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Abnormal Stock Returns, for the Event Firm and Its Rivals, Following the Event Firm's Large One-Day Stock Price Drop

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Abnormal stock returns, for the event firm and its rivals, following the event firm's large one-day stock price drop

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Abstract

Purpose – The purpose of this paper is to examine intra-industry contagion and the following apparent violations of the efficient market hypothesis around large one-day price decline events in individual stocks.

Design/methodology/approach – The paper examines daily stock returns around one-day price declines of 10 percent or more for event stocks and their rivals. Using techniques similar to those used in Bremer and Sweeney and Cox and Peterson, the paper includes event stocks whose prices are at least $10 per share prior to the event to reduce the possible price reversal induced by bid-ask price bounce. As is typical for the literature, the stock daily abnormal return (AR) is calculated as the difference between the actual daily stock return and the estimated stock return based on the market model estimated over a 200-trading-day pre-event period [−220, −21]. Cumulative abnormal returns (CARs) for each stock are formed by aggregating the individual daily stock ARs. Denoting the large price decline event day as day 0, we examine the ARs of 41 trading days [−20, +20], the CARs for the [+1, +3] period, and the CARs for the [+4, +20] period. Cross-sectional average ARs and CARs are calculated and tested for statistical significance. Furthermore, the paper examines whether the post-event abnormal stock returns for the event firm and its rivals can be explained by prior event firm and industry variables.

Findings – On average, after an event, the event stock experiences a positive three-day AR (S&P 600 stocks) followed by a 17-day negative AR (both S&P 500 and 600 stocks). Moreover, for that 17-day period: the rivals' stocks outperform the event firms' stocks and the event firms' returns are statistically significantly related to prior variables. The paper also finds statistically significant relationships between the prior variables and the rivals' post-event stock returns. It provides an intra-industry effects explanation for these results.

Originality/value – The paper offers insights into abnormal stock returns, for the event firm and its rivals, following the event firm's large one-day stock price drop.

Keywords Finance, Financial markets, Financial performance, Stock returns

Paper type Research paper

I. Introduction

According to the efficient market hypothesis (EMH), traders should not be able to make abnormal positive returns using publicly available information. Several studies test it by examining stock price changes immediately following their large price declines. Atkins and Dyl (1990) find market overreaction in daily winners and losers but conclude that such reversals are not significant after controlling for the bid-ask price bounce and transaction costs. In contrast, Bremer and Sweeney (1991) note that for 1962-1986,

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Fortune 500 stocks that have a large one-day price drop tend to experience a significant abnormal price reversal over the next three days in violation of the weak form EMH.

Cox and Peterson (1994) study NYSE (large capitalization), AMEX, and National Market System stocks (small cap stocks traded on the NASDAQ) for the 1963-June 1991 time period and note the post-price drop three-day reversal. Further, they note that the reversals are greater for small cap than large cap stocks and that the reversal disappears even for the small cap stocks by the October 1987 stock price crash. They also find no evidence that stocks with greater event-day price decline have greater reversal and conclude that their data do not support the DeBondt and Thaler (1985) overreaction hypothesis. They attribute the pre-October 1987 reversals to bid-ask price bounce and illiquidity effects and argue that these effects were more pronounced for small cap stocks and disappeared as the market became more liquid by the time of the October 1987 crash. However, it seems unlikely that the October 1987 stock market crash should coincide with a rise in market liquidity and their conclusion that the small cap reversal disappeared in the post-October 1987 period may be due to their short post-October 1987 period.

Cox and Peterson (1994) also note that the event-day price decline inexplicably, and in apparent violation of the EMH, resumes in the period starting the fourth day after the event and ending 20 days after the event (denoted hereafter as $[+4, +20]$). Finally, they show, as further evidence against the overreaction hypothesis, that the event stock's performance in the $[+4, +20]$ period is worse; the greater is its event-day price drop. Cox and Peterson (1994) have not been updated to see if the apparent violation of the EMH persists and whether the evidence against the overreaction hypothesis continues. This literature also does not consider the event firms' rivals' stock price movements to see if intra-industry effects exist and how quickly the news gets reflected into the rivals' stocks' prices. Nor does this literature consider that there may be a feedback response from the rivals' stocks' prices to the event firms' stock prices.

