP/(NP + NS)$. Similarly, SP denotes the number of shares purchased (in thousands), SS denotes the number of shares sold (in thousands), and SPRAT equals $SP/(SP + SS)$.

Panel A: Monthly Insider Trading Activity						
Month	NP	NS	PRAT	SP	SS	SPRAT
January 1987	1,051	1,591	0.40	7,163.1	18,005.1	0.28
February 1987	918	2,177	0.30	5,563.6	29,118.4	0.16
March 1987	929	1,918	0.33	15,723.0	28,664.4	0.35
April 1987	1,162	1,311	0.47	11,243.4	26,945.4	0.29
May 1987	1,126	1,312	0.46	8,957.1	20,815.3	0.30
June 1987	896	1,387	0.39	7,105.8	25,206.4	0.22
July 1987	1,004	1,320	0.43	16,410.9	35,245.2	0.32
August 1987	794	1,774	0.31	5,075.4	21,352.0	0.19
September 1987	938	1,100	0.46	22,805.1	16,347.4	0.58
October 1987	3,377	849	0.80	28,762.4	17,581.6	0.62
November 1987	2,151	689	0.76	13,436.6	21,149.2	0.39
December 1987	2,119	847	0.71	19,463.4	11,234.2	0.63
January 1988	1,133	908	0.56	18,533.5	9,799.2	0.65
February 1988	1,285	1,709	0.43	11,222.2	21,757.9	0.34
March 1988	1,713	2,124	0.45	33,661.8	41,451.4	0.45
April 1988	1,562	1,354	0.54	17,293.1	25,740.0	0.40
May 1988	1,803	1,504	0.55	16,299.2	31,581.0	0.34
June 1988	1,480	1,719	0.46	18,153.5	33,160.3	0.35
July 1988	1,281	1,171	0.52	12,459.5	46,577.1	0.21
August 1988	1,612	1,505	0.52	15,496.6	25,515.9	0.38
September 1988	1,238	1,275	0.49	14,495.6	21,489.5	0.41
October 1988	1,239	1,205	0.51	28,526.4	18,050.9	0.61
November 1988	939	563	0.63	9,108.4	15,496.1	0.37
Panel B: Monthly Sample Statistics (January 1975 to November 1988)						
Mean	1,298	1,520	0.48	9,882.6	16,944.7	0.44
Standard dev.	329	641	0.11	7,807.4	18,604.6	0.15
Minimum	794	462	0.22	2,275.0	1,139.0	0.06
Maximum	3,377	3,330	0.80	77,345.0	170,930.0	0.81

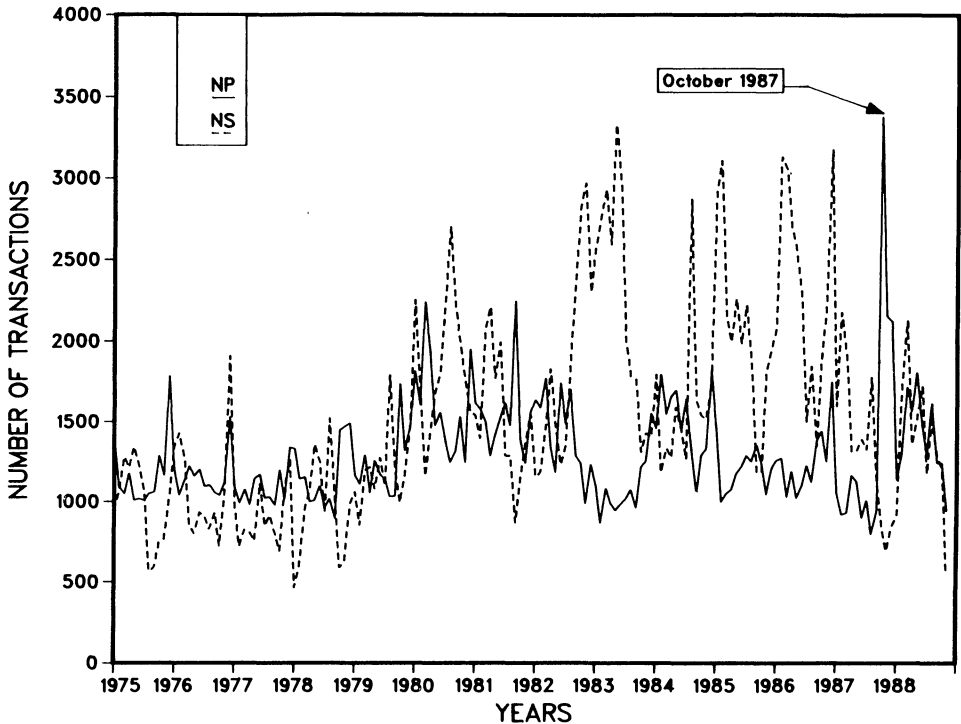


Figure 1. Monthly number of purchases (NP) and sales (NS) by insiders from January 1975 to November 1988. The sample contains 6,865 firms present on the insider trading tape of the SEC and the New York Stock Exchange, American Stock Exchange, or NASDAQ files of the Center for Research in Security Prices of the University of Chicago during 1987–1988.

insider trading activity (mean, standard deviation, minimum, and maximum) for 167 months from January 1975 to November 1988. Figures 1 to 3 show the monthly values of NP, NS, SP, SS, PRAT, and SPRAT from January 1975 to November 1988.

Table I shows that, over the 167 months, there were, on average, 1,298 purchase and 1,520 sale transactions per month by insiders. Hence, the data base contains over 470,000 insider transactions. For October 1987, the number of stock purchases by insiders equals 3,377, which is the sample *maximum*, and is 6.32 standard deviations above the sample monthly average of 1,298. Similarly, the number of sales by insiders equals 849, which is 1.05 standard deviations below the sample monthly average of 1,520. Visual examination of Figure 1 suggests that both NP and NS are mean-stationary series from 1975 to 1988.⁷ There is a gradual decline in NS prior to the Crash accompanied by a sharp rise in NP during the Crash. Also, NS displays substantially greater variability than NP, especially during the 1980's.

⁷ AR(1) models with estimated autoregressive coefficients equal to 0.49 and 0.77 yield insignificant Box–Pierce Q-statistics at conventional levels for NP and NS, respectively.

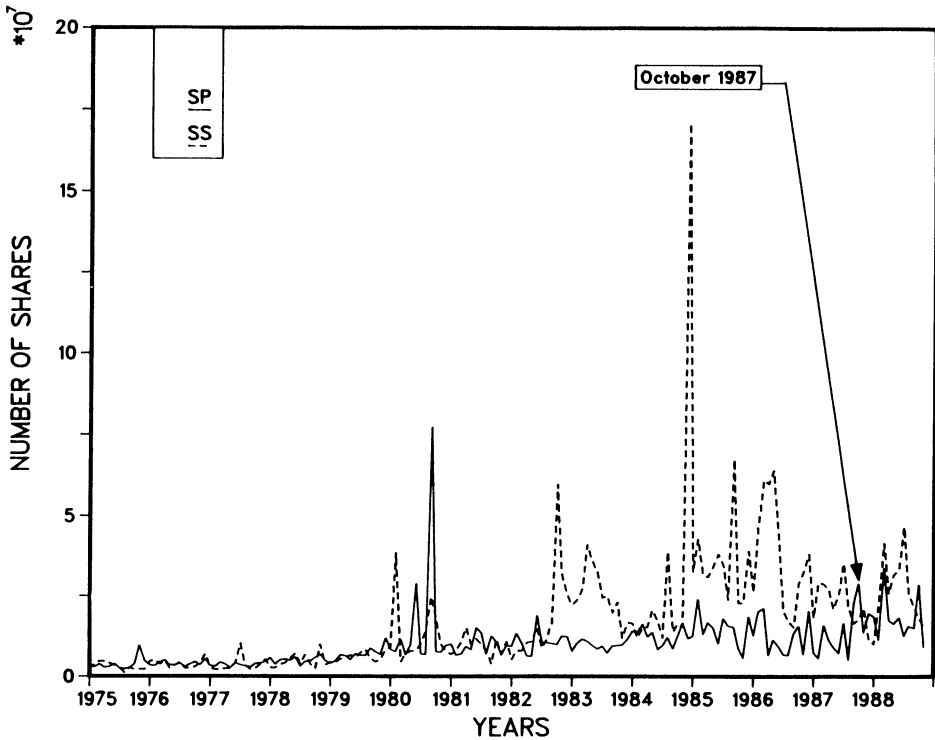


Figure 2. Monthly number of shares purchased (SP) and shares sold (SS) by insiders from January 1975 to November 1988. The sample contains 6,865 firms present on the insider trading tape of the SEC and the New York Stock Exchange, American Stock Exchange, or NASDAQ files of the Center for Research in Security Prices of the University of Chicago during 1987–1988.

The number of shares traded by insiders follows a pattern similar to the number of transactions. Over the 167 months, there were, on average, 9.88 million share purchases and 16.94 million share sales per month. For October 1987, the number of shares purchased equals 28.76 million, and the number of shares sold equals 17.58 million. As Table I and Figure 2 indicate, there is substantially greater variability in the number of shares traded. As a result, the number of shares traded does not exhibit the same significance levels as the number of purchases. For instance, in October 1987 the SP value of 28.8 million is only 2.42 standard deviations above its sample average of 9.88 million shares. Also, visual examination of Figure 2 suggests that both SP and SS display a positive trend over the sample period.

Finally, Table I and Figure 3 show the purchase ratios, PRAT and SPRAT. For October 1987, PRAT equals 0.80, which is also the sample maximum and is 2.91 standard deviations above the sample average of 0.48. The share purchase ratio, SPRAT, shows a more modest increase for October 1987. It equals 0.62, which is 1.20 standard deviations above the sample average of 0.44. Figure 3

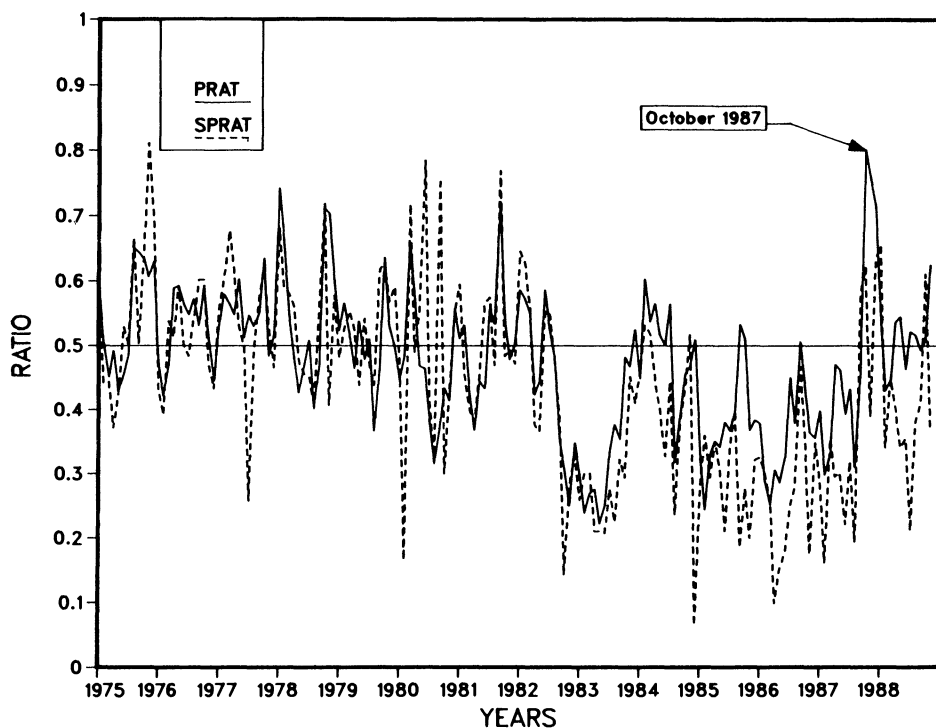


Figure 3. Ratio of monthly number of insider purchases to all insider transactions (PRAT) and ratio of monthly number of shares purchased by insiders to all shares traded by insiders (SPRAT) from January 1975 to November 1988. The sample contains 6,865 firms present on the insider trading tape of the SEC and the New York Stock Exchange, American Stock Exchange, or NASDAQ files of the Center for Research in Security Prices of the University of Chicago during 1987–1988.

indicates a positive autocorrelated, mean-stationary series for both PRAT and SPRAT.⁸

Top executives' transactions are examined separately since they are more informative about future stock price movements (Seyhun (1986)). Top executives are defined as chairmen of the boards of directors, officer-directors, controlling persons, and general partners. Data show that the top executives purchased shares even to a greater extent than all insiders during the Crash: in October 1987 PRAT for the top executives equaled 0.81, which was also the sample maximum. In general, sales were normally more prevalent than purchases during the 167-month sample period because the top executive received more shares as compensation that were disposed of through open market sales.

Mitchell and Netter (1989) argue that the Crash was triggered by a decline in takeover activity due to a proposed tax legislation. If the stock price declines are due entirely to a worsening cash flow outlook as a result of the proposed tax

⁸ An AR(1) model with an estimated autoregressive coefficient equal to 0.71 produces a good fit for PRAT. SPRAT is more complex. An ARMA(1,1) with a seasonal AR(1) at the 12th lag produces a good fit as judged by insignificant Box–Pierce Q-statistics.

legislation, then insiders in the takeover-related firms would be net sellers of stock immediately before and during the Crash. On the other hand, if overreaction is also present, then insiders would be expected to be purchasers of stock following the stock price declines.

The data indicate that insiders in 19 takeover-related firms identified by Mitchell and Netter (1989) were mostly purchasers of their firms' stock immediately before and following the Crash (not shown). During the one week before October 19, there is a single purchase transaction for 100 shares, while there is no stock sale. During the two weeks starting on October 19, insiders bought 33,352 shares with 21 purchases in seven firms and sold only 3,700 shares with two sales in two firms. In ten firms, there were no insider transactions. This evidence is consistent with an overreaction effect even in the takeover-related firms.

Overall, Table I and Figures 1 to 3 indicate that insiders responded to the stock market Crash of October 1987 with record increases in purchases. The next group of test formally examines whether the increases in insider trading activity and the greater prevalence of purchases are statistically significant.

B. Time Series Tests

The test shown in this section analyze insider trading activity before, during, and after the Crash. The purpose of these tests is to determine insiders' response to the Crash. Table II shows the results of a time series regression analysis. The dependent variables are various measures of insider trading activity. The independent variables are indicator variables for various periods around the stock market Crash. The first nine months of 1987 saw a sharp rise in stock prices (the DJIA was up by about 40 percent) and hence provide a benchmark time period to contrast with the Crash period. Given that all the series are positively autocorrelated, the regressions also estimate univariate time series models for the errors to ensure that the usual Gauss-Markov assumptions about the residuals are satisfied.

Overall evidence in Table II shows i) a reduction in both purchases and sales during the nine months before the Crash, resulting in insignificant net trading activity, ii) a significant increase in insiders' purchases during the Crash, iii) a continued increase in purchases immediately following the Crash, and iv) a return to usual trading activity during 1988.