The event firm's rivals may experience contagion or competitive (intra-industry) effects. They experience a contagion effect if their stock prices decline approximately coincident with the event. Assuming the event was due to an unexpected drop in the demand forecast for the event firm's products and services, a contagion would be observed if, approximately coincident with the event, the market also reduced its demand forecast for the event firm's rivals' products and services. A competitive effect is defined as a negative correlation between the stock returns of the event firm and its competing (i.e. rival) firms. Assuming the event was due to an unexpected drop in the demand forecast for the event firm's products and services, a competitive effect would be observed if, approximately coincident with the event, the market increased its demand forecast for the event firm's rivals' products and services (i.e. it unexpectedly forecast that the industry demand will shift away from the event firm's products and services toward its rivals' products and services, so that the rivals benefit from the event firm's problems).

Lang and Stulz (1992) studied event firm and their rivals' abnormal stock returns for the 11-day period $[-5, +5]$ around events for the 1970-1989 period for firms in both the CRSP and COMPUSTAT databases. They found when:

- the pre-event stock return correlation between the event firm and its rivals was high; or

- the industry had high financial leverage, that both the event firm and its rivals' stock prices statistically significantly declined (i.e. the contagion effect dominated).

On the other hand, when there was low financial leverage and the market was highly concentrated, the rivals' stock prices statistically significantly rose (i.e. the competitive effect dominated). In addition to Lang and Stulz (1992), others, such as Slovin *et al.* (1991), Laux *et al.* (1998) and Akhigbe and Madura (2008), have studied whether the contagion or competitive effect dominates. It seems that the intra-industry effect literature has not focused on the issue of the extent that the rivals' response lags the event firms' response; however, the Lang and Stulz (1992) Table I results suggest that rivals' response lags the event firms' response by about two days. This literature also does not consider that there may be a feedback response from the rivals to the event firms; such feedback would represent an EMH anomaly.

We examine the price movements of the event stocks as well as their respective industry rivals around an event. In our paper, as in Bremer and Sweeney (1991) and Cox and Peterson (1994), an event occurs when a stock's price drops at least 10 percent in one day. We examine the price movements of large cap (S&P 500) stocks for two periods, 1973-2006 and 1995-2006. We also study the price movements of small cap (S&P 600) stocks for 1995-2006. The 1995-2006 period is distinct from the pre-July 1991 period studied in Cox and Peterson (1994) and the period studied in Bremer and Sweeney (1991). We examine both large and small cap stocks to see if the differences between them, noted by Cox and Peterson (1994), hold.

Our contributions are in four main areas and focus on how efficiently publicly available information becomes reflected in stock prices and what factors effect the event firm's and its rivals' post-event abnormal returns (ARs). First, we examine the event stocks' ARs for the 41 days surrounding the event $[-20, +20]$ and address the following issues studied primarily by Cox and Peterson (1994). Is the $[+1, +3]$ period positive abnormal stock return (i.e. reversal) present in the post-October 1987 stock price crash period? Does the event-day negative abnormal stock return continue in the $[+4, +20]$ period? For both the Cox and Peterson (1994) $[+1, +3]$ and $[+4, +20]$ periods are ARs present in either small or large cap stocks? We examine these issues over a post Cox and Peterson (1994) period (i.e. 1995-2006, a much longer post-October 1987 period than in Cox and Peterson, 1994). A finding of yes to any of these extends the apparently anomalous Cox and Peterson (1994) findings regarding the EMH.

Second, we determine whether intra-industry (where industry is defined by the COMPUSTAT four-digit SIC) effects exist: preceding, during and following the event stocks' large one-day price decline. We add to the literature by studying the extent to which a lag exists between the event firm's price response and its rivals' price response. We extend the contagion versus competitive effect literature by: examining the issue for both small and large cap stocks and extending the Lang and Stulz (1992) $[-5, +5]$ period to the Cox and Peterson (1994) $[-20, +20]$ period. The intra-industry effects literature has not addressed the issue of whether the intra-industry effects differ depending on whether the firms are large or small cap. Given the Cox and Peterson (1994) finding that the event firms' post-event returns differed depending on whether the firm is large cap or small cap, there is no reason to believe that the intra-industry effect and the speed with which it occurs will not differ for large and small cap firms. To the extent that

Day	Event firms' abnormal stock return (AR) Average (%)	Positive (%)	Rivals portfolios' abnormal stock return (AR) Average (%)	Positive (%)	Rivals portfolios' AR − event stocks' AR Average (%)	Positive (%)
−20	−0.0472	47.8**	−0.0723*	47.1***	−0.0251	50.1
−19	−0.1199**	48.2**	−0.0281	49.0	0.0918	51.7*
−18	−0.1130**	47.4***	0.2259***	52.2**	0.3389***	53.5***
−17	−0.1629***	45.3***	−0.0475	47.5***	0.1154*	52.0**
−16	−0.0862	47.3***	−0.1350***	46.3***	−0.0488	50.6
−15	−0.0268	46.3***	−0.1933***	44.3***	−0.1664***	49.3
−14	−0.0577	47.8**	−0.0825**	47.0***	−0.0248	49.9
−13	−0.1921***	46.8***	0.0267	49.6	0.2188***	51.6*
−12	−0.1826***	47.3***	0.1163***	51.2	0.2990***	53.1***
−11	−0.1163*	46.4***	0.0354	49.8	0.1517**	52.1**
−10	−0.1053*	46.6***	0.0506	50.5	0.1559**	52.6***
−9	−0.1229*	46.6***	−0.0135	49.9	0.1095	52.9***
−8	−0.0870	47.0***	0.0544	50.4	0.1414**	52.3***
−7	−0.1433**	47.3***	0.0036	49.3	0.1468**	52.1**
−6	−0.0474	47.9**	0.0834**	52.4***	0.1308*	52.7***
−5	−0.1574**	46.9***	−0.1225***	45.8***	0.0349	50.5
−4	−0.2180***	46.4***	−0.1156***	47.4***	0.1024	52.3**
−3	−0.0381	48.0**	−0.0153	48.1**	0.0229	51.4
−2	−0.1680**	45.5***	−0.0840*	49.1	0.0839	52.7***
−1	−0.7453***	40.9***	−0.1470***	47.2***	0.5982***	57.5***
0	−12.4665***	0.7***	−0.5143***	39.5***	11.9522***	99.5***
1	0.1717*	53.1***	−0.1769***	47.9**	−0.3486***	46.6***
2	0.0302	50.8	0.1097**	50.5	0.0795	49.1
3	0.0206	48.0**	−0.0633	48.0**	−0.0839	49.7
4	0.0154	48.8	−0.0954**	46.3***	−0.1108	49.6
5	−0.0651	48.0**	−0.0552	48.4*	0.0098	51.5*
6	−0.1189*	46.6***	0.0005	51.0	0.1194	52.7***
7	−0.1600**	45.9***	0.1161***	50.3	0.2761***	53.8***
8	0.1037	48.6	−0.0416	48.7	−0.1453*	50.0
9	−0.0368	48.8	−0.0651	47.4***	−0.0283	50.3
10	−0.0210	50.5	0.1403***	52.4***	0.1613**	50.5
11	−0.0484	48.8	0.0017	48.9	0.0501	50.8
12	−0.0631	49.0	0.1042***	51.5	0.1673**	50.5
13	−0.1025	47.5***	−0.0438	48.8	0.0587	52.2**
14	0.0394	49.4	0.1314***	49.6	0.0919	49.8
15	−0.1299*	46.6***	−0.0438	49.1	0.0861	52.5***
16	−0.0584	49.6	−0.1334***	46.1***	−0.0750	48.8
17	0.0835	49.7	0.1878***	51.4	0.1042	51.4
18	0.0434	48.9	0.1326***	50.5	0.0892	51.1
19	0.0586	48.9	−0.1323***	47.3***	−0.1909***	48.8
20	−0.0925	46.4***	−0.0917**	47.4***	0.0008	50.4
1 through 3	0.1865	51.1	−0.1384*	47.3***	−0.3249**	0.4875
4 through 20	−0.8217***	45.8***	0.0431	50.2	0.8648***	0.5389***

Table I.
Abnormal stock returns around large stock price decline (i.e. event) days (for 3,112 events of S&P 500 stocks from 1973 through 2006)

Notes: Significance at: *0.10, **0.05 and ***0.01 levels (two-tailed test); each event stock has an at least 10 percent event-day stock price drop (i.e. the event-day return is $< = -10$ percent); its rival portfolio is equally weighted and is composed of the indexes' other stocks that have its SIC; the daily abnormal stock return on day t (where $t = -20$ to $+20$) is the difference between the actual return and the market model estimated return; the market model coefficients are estimated on the 200-day period (days −220 through −21) prior to the event day; the CRSP Value-Weighted Return Index is the market return proxy

there is an industry effect lag (from the event stocks to the rivals) and it differs for small and large cap stocks, it should be more pronounced for the small cap stocks as they have greater transactions costs and are followed by fewer analysts; likewise, to the extent that there is a feedback response from the rivals to the event firms, it should be more pronounced for the small cap stocks.