Model (1) of Table II shows that the nine months before October 1987 (January 1987 to September 1987) were characterized by lower stock purchases by corporate insiders as compared with the period from 1975 to 1987. The coefficient estimate for the month of October 1987 shows an increase of 1,900 purchases over the normal purchases of 1,290 (given by the intercept). The increase in the number of purchases has a *t*-statistic of 7.7 and is statistically significant at the one percent level. This increase in the purchase activity continues for the next three-month period.

Model (2) of Table II shows the number of insiders' sale transactions. Once again, the pre-Crash period is characterized by reduced sales. October 1987 displays a reduction in insiders' sales which is significant at the 5 percent level.

Table II
Time Series Regression of Monthly Insider Trading Activity in 6,865 Firms Against Indicator Variables Denoting Various Periods Around October 1987

The time period of analysis is from January 1975 to November 1988. NP denotes the number of purchases (in thousands), NS denotes the number of sales (in thousands), and PRAT equals NP/(NP + NS). Similarly, SP denotes the number of shares purchased (in millions), SS denotes the number of shares sold (in millions), and SPRAT equals SP/(SP + SS). Insider trading activity (NP, NS, SP, SS) is first summed across the 6,865 firms. PRAT and SPRAT are computed using aggregated data. The indicator variable I_t equals one for period t relative to October 1987 and equals zero otherwise. For instance, for October 1987, I_0 equals one, and it equals zero otherwise; and, for the period November 1987 to January 1988, $I_{1,3}$ equals one, and it equals zero otherwise. t -Statistics are in parentheses. In brackets are the p -values of $\chi^2(24)$ (Box-Pierce statistics), which test the hypothesis that autocorrelations of the residuals up to 24 lags are equal to zero.

$$(\text{Insider Trading Variable})_t = \alpha_0 + \alpha_1 I_{t-9} + \alpha_2 I_{t-6} + \alpha_3 I_{t-3} + \alpha_4 I_0 + \alpha_5 I_{1,3} + \alpha_6 I_{4,6} + \alpha_7 I_{7,9} + A(L)\epsilon_t,$$

$$A(L) = 1/(1 - \gamma_1 L - \gamma_2 L^2 - \gamma_{12} L^{12}), \quad \text{where } L \text{ is the lag operator.}$$

Model No.	Insider Trading Variable	Regression Model							Error Model				
		Constant	I_{t-9}	I_{t-6}	I_{t-3}	I_0	$I_{1,3}$	$I_{4,6}$	$I_{7,9}$	γ_1	γ_2	γ_{12}	$\chi^2(24)$
(1)	NP	1.29 (33.3)	-0.50 (-2.6)	-0.32 (-1.6)	-0.37 (-1.8)	1.90 (7.7)	0.43 (2.1)	0.24 (1.2)	0.14 (0.7)	0.51 (7.1)	—	—	24.1 [0.34]
(2)	NS	1.51 (9.1)	-1.03 (-2.6)	-1.26 (-2.5)	-1.08 (-2.0)	-1.20 (-2.1)	-1.25 (-2.3)	-0.40 (-0.8)	-0.28 (-0.7)	0.82 (16.2)	—	—	18.6 [0.67]
(3)	PRAT	0.48 (23.8)	-0.06 (-0.9)	0.00 (0.0)	-0.02 (-0.2)	0.28 (3.1)	0.20 (2.4)	0.04 (0.5)	0.03 (0.4)	0.69 (11.7)	—	—	18.5 [0.68]
(4)	SP	9.27 (8.6)	-3.93 (-0.8)	-1.07 (-0.2)	4.64 (1.0)	14.07 (2.0)	6.48 (1.4)	9.48 (1.9)	4.72 (1.0)	0.12 (1.5)	0.11 (1.4)	0.25 (3.0)	32.8 [0.04]
(5)	SS	15.01 (3.4)	-5.9 (-0.5)	-10.4 (-0.8)	-0.78 (-0.1)	-1.62 (-0.1)	-4.58 (-0.3)	11.45 (0.8)	13.82 (1.1)	0.30 (3.9)	0.28 (3.6)	0.18 (2.4)	23.6 [0.26]
(6)	SPRAT	0.47 (11.9)	-0.10 (-1.1)	-0.04 (-0.4)	0.04 (0.4)	0.19 (1.5)	0.15 (1.5)	-0.06 (-0.5)	-0.12 (-1.2)	0.36 (4.6)	0.17 (2.2)	0.26 (3.7)	26.8 [0.14]

Moreover, the reduction in insiders' sales extends into the first three months of the post-Crash period. The reduction in insider sale activity for the last six months of the post-Crash period is not significant.

Model (3) of Table II examines the behavior of the purchase ratio, PRAT. For the first nine months of 1987, PRAT is not significantly different from its sample average of 0.48. Consequently, it appears that insiders were neither optimistic nor pessimistic during the nine months January 1987 to September 1987 when stock prices increased rapidly. For October 1987, PRAT jumps to 0.76 (0.48 plus 0.28). This increase in PRAT is significant at the one percent level. PRAT remains high, at a level of 0.68 (0.48 plus 0.20) for the first three months following October 1987. Finally, for the last six months of the post-Crash period, PRAT settles to its average level of about 0.48.

Models (4) to (6) of Table II show the behavior of the number of shares purchased, the number of shares sold, and the share-purchase ratio. The number of shares traded is a substantially more volatile measure of insider trading activity, and consequently the significance levels in models (4) to (6) are substantially lower. Nevertheless, as model (6) shows, the share-purchase ratio also shows a marginal increase for October 1987 and for the three months following October 1987.

The evidence provided by Table II statistically confirms the visual evidence provided by Figures 1 to 3. Overall, the evidence is consistent with the interpretation that insiders did not receive advance information about the Crash, and they regarded the stock market Crash as an unusually good opportunity to purchase shares. Positive insider sentiments continued for another three months following the Crash. The next group of tests provides greater detail about insider trading activity.

C. Daily Insider Trading Activity

Daily insider trading activity is analyzed to determine how insiders responded to the daily stock price movements in October 1987. Table III shows NP, NS, SP, SS, PRAT, and SPRAT, as well as the daily returns to the value-weighted and equally weighted indices of NYSE and AMEX firms in October 1987.⁹ The first seven trading days of October reveal a stock price decline of about three percent for the value-weighted index, without significant changes in insider trading activity. The average purchase ratio, PRAT, equals 0.54, which is close to its sample daily average of 0.48. Similarly, the average share-purchase ratio equals 0.34, which is also close to its sample daily average of 0.39.

The week of October 12 to October 16 shows the first signs of a major price break in the stock market as well as the first signs of increased insider purchase activity. The value-weighted index declines by about 9 percent, while PRAT averages 0.68 and SPRAT averages 0.54. Both figures are above their sample

⁹ Out of more than 470,000 transactions in the sample, the trading days for 9,068 transactions (1.9 percent) fell on weekends, presumably representing after-hours trading. In October 1987, there were 16 such transactions. In computing the daily sample statistics, these transactions were assumed to take place on the preceding Friday. Exclusion of these transactions does not affect the daily sample statistics.

Table III
Daily Insider Trading Activity in 6,865 Firms and Returns to Value-Weighted and Equally Weighted Market Indices of NYSE and AMEX Firms for October 1987, and Selected Sample Statistics from January 1, 1975 to November 30, 1988

There are 1,496 firms with insider trading activity in October 1987 (out of 6,865 firms in the sample). NP denotes the number of purchases, NS denotes the number of sales, and PRAT equals NP/(NP + NS). Similarly, SP denotes the number of shares purchased (in thousands), SS denotes the number of shares sold (in thousands), and SPRAT equals SP/(SP + SS). While October 31, 1987 is a Saturday, the New York Stock Exchange trading floor was open from 8:00 A.M. to noon to process orders from recent heavy trading volume.

Panel A: Daily Insider Trading Activity									
Date	NP	NS	PRAT	SP	SS	SPRAT	R _o	R _e	
10/1	71	54	0.57	136.5	1,829.7	0.07	0.0146	0.0055	
10/2	54	44	0.55	323.5	585.1	0.36	0.0026	0.0037	
10/5	42	53	0.44	386.6	596.3	0.39	0.0003	-0.0003	
10/6	37	31	0.54	93.5	636.1	0.13	-0.0230	-0.0129	
10/7	53	35	0.60	201.5	318.0	0.39	-0.0033	-0.0045	
10/8	41	31	0.57	129.5	188.8	0.41	-0.0132	-0.0090	
10/9	34	35	0.49	709.6	371.7	0.66	-0.0084	-0.0044	
10/12	38	16	0.70	208.3	35.1	0.86	-0.0064	-0.0091	
10/13	39	29	0.57	1,239.2	1,612.2	0.43	0.0139	0.0042	
10/14	47	25	0.65	351.6	740.1	0.32	-0.0250	-0.0159	
10/15	86	30	0.74	445.8	431.5	0.51	-0.0233	-0.0156	
10/16	84	31	0.73	631.4	442.1	0.59	-0.0487	-0.0393	
10/19	206	39	0.84	2,626.3	372.7	0.88	-0.1804	-0.1418	
10/20	352	39	0.90	4,051.7	1,585.5	0.72	0.0197	-0.0642	
10/21	340	45	0.88	2,089.6	1,748.4	0.54	0.0886	0.0984	
10/22	257	37	0.87	1,481.9	981.5	0.60	-0.0388	-0.0405	
10/23	235	37	0.86	1,721.0	540.4	0.76	-0.0031	-0.0139	
10/26	280	44	0.86	1,682.3	609.7	0.73	-0.0815	-0.0868	
10/27	309	43	0.88	1,623.4	717.2	0.69	0.0191	-0.0013	
10/28	287	32	0.90	2,621.0	512.6	0.84	-0.0003	-0.0152	
10/29	240	53	0.82	1,675.8	781.8	0.68	0.0445	0.0373	
10/30	203	46	0.82	2,892.3	685.9	0.81	0.0360	0.0604	
10/31	42	20	0.68	1,439.7	1,259.1	0.53	—	—	

Table III—Continued

Panel B: Daily Sample Statistics (January 1, 1975 to November 30, 1988)						
Statistics	NP	NS	PRAT	SP	SS	SPRAT
Mean	59.8	70.0	0.48	455.4	780.8	0.39
Standard dev.	31.5	37.8	0.14	1,314.5	2,341.6	0.23
Minimum	0	0	0	0	0	0
Maximum	352	270	1.00	38,538.3	87,485.6	1.00

averages. Most significantly, the large stock price drops on Friday, October 16, were accompanied by significant increases in insider purchase activity.

On October 19, the value-weighted CRSP index declines by 18.0 percent, while the equally weighted CRSP declined by 14.2 percent. At the same time, insiders responded to the Crash by purchasing shares in the open market in large numbers. On October 19, NP equals 206, which is 4.64 standard deviations above its sample daily average of 59.8, while NS equals 39, which is 0.82 standard deviations below its sample daily average of 70.0.¹⁰ Similarly, PRAT equals 0.84, which is 2.57 standard deviations above its sample daily average of 0.48. On October 20, 1987, NP equals 352 (9.28 standard deviations above its sample mean), which is also the *highest* daily purchase activity by insiders of any day from January 1, 1975 to November 30, 1988. Also on October 20, PRAT equals 0.90 (3.0 standard deviations above its sample mean). Consequently, it appears that insiders viewed the Crash as an unusually good stock purchase opportunity and responded by purchasing shares in record numbers immediately following the decline in prices. The dramatic increase in insider purchase activity during the Crash is even more remarkable since Section 16(b) of the Securities and Exchange Act requires insiders to return their "profits" back to their corporations if they sold any stock during the past six months at a (presumably) higher stock price.

Overall, the absence of selling prior to October 19 suggests that the corporate insiders did not expect the imminent crash as late of October 16, 1987.¹¹ Moreover, the data cast doubt on the view that sharply declining relative risk aversion was responsible for the Crash, which predicts selling activity by corporate insiders, since declining prices would reduce insiders' wealth, increase their risk aversion, and make them less willing to hold stock. Instead, the data suggest that insiders were surprised by the price drops. They viewed the sharp price drops as a possible overreaction and responded by purchasing shares in their own firms rather than selling shares.

The immediate post-Crash insider trading activity also suggests that insiders did not act as naive contrarians (i.e., mechanically taking positions against the market). While stock prices bounced back by about nine percent on October 21, insiders continued to purchase stock. Consequently, it appears that insiders were responding to a comparison between the current level of stock prices and what they believed were the fundamental values, rather than a naive contrarian strategy.

While not shown, the daily transactions of the top executives in October 1987 are also examined. The pre-Crash trading activity of top executives does not reveal that they expected an imminent crash. As stock prices dropped, top executives responded by purchasing shares. Moreover, the week of October 19

¹⁰ The greater increase in insiders' purchases compared with the decrease in insiders' sales is consistent with the greater information content of insiders' purchases in general (Seyhun (1986)). This may be explained in part by insider sales to diversify employment-related stockholdings and provide consumption.

¹¹ However, not all insiders would be expected to sell stock even if they expected an imminent crash. If an insider had previously purchased stock at a lower price, then his or her profit could be recaptured by the corporation (Section 16(b) of the Securities and Exchange Act). In general, Section 16(b) would restrain insiders' responses to unjustified short-term stock price movements.

reveals that the top executives responded to the Crash to a greater extent. Both PRAT and SPRAT values for the top executives exceed those for all insiders around the Crash. Following the Crash, the top executives continued their increased stock purchase activity. Hence, the increased stock purchases by corporate insiders were not confirmed to a particular group. In fact, the more informed and also less well-diversified top executives engaged in greater stock purchase activity around the Crash.

D. Cross-Sectional Tests

The next groups of test provide a cross-sectional analysis of insider trading around the Crash. The purpose of these tests is to determine whether insiders can identify those firms which moved further away from the fundamentals during the Crash.

Table IV shows the means, the standard deviations, and the cross-correlations of the variables used in the cross-sectional tests. The average stock price fall in October 1987 for the 6,865 firms included in this study is 26.6 percent, with a standard deviation of 0.149. The simple cross-correlations indicate that the Crash returns are negatively correlated with the post-Crash returns. The simple correlation coefficient of the October 1987 return with the 14-month return from November 1987 to December 1988 is -0.039 , which is significant at the one percent level. Hence, those stocks which fell more during the Crash also rebounded more following the Crash.

Table IV

Cross-Sectional Means, Standard Deviations, and Simple Cross-Correlations of Selected Variables for 6,865 Firms in the Sample

R_c denotes the stock return for the month of October 1987. $R_{p,1}$ denotes the 14-month post-Crash return from November 1987 to December 1988. $R_{p,2}$ denotes the 12-month post-Crash return from January 1988 to December 1988. Beta, denoted as β , is the market model slope coefficient and is computed using even months from 1981 to 1986. Due to a 12-month data availability requirement, beta is estimated for only 5,022 firms. LV denotes the log of the average market value of equity (in thousands) from 1975 to 1988. NP is the number of purchases, NS the number of sales, SP the number of shares purchased (in thousands), and SS the number of shares sold (in thousands) during October 1987.