Small cap stocks are followed by fewer analysts in part because:

- institutions invest primarily in large cap stocks due to liquidity and regulatory constraints;
- institutions are a large part of the demand for stock price information that is met by analysts (Hodgson *et al.*, 2003; Atiase, 1985); and
- private information is more noticeable in thinly traded stocks (Atiase, 1985).

Because small cap stocks are less analyzed, information dissemination is more gradual regarding them. Ayers and Freeman (2000) finds that small cap stock prices lag large cap stock prices with respect to industry-wide information, while Martikainen *et al.* (1995) find that large cap stock prices lead small cap stock prices generally.

Third (to our knowledge, for the first time), we study the event firm's stock's performance relative to its industry rivals in both the Cox and Peterson (1994) [+1, + 3] and [+4, + 20] periods. The existing literature only looks at the event firm's stock's performance relative to the market (e.g. the S&P 500); this is a less preferred indirect approach.

Fourth, we examine whether the post-event abnormal stock returns (for the event firms, their rivals, and the rival-event firm return differential) can be explained by prior variables. While the intra-industry effects literature has analyzed which factors determine whether the contagion or competitive effect dominates for the event-contemporaneous period (i.e. essentially day [0]), it has not examined the factors that effect the rivals' stocks' ARs over the extended Cox and Peterson (1994) periods: [+1, + 3] and [+4, + 20]. Specifically, we test whether two event firm and two industry pre-event variables predict the post-event AR for day +1 (AR[+1]) and the cumulative abnormal returns (CARs) in the Cox and Peterson (1994) periods: [+1, + 3] and [+4, + 20]. The two event firm pre-event variables are net sales market share (MKTSHR) and the stock return correlation with its rivals' stock return (CORR). The two industry pre-event variables are the degree of industry concentration as measured by the Herfindahl-Hirschman Index (HHI) and the industry average stock return standard deviation (AVGSTD). Additionally, we use the event firm pre-event through event period (i.e. [−20, 0]) CAR as a fifth explanatory variable (denoted PRECAR, which is succinct but slightly misleading since it also includes the event).

Lang and Stulz (1992) found that CORR, HHI, and financial leverage help explain intra-industry effects. We use MKTSHR as a measure of the event firm's leadership (and/or size) and, as in Slovin *et al.* (1991) and Laux *et al.* (1998), presume that when the event firm is the industry leader, the intra-industry effect will be magnified. As in Akhigbe and Madura (2008), we use AVGSTD rather than leverage as an explanatory variable because it reflects both operating and financial leverage. Additionally, we test whether the event stock's pre-event through event CAR is negatively related to the post-event ARs (as is implied by the overreaction hypothesis).

Like Cox and Peterson (1994), we test whether the event stock's post-event AR is negatively related to the PRECAR (as is implied by the overreaction hypothesis)

and negatively related to the MKTSHR (as found by Cox and Peterson, 1994, using a SIZE variable similar to our MKTSHR variable). Additionally, we test whether the event stock's post-event AR is related to CORR (the closer the event firm and its rivals are, the more likely a lagged event firm response is coincident with a lagged intra-industry effect). Likewise, the event stock's post-event AR may be related to HHI and AVGSTD since when the industry is concentrated and high risk, the bad news is magnified.