	Mean	Standard deviation	Cross-Correlation Coefficients							
			$R_{p,1}$	$R_{p,2}$	β	LV	NP	NS	SP	SS
R_c	-0.268	0.149	-0.039 ^a	-0.019	-0.185 ^a	0.043 ^a	-0.033 ^a	-0.036 ^a	-0.024 ^b	-0.034 ^a
$R_{p,1}$	0.137	0.656	—	0.902 ^a	-0.054 ^a	0.097 ^a	0.030 ^b	-0.023	0.019	0.001
$R_{p,2}$	0.167	0.606		—	-0.040 ^a	0.043 ^a	0.020	-0.031 ^b	0.011	-0.008
β	0.952	0.950			—	0.050 ^a	0.007	0.029 ^b	0.026 ^b	0.015
LV	10.61	1.71				—	0.124 ^a	0.116 ^a	0.075 ^a	0.040 ^a
NP	0.492	2.009					—	0.086 ^a	0.317 ^a	0.042 ^a
NS	0.124	0.865						—	0.015	0.457 ^a
SP	4.19	48.45							—	0.086 ^a
SS	2.56	57.11								—

^a Significant at the 1% level.

^b Significant at the 5% level.

The simple correlation of the Crash returns with the pre-Crash estimate of market risk (β) equals -0.185 , which is significant at the one percent level. This evidence is consistent with Roll (1989), who finds that the world-beta is the most significant explanatory variable for cross-country Crash returns. This evidence suggests that the Crash may have been started with a decline in some fundamental factors. Consequently, stocks that are more sensitive to changes in economy-wide activity fell more during the Crash. Also, the simple cross-correlations of the Crash returns with measures of insider trading activity are negative. Hence, insider trading activity appears to be more pronounced in firms which had a greater stock price fall during the Crash.

Table IV shows that post-Crash stock returns are significantly positive. The 14-month stock returns from November 1987 to December 1988 average 0.137 , with a standard deviation of 0.656 . Similarly, the 12-month stock returns from January 1988 to December 1988 average 0.167 , with a standard deviation of 0.606 . The simple cross-correlations of the post-Crash returns with market risk are significantly negative, which seems to contradict the fundamentals view. Given the large increases in stock prices, riskier stocks should have benefited more from the increase in fundamental factors. Also, the simple cross-correlations of the post-Crash returns with the insider trading activity are highly suggestive. During the Crash, insiders bought more of the stocks that had higher than average post-Crash stock returns. In addition, insiders sold less of the stocks that had higher than average post-Crash stock returns.

Finally, Table IV provides information on pre-Crash beta, firm size, and insider trading activity. Insider trading activity appears to be more intense in higher risk firms and higher market capitalization firms. As expected, the correlations between the number of transactions and the number of shares traded are all positive.

To examine the role that overreaction of fundamentals played in the Crash, the next set of tests examines the relation between stock returns before and during the Crash, insider trading activity, and pre-Crash market risk using a multiple regression analysis. If changes in security prices were affected by expectations about a decline in future real activity or an increase in required stock returns, then more risky firms ought to have been more sensitive to changes in stock prices. If overreaction also affects stock prices, then corporate insiders should have been able to identify relative profit opportunities and purchase the stocks of firms that show a stock price fall not justified by a fall in fundamentals.

The cross-sectional analysis is performed on grouped data. For most calendar months, there is no insider trading activity in individual firms, and, hence, PRAT and SPRAT are undefined. This difficulty is avoided by grouping firms at a cost of reduction in sample size. Grouping also reduces the measurement errors in estimated variables. To increase the dispersion of the explanatory variables, all firms are ranked into 100 groups based on the decile ranks of firm size and pre-Crash market risk. The pre-Crash market risk is computed using monthly data from 1981 to 1986 separately for odd and even months. Ranking is done using the odd-month betas, while the regressions used the even-month betas to avoid the regression bias (Fama and MacBeth (1973)). The monthly standardized values of PRAT (or SPRAT) for the October 1987 and the October 1987 to

December 1987 periods are computed by subtracting their sample means over the 167 months and dividing by their sample standard deviations over 167 months for each of the 100 groups. Standardization is performed to abstract from differences in mean values of PRAT (or SPRAT) over the entire sample period that can be attributed to factors other than the stock price fall of October 1987 and to minimize potential heteroscedasticity problems.

Table V examines the relation between insider trading activity and Crash returns. The dependent variable is the insider trading activity around the Crash, while the independent variables are the October 1987 return and firm size. Panel A of Table V includes only the 1,496 firms which have insider trading activity during October 1987.

Table V

Weighted Least Squares Regression of Cross-Sectional Changes in Insider Trading Activity Around October 1987 Against the October 1987 Stock Return, R_c , and log of Firm Size, LV

In each panel, firms are classified into 100 groups based on the decile ranks of October 1987 stock returns and log of firm value, LV. Weights are the number of observations in each group. PRAT denotes the number of purchases divided by the number of transactions in each group. SPRAT denotes the number of shares purchased divided by the number of shares traded in each group. The variable $\Delta PRAT_1$ denotes the change in PRAT during October 1987, computed as October 1987 PRAT net of mean PRAT for the 167 sample months divided by the standard deviation of PRAT for the 167 sample months. The variable $\Delta PRAT_3$ denotes the change in average monthly PRAT from October 1987 to December 1987, computed analogously. The variables $\Delta SPRAT_1$ and $\Delta SPRAT_3$ are also computed analogously using the share purchase ratio, SPRAT. R^2 denotes the adjusted R-square. t -Statistics are in parentheses. The p -values of the F -statistics, which test the hypothesis that $\alpha_1 = \alpha_2 = 0$, are shown in brackets.

$$(\Delta \text{Insider Trading Variable}_i) = \alpha_0 + \alpha_1 R_c + \alpha_2 LV + \epsilon_i$$

No.	Δ Insider Trading Variable	Regression Model			R^2	F -Statistic
		Constant	R_c	LV		
Panel A: 1,496 Firms with Insider Trading in October 1987						
(1)	$\Delta PRAT_1$	-2.82 (-5.89)	-1.51 (-3.01)	0.353 (9.37)	0.473	45.39 [0.000]
(2)	$\Delta PRAT_3$	-0.82 (-1.84)	-1.78 (-3.84)	0.144 (4.11)	0.206	13.86 [0.000]
(3)	$\Delta SPRAT_1$	1.02 (1.62)	-0.27 (-0.40)	-0.002 (-0.03)	-0.019	0.09 [0.920]
(4)	$\Delta SPRAT_3$	1.36 (2.23)	-0.83 (-1.31)	-0.060 (-1.26)	0.018	1.92 [0.153]
Panel B: All Firms						
(5)	$\Delta PRAT_1$	-2.57 (-6.43)	-1.54 (-3.60)	0.330 (9.70)	0.506	51.71 [0.000]
(6)	$\Delta PRAT_3$	-0.94 (-2.45)	-1.79 (-4.39)	0.151 (4.62)	0.269	19.23 [0.000]
(7)	$\Delta SPRAT_1$	0.048 (0.09)	-0.50 (-0.84)	0.071 (1.46)	0.007	1.36 [0.262]
(8)	$\Delta SPRAT_3$	0.406 (0.81)	-1.21 (-2.26)	0.008 (0.18)	0.030	2.55 [0.084]

Model (1) in Table V, Panel A, indicates that a decrease in the October 1987 return is significantly associated with an increase in the purchase ratio for October 1987. The t -statistic for the stock return in October 1987 is -3.01 , which is significant at the one percent level. Hence, holding firm size constant, those stocks which declined by a greater amount during the Crash were purchased to a greater extent by corporate insiders at the time of the Crash.