Our data show that the event firms' stock prices fall about 13 percent on the event day, while their rivals' stock prices fall roughly only about a 30th as much (roughly 0.4 percent). Moreover, much of the rivals' stocks' price fall is delayed for up to a couple days (less so for the large cap stocks than for the small cap stocks since the large cap stocks are followed more closely by analysts). In part, the rivals' stock prices presumably fall much less than the event firms' stock prices because there are many rivals for each event stock. While the average rivals' stock price drop is a small percentage (roughly 0.4 percent), due to the numbers of rivals, the $ effect on the industry can be very large. This prompts a feedback response upon the event firms' stocks that can be competitive for a couple days [+1, + 3] (mostly noticed for small cap stocks), but is magnified, gradual and a contagion over the longer [+4, + 20] period for which the event firms' stocks decline an additional 0.8-1.8 percent (again less so for the large cap stocks than for the small cap stocks since the large cap stocks are followed more closely by analysts). The gradualness may be explained by the numbers of the rivals' stock prices that are feeding back onto the event firm's stock price and the smaller rivals' stock price drop (i.e. less discernable signal) that is precipitating the feedback to the event firm's stock price (roughly 0.4 percent rather than the event firm's initial 13 percent). The magnification is due to the numbers of the rivals' stock prices that are feeding back onto the event firm's stock price. Thus, while we observe the event firm's resumed stock price drop in the [+4, + 20] period that was observed in Cox and Peterson (1994), we provide an intra-industry effects and feedback explanation. This explanation is bolstered by the fact that the event firm's CAR[+4, + 20] is better the: smaller the event, smaller the event firm's pre-event market share, more correlated the event firm and rivals' stock prices in the pre-event period, less concentrated the industry and less risky the industry.

The remainder of the paper is organized as follows. Section II describes our data and methodology. Section III presents our empirical results and Section IV concludes.

II. Data and methodology

A. Data

We examine daily stock returns around one-day price declines of 10 percent or more for event stocks and their rivals. Daily returns from the Center for Research in Security Prices (CRSP) for all S&P 500 (large cap) and S&P 600 (small cap) member firms in the COMPUSTAT S&P index member database are analyzed. Our sample consists of all events for:

- S&P 500 member firms from January 1973 through December 2006; and
- S&P 600 member firms from January 1995 through December 2006.

We define a firm's industry by its COMPUSTAT four-digit SIC code. An event firm's rivals are the firms from the same S&P index as the event firm that have the event firm's four-digit SIC code.

Using techniques similar to those used in Bremer and Sweeney (1991) and Cox and Peterson (1994), we include event stocks whose prices are at least \$10 per share prior to the event to reduce the possible price reversal induced by bid-ask price bounce. We exclude stocks whose prices were based on bid-ask averages because it is unclear that an investor could transact at such prices. In addition, we exclude the entire industry for any day when the industry has multiple stocks that had price declines of 10 percent or more to avoid industry-wide price movements. For each event stock, we form an equally weighted portfolio of all its rival firms' stocks (those of the same COMPUSTAT SIC code, as in Lang and Stulz, 1992) and calculate its daily CRSP return.

Among the S&P 500 member firms between 1973 and 2006, there are 7,948 occurrences of a stock having a one-day price decline of 10 percent or more. About half of them (4,055 occurrences) occur in the 1995 through 2006 sub-period. The number of events initially reduced to 5,163 (and 2,948 for the 1995-2006 sub-period) as 20 of these stocks have prices calculated from bid-ask averages and 2,765 stocks had initial prices smaller than \$10. In addition, we exclude 1,283 occurrences due to multiple stocks from the same industry having same day events and 768 occurrences for which no rival portfolio can be constructed. This leaves us with 3,112 event stocks (or 39.15 percent of the initial 7,948 event stocks) in our final sample (and 1,871 event stocks (or 46.14 percent of the initial 4,055) for the 1995-2006 sub-period). Among the S&P 600 member firms, we start with a total of 11,218 occurrences of a one-day stock price decline of 10 percent or more between 1995 and 2006 and end up with 4,096 event stocks (or 36.51 percent of the initial 11,218) in our final sample. We excluded 5,258 stocks (two stocks because their prices came from bid-ask averages and 5,256 stocks that had initial prices smaller than \$10). We also excluded 1,045 stocks due to multiple stocks from the same industry dropping at least 10 percent in price on the same day and 819 stocks because they had no rivals.

B. Daily abnormal stock returns around an event

As is typical for the literature (Akhigbe and Madura, 2008), the stock daily AR is calculated as the difference between the actual daily stock return and the estimated stock return based on the market model estimated over a 200-trading-day pre-event period $[-220, -21]$. The event day, denoted [0], is the day with at least 10 percent stock price decline. The daily AR of each event firm i for each day t in the $[-20, +20]$ period is calculated as:

$$AR_{i,t} = R_{i,t} - (a_i + \beta_1^* R_{m,t}) \tag{1}$$

where:

$AR_{i,t}$ = the daily abnormal stock return of event firm i on day t.