Model (2) in Table V shows that the increased insider stock purchase activity due to the Crash continued during November and December 1987. The stock return for the month of October 1987 predicts the three-month insider trading activity from October to December 1987 to a greater extent. In model (2), the regression coefficient for October 1987 return is estimated to be -1.78 , with a t -statistic of -3.84 . Models (3) and (4) show that the ratio of shares purchased to all shares traded is only marginally related to the October 1987 return. This finding is not too surprising given the substantially greater variability of the shares traded shown in Figure 2.

Panel B of Table V includes all 5,022 firms, for which all variables are available. If a firm did not have insider trading activity during October 1987, then NP, NS, SP, and SS are all set to zero in calculating PRAT and SPRAT. For each of the 100 groups, *some* firms had insider trading activity; hence, PRAT and SPRAT are defined.

Panel B of Table V shows stronger negative relations between October 1987 returns and insider trading for all firms. In each case, both the point estimates and the t -statistics are larger in absolute value than the corresponding values in Panel A. Moreover, the relation between Crash returns and Δ SPRAT from October 1987 to December 1987 also attains statistical significance. Hence, including the firms without insider trading during October 1987 does not weaken the results shown in Panel A.

While not shown, the analysis in Table V is also repeated using insider trading activity in September 1987. There is no relation between Crash returns and insider trading activity in September 1987. This finding further corroborates the interpretation that the insider trading did not anticipate the Crash and that the Crash returns served as an impetus for the increase in post-Crash insider purchase activity.

Overall, the evidence presented in Tables IV and V does not clearly distinguish between overreaction and fundamentals. Instead, the evidence suggests that the Crash may have started with a decline in fundamentals. Moreover, the decline in stock prices also served as a significant impetus to insider trading activity, possibly because prices moved below the fundamentals. To distinguish between overreaction and fundamentals, the next set of tests examines the predictive ability of market risk and insider trading activity for subsequent stock returns.

E. Predicting Future Stock Price Recovery

If increased required stock returns or a decline in economic outlook contributed to the Crash in an important way, then, as expectations were reversed during 1988, stock prices of all firms should have risen. Moreover, the stock prices of

the risky firms ought to have risen to a greater extent. Hence, a positive relation between post-Crash return and market risk is expected. Other variables should be less important in predicting the cross-sectional stock returns during 1988.

Alternatively, if overreaction was an important part of the Crash, then the Crash returns would be reversed in the post-Crash period. Moreover, insider purchase activity during the Crash should predict the stock returns during 1988. Stocks that were purchased to a greater extent by insiders would be expected to recover to a greater extent in the post-Crash period. Also, if insiders based their trading decisions during the Crash on the stock price fall for October 1987 alone (a naive contrarian strategy), then insider trading activity should not have marginal explanatory power over the October 1987 stock returns. Finally, if the trading decisions of the uninformed affects stock prices, then price reversals need not be immediate. Instead, the cross-sectional stock returns during 1988 can be predictable, conditional on publicly available information about insider purchase activity during the Crash.

Table VI shows regressions of post-Crash stock returns against changes in insider trading activity during the Crash, stock returns for October 1987, pre-Crash market risk measured by the market model β coefficient, and the log of the market value of firms, LV. In Panel A, only the 1,496 firms that have insider trading activity during October 1987 are included. Once again, since PRAT and SPRAT are not defined for most months at the individual firm level, firms are grouped into 256 groups (yielding 217 groups with data) based on the quartile ranks of PRAT, Crash returns, pre-Crash β estimates, and LV.

Models (1) and (2) in Table VI, Panel A, show strong relations between post-Crash returns and changes in insider trading activity during October 1987. Firms that increased insider purchase activity had significantly higher positive post-Crash returns. Model (3) in Table VI, Panel A, shows that the post-Crash stock returns are negatively related to October 1987 returns, indicating a reversal of the Crash returns. Model (4) shows that the post-Crash stock returns average about 15 percent and are unrelated to pre-Crash market risk. Consequently, it is difficult to explain the post-Crash stock returns in terms of an improvement in expectations about the fundamental factors such as a decline in required stock returns or higher expected economic activity. Finally, model (5) shows a positive relation between post-Crash returns and firm size.

Models (6) to (11) in Table VI, Panel A, shows strong positive relations between changes in insider trading activity during the Crash period and the subsequent stock returns holding all other variables constant. In model (6), the coefficient of the insider trading activity equals 0.071, with a t -statistic of 5.17, which is significant at the one percent level. A one-standard-deviation increase in insider trading activity increases the predicted post-Crash returns by 9.6 percent (the estimated coefficient of 0.071 times the estimated sample standard deviation of Δ PRAT across the 217 groups, which is 1.35). Insider trading activity remains significantly positively related to post-Crash returns when included with October 1987 stock returns. Hence, even after controlling for the decline during the Crash, the prices of stocks that insiders purchased more of went up more during 1988. It appears that insiders used additional information beyond the

Table VI

**Weighted Least Squares Regression of Cross-Sectional Post-Crash
Stock Returns, R_p , Against Changes in Insider Trading Activity
Around October 1987, October 1987 Stock Return, R_c , Pre-Crash
Market Risk, β , and log of Market Value, LV**

Firms are classified into 256 groups (yielding 217 groups with data) based on quartile ranks of PRAT, October 1987 returns, LV, and pre-Crash β estimates. The weights are the number of observations in each group. PRAT denotes the number of purchases divided by number of transactions in each group. SPRAT denotes the number of shares purchased divided by number of shares traded in each group. The variable $\Delta PRAT_1$ denotes the change in group PRAT during October 1987, computed as October 1987 PRAT net of group mean PRAT for the 167 sample months divided by the standard deviation of group PRAT for the 167 sample months. The variable $\Delta PRAT_3$ denotes the change in average monthly PRAT from October 1987 to December 1987, computed analogously. The variables $\Delta SPRAT_1$ and $\Delta SPRAT_3$ are also computed analogously using the share purchase ratio, SPRAT. For PRAT, the four groups are determined as follows: group 1, PRAT equal to zero; group 2, PRAT between zero and one-half; group 3, PRAT greater than or equal to one-half and less than one; group 4, PRAT equal to one. In Panel B, firms with no insider trading are also classified with group 1. R^2 denotes the adjusted R-square. t -Statistics are in parentheses. The p -values of the F -statistics, which test the hypothesis that $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = 0$, are shown in brackets.

$$R_p = \alpha_0 + \alpha_1 \Delta \text{Insider Trading Variable} + \alpha_2 R_c + \alpha_3 \beta + \alpha_4 LV + \epsilon_i$$

No.	Post-Crash Prediction Period	Δ Insider Trading Variable	Constant	Δ Insider Trading Variable	R_c	β	LV	R^2	F -Statistic
Panel A: 1,496 Firms with Insider Trading Activity in October 1987									
(1)	11/87 to 12/88	$\Delta PRAT_1$	0.104 (4.70)	0.077 (5.70)	—	—	—	0.127	32.50 [0.000]
(2)	11/87 to 12/88	$\Delta SPRAT_1$	0.106 (4.84)	0.090 (5.79)	—	—	—	0.131	33.57 [0.000]
(3)	11/87 to 12/88	—	0.108 (2.34)	—	-0.295 (-1.95)	—	—	0.013	3.81 [0.052]
(4)	11/87 to 12/88	—	0.154 (3.39)	—	—	0.039 (0.91)	—	-0.001	0.82 [0.366]
(5)	11/87 to 12/88	—	-0.123 (-0.92)	—	—	—	0.027 (2.37)	0.021	5.63 [0.019]
(6)	11/87 to 12/88	$\Delta PRAT_1$	-0.179 (-1.29)	0.071 (5.17)	-0.306 (-1.92)	0.000 (0.00)	0.018 (1.56)	0.140	9.82 [0.000]
(7)	11/87 to 12/88	$\Delta SPRAT_1$	-0.275 (-2.01)	0.086 (5.58)	-0.317 (-2.02)	0.003 (0.07)	0.025 (2.31)	0.156	11.00 [0.000]
(8)	1/88 to 12/88	$\Delta PRAT_3$	-0.039 (-0.33)	0.071 (6.06)	-0.081 (-0.60)	0.004 (0.11)	0.011 (1.14)	0.149	10.43 [0.000]
(9)	1/88 to 12/88	$\Delta SPRAT_3$	-0.112 (-0.96)	0.084 (6.32)	-0.076 (-0.56)	0.009 (0.24)	0.017 (1.79)	0.160	11.25 [0.000]
(10)	1/88 to 12/88	$\Delta PRAT_1$	0.004 (0.03)	0.063 (5.34)	-0.092 (-0.67)	0.001 (0.02)	0.007 (0.74)	0.120	8.34 [0.000]
(11)	1/88 to 12/88	$\Delta SPRAT_1$	-0.082 (-0.69)	0.077 (5.76)	-0.102 (-0.75)	0.003 (0.09)	0.014 (1.49)	0.136	9.52 [0.000]
Panel B: All Firms									
(1)	11/87 to 12/88	$\Delta PRAT_1$	0.156 (13.50)	0.041 (6.03)	—	—	—	0.139	36.30 [0.000]
(2)	11/87 to 12/88	$\Delta SPRAT_1$	0.151 (13.11)	0.055 (6.59)	—	—	—	0.162	43.39 [0.000]

Table VI—Continued

No.	Post-Crash Prediction Period	Δ Insider Trading Variable	Constant	Δ Insider Trading Variable	R_e	β	LV	R^2	F-Statistic
(3)	11/87 to 12/88	—	0.085 (2.86)	—	−0.287 (−2.94)	—	—	0.036	8.64 [0.004]
(4)	11/87 to 12/88	—	0.109 (2.90)	—	—	0.056 (1.53)	—	0.006	2.35 [0.127]
(5)	11/87 to 12/88	—	−0.175 (−2.03)	—	—	—	0.030 (3.97)	0.063	15.77 [0.000]
(6)	11/87 to 12/88	$\Delta PRAT_1$	−0.147 (−1.59)	0.032 (4.55)	−0.294 (−2.68)	−0.031 (−0.77)	0.023 (2.95)	0.181	13.07 [0.000]
(7)	11/87 to 12/88	$\Delta SPRAT_1$	−0.158 (−1.78)	0.046 (5.38)	−0.295 (−2.75)	−0.023 (−0.60)	0.023 (3.03)	0.209	15.43 [0.000]
(8)	1/88 to 12/88	$\Delta PRAT_3$	0.105 (1.33)	0.029 (4.68)	−0.134 (−1.41)	−0.020 (−0.57)	0.005 (0.69)	0.108	7.62 [0.000]
(9)	1/88 to 12/88	$\Delta SPRAT_3$	0.093 (1.21)	0.040 (5.26)	−0.133 (−1.43)	−0.012 (−0.36)	0.005 (0.71)	0.129	9.11 [0.000]
(10)	1/88 to 12/88	$\Delta PRAT_1$	0.108 (1.34)	0.026 (4.29)	−0.140 (−1.47)	−0.021 (−0.59)	0.004 (0.61)	0.095	6.72 [0.000]
(11)	1/88 to 12/88	$\Delta SPRAT_1$	0.097 (1.25)	0.038 (5.02)	−0.142 (−1.51)	−0.015 (−0.42)	0.004 (0.63)	0.120	8.47 [0.000]

Crash return in deciding to purchase their own firm's stock, not merely a naive mean-reversion strategy. In contrast, the marginal effect of pre-Crash market risk remains insignificant, which contradicts the fundamentals view.

Panel B of Table VI includes all 5,022 firms for which all variables are available. If a firm did not have insider trading during October 1987, then NP, NS, SP, and SS are set to zero in computing the grouped PRAT and SPRAT values. The results in Panel B are similar to those in Panel A. Moreover, the coefficient estimates of β turn negative when included with the insider trading activity, which again contradicts the fundamentals view. Once again, including firms without insider trading activity during October 1987 does not diminish the strength of the results.

F. Sensitivity Tests

To gauge the sensitivity of the results, the tests in Tables V and VI are also replicated (not shown) using the net number of transactions (NP – NS) as well as the net number of shares traded (SP – SS). These results are qualitatively similar and, especially for the net number of transactions, stronger in magnitude. The tests in Tables V and VI are also replicated using unstandardized PRAT and SPRAT. The qualitative results are again similar, while the significance levels are somewhat reduced using the unstandardized insider trading activity. Hence, the results are not due to a particular definition of insider trading activity.

Time series regressions of future stock returns against PRAT and SPRAT are also run using data from 1975 to 1988 (not shown). The purpose of these tests is to determine whether aggregate insider trading activity predict aggregate future stock returns (as opposed to cross-sectional differences in returns). The evidence

indicates that both PRAT and SPRAT from the past 12 months predict the future 6-month and 12-month aggregate stock returns. These findings are similar to Seyhun's (1988) and indicate that insider trading activity also predicts the levels of future stock returns.

The data in Tables IV to VI are replicated using only the transactions of the top executives to compute the insider trading activity. These results are also qualitatively similar to those for all insiders; however, the results are somewhat weaker due to a reduction in the number of firms with transactions by top executives.

The data are also grouped using various classification variables and different numbers of classes. None of the results regarding insider trading is sensitive to the choice of particular classification variables or the number of classes. On the other hand, the relation between post-Crash returns and beta becomes significantly negative as the number of groups increases, contradicting the fundamentals view (also see Table IV).

G. Economic Significance

To determine the economic significance of the predicted post-Crash returns, Table VII uses indicator variables based on the levels of the insider trading ratios. All 5,022 firms for which data are available are classified in 110 groups based on decile ranks of pre-Crash betas—decimal increments of PRAT and the nontrading group. The dependent variables are the post-Crash returns from November 1987 to December 1988. As measures of insider trading activity, the levels of PRAT are used, rather than standardized changes Δ PRAT, to demonstrate that predictive ability of insider trading activity does not depend on statistical adjustments. Moreover, interpretations based on PRAT are more intuitive.

The indicator variables are defined as follows: indicator variable I_2 equals one if the insider trading ratio (PRAT or SPRAT) equals zero, and it equals zero otherwise (sale only); I_3 equals one if the insider trading ratio is greater than zero and less than one half, and it equals zero otherwise (predominantly sales); I_4 equals one if the insider trading ratio is greater than or equal to one half and less than one, and it equals zero otherwise (predominantly purchases); I_5 equals one if the insider trading ratio is equal to one, and it equals zero otherwise (purchase only). The intercept shows the subsequent returns when there is no insider purchase or sale activity in October 1987. (Hence, PRAT and SPRAT are undefined.) To hold market risk constant, β is included as an additional independent variable.

Model (1) in Table VII shows that the stocks where insiders exhibit sales only in October 1987 (I_2 equals one, which contains 246 firms) had a return from November 1987 to December 1988 that is 7.9 percent below the nontrading group, for a total return of 4.7 percent (12.6 percent intercept minus 7.9 percent). The post-Crash returns increase monotonically with increasing insider purchase activity. Stocks where insiders exhibit purchases only in October 1987 (I_5 equals one, which contains 1,074 firms) have an additional return of 10.6 percent above the nontrading group, for a total return of 23.2 percent (12.6 percent plus

Table VII
**Weighted Least Squares Regression of Cross-Sectional Stock Returns, R_p , During
 Selected Post-Crash Periods, Against Indicator Variables Based on the Insider Trading
 Ratio Around October 1987, and Pre-Crash Market Risk, β**

All 6,865 firms are classified into 110 groups based on the decile ranks of pre-Crash β estimates and the decimal increments of PRAT and the nontrading group. There are 107 observations in models (3) and (4) and 83 observations in all others. The weights are the number of observations in each group. PRAT denotes the number of purchases divided by the number of transactions in each group. SPRAT denotes the number of shares purchased divided by the number of shares traded in each group. The indicator variable I_2 equals one if the insider trading ratio equals zero, and it equals zero otherwise; I_3 equals one if the insider trading ratio is greater than zero and less than one-half, and it equals zero otherwise; I_4 equals one if the insider trading ratio is greater than or equal to one-half and less than one, and it equals zero otherwise; I_5 equals one if the insider trading ratio is equal to one, and it equals zero otherwise. The intercept shows the subsequent returns when there is no insider purchase or sale activity. (Hence, PRAT and SPRAT are undefined.) R^2 denotes the adjusted R -square. t -Statistics are in parentheses. The p -values of the F -statistics, which test the hypothesis that $\alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = 0$, are shown in brackets.

$$R_p = \alpha_1 + \alpha_2 I_2 + \alpha_3 I_3 + \alpha_4 I_4 + \alpha_5 I_5 + \alpha_6 \beta + \epsilon_t$$

No.	Subsequent Prediction Period	Insider Trading Ratio	Constant	I_2	I_3	I_4	I_5	β	R^2	F -Statistic
(1)	11/87 to 12/88	PRAT ₁	0.126 (3.02)	-0.079 (-1.72)	0.042 (0.51)	0.086 (1.86)	0.106 (4.35)	-0.011 (-0.25)	0.21	5.38 [0.000]
(2)	11/87 to 12/88	SPRAT ₁	0.122 (2.82)	-0.081 (-1.74)	0.043 (0.68)	0.111 (1.84)	0.105 (4.24)	-0.004 (-0.10)	0.21	5.45 [0.000]
(3)	1/88 to 12/88	PRAT ₃	0.147 (5.13)	-0.089 (-3.07)	-0.030 (-0.76)	0.025 (1.06)	0.083 (4.81)	0.008 (0.29)	0.28	9.15 [0.000]
(4)	1/88 to 12/88	SPRAT ₃	0.144 (5.04)	-0.086 (-3.00)	-0.004 (-0.11)	0.039 (1.46)	0.086 (4.99)	0.017 (0.59)	0.28	9.23 [0.000]
(5)	1/88 to 12/88	PRAT ₁	0.165 (5.13)	-0.121 (-3.43)	-0.016 (-0.26)	0.015 (0.45)	0.065 (3.47)	-0.009 (-0.27)	0.24	6.29 [0.000]
(6)	1/88 to 12/88	SPRAT ₁	0.164 (5.08)	-0.126 (-3.44)	-0.007 (-0.16)	0.032 (0.41)	0.065 (3.51)	-0.009 (-0.30)	0.25	6.37 [0.000]

10.6 percent). Once again, the coefficient of market risk is negative and insignificant.

Table VII, model (1), shows that the difference in the 14-month post-Crash returns between the purchases-only and sales-only groups reaches 18.5 percent (23.2 percent minus 4.7 percent). This difference between the risk-matched groups is both statistically and economically significant. This difference also substantially exceeds the previously reported abnormal stock price movements following insiders' transactions. (Seyhun (1986, p. 198) reports an average increase of 4.3 percent following insiders' purchases, and an average decline of 2.2 percent following insiders' sales, over the following 14-month period during 1975–1981.)

The results in Table VII indicate that the lack of insider trading activity during October 1987 also provides information. The post-Crash returns for the non-trading group (12.6 percent) are between the sales-only and purchases-only groups. Consequently, insiders in this group had less of an incentive to trade as a response to the Crash.

Model (2) in Table VII uses SPRAT during October 1987 to classify the firms. Once again the results are similar. Models (3) and (4) use insider trading activity from October 1987 to December 1987 to forecast stock returns from January 1988 to December 1988. These results are also qualitatively similar.

Finally, models (5) and (6) examine a potentially implementable strategy. The insider trading activity during October 1987 is used to forecast stock returns from January 1988 to December 1988, allowing for a two-month implementation delay. Once again, the differences in post-Crash returns are large and predictable. For instance, in model (5) holding risk differences constant, the difference between sales-only and purchases-only portfolios remains at 18.6 percent (6.5 percent minus -12.1 percent), even after a two-month implementation delay.

III. Conclusions

Evidence presented in this paper indicates that corporate insiders, expected to be the most knowledgeable about the fundamentals concerning their firms, were neither heavy buyers nor heavy sellers of their firms' stock during the sharp rise in stock prices for the first nine months of 1987. This finding suggests that insiders viewed the stock price increases from January to September of 1987 as being in line with changes in fundamentals.

Evidence also indicates that corporate insiders did not systematically foresee the Crash. As stock prices began to decline during the week of October 12, 1987, insiders became buyers rather than sellers. As late as October 16, 1987, there is no evidence to suggest that insiders foresaw the imminent stock price decline. The absence of insider selling activity immediately *before* the stock price declines during the week of October 12, 1987 suggests that insiders did not view the pre-Crash stock prices as too high. The absence of insider selling activity *during* the stock price declines during the week of October 12, 1987 suggests that corporate insiders served as a stabilizing factor in the market Crash.

The evidence from the Crash and post-Crash periods is consistent with an overreaction effect in market pricing. First, October 19, 1987 found intense daily

purchase activity by insiders. Both the number of purchases and the ratio of insiders' purchases to total transactions rose to record levels during the week of October 19, 1987. Moreover, intense purchase activity was not confined to one group of insiders. Top executives who are expected to be more knowledgeable about their firms purchased the stock of their firms to a greater extent. Evidence also shows that those firms that suffered relatively greater stock price falls during October 1987 were also purchased to a greater extent by insiders.

The post-Crash data indicate further support for the presence of an overreaction effect. First, stocks that declined more during the Crash recovered more during the post-Crash period. Second, those firms which were purchased by insiders to a greater extent during the Crash period also showed significantly greater price recovery during the post-Crash period. Moreover, insider trading activity is the most significant explanatory variable for the post-Crash returns. The cross-sectional stock returns in 1988 remained predictable conditional on publicly available information about the one-month insider trading activity in October 1987. Also, the magnitude of the predicted difference in post-Crash returns is economically significant. In contrast, the pre-Crash market risk does not explain the post-Crash stock price performance. Neither the pre-Crash market risk nor the October 1987 stock returns attenuate the predictive power of the aggregate insider trading activity.

The overall evidence suggests that overreaction was an important part of the Crash. While the data examined here do not provide much support for the fundamentals view, it is important to note that other fundamental factors not examined here (e.g., a decline in expected future takeover activity) may have contributed significantly to the Crash.

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