$R_{i,t}$ = the actual stock return for event firm i on day t.

$R_{m,t}$ = the daily stock return on the CRSP value-weighted index market return on day t.

α_i, β_i = firm i's market model parameters based on the pre-event period $[-220, -21]$.

The daily abnormal stock return for the event firm i's rivals' portfolio for each day t in the event period $[-20, +20]$ is computed as:

$$AR_{i's\_rivals,t} = R_{i's\_rivals,t} - (\alpha_{i's\_rivals} + \beta^{*}_{i's\_rivals} R_{m,t}) \quad (2)$$

where:

$AR_{i's\_rivals,t}$ = event firm i's rivals' stock portfolio's AR on day t.

$R_{i's\_rivals,t}$ = event firm i's rivals' stock portfolio's equally weighted return on day t.

$\alpha_{i's\_rivals}$, $\beta_{i's\_rivals}$ = event firm i's rivals' stock portfolio's market model parameters based on the $[-220, -21]$ period.

CARs for each stock are formed by aggregating its individual daily stock ARs. Denoting the large price decline event day as day 0, we examine:

- the ARs of 41 trading days: day -20 through day $+20$;
- the CARs for day $+1$ through day $+3$; and
- the CAR from day $+4$ through day $+20$.

Cross-sectional average ARs and CARs are calculated and tested for statistical significance. Two-tailed t-tests are conducted to test the significance of cross-sectional averages of the event stocks, the rivals' stock portfolios, and the differences between the rivals' stock portfolios' and the event stocks' ARs and CARs. We also determine the proportion with positive ARs for each.

C. The relation between the post-event stock ARs and prior variables

Here, we examine whether the post-event abnormal stock returns for the event firm and its rivals can be explained by prior event firm and industry variables. Specifically, the post-event AR$[+1]$ and CARs ($[+1, +3]$ and $[+4, +20]$) for the event firms, their rivals and the rivals'-event firms' return differential are cross-sectionally regressed on the:

- event firm's pre-event through event CAR;
- event firm's pre-event market share;
- pre-event correlation between the event firm's stock returns and its rivals' stock portfolios' returns;
- pre-event industry market concentration; and
- pre-event industry average stock return standard deviation to determine the relationship between these variables and the post-event AR and CARs.

According to the overreaction hypothesis, the overreaction should be greater, the greater the event. Similarly, as argued by Akhigbe and Madura (2008), if negative news by a firm has an intra-industry impact (either contagion or competitive), this effect should be larger when the information magnitude is greater. In this paper, we use the event firm pre-event through event period (i.e. $[-20, 0]$) CAR (denoted as PRECAR which is succinct but slightly misleading since it also includes the event) to represent the magnitude of the negative information.

An event firm's market share (MKTSHR) is measured as the ratio of the event firm's net sales to the industry's combined net sales in the four quarters prior to the event day. News regarding the industry leader (where the leader is determined in terms of net sales)

is hypothesized to have greater information content regarding the rival firms' stock prices than news regarding non-leaders.

Lang and Stulz (1992) and Akhigbe and Madura (2008) argue that an event concerning a single firm is more likely to affect other firms if the event firm is closely related to the other firms. We use the pre-event stock return correlation coefficient (CORR) between the event firm and its rivals, measured for day −220 through day −21, to proxy the relatedness between the event firm and its rivals.

Lang and Stulz (1992) consider the industry market concentration as a key intra-industry effect factor. They argue that the more concentrated the industry, the greater the event's effect on the rivals' stock prices. They measure the degree of concentration by the HHI, where low numbers indicate that the industry is more competitive. It is constructed from the net sales prior to the event day for all the industry members by summing the squares of the percentage market shares held by each firm. We adopt the same technique to measure the industry market concentration and examine its relationship with the post-event AR and CARs.

With the belief that stock returns in more risky industries are more affected by information, we adopt the industry average stock return standard deviation (AVGSTD) to proxy risk for the industry. Lang and Stulz (1992) find that higher financial leverage results in contagion.

For the event firm, according to the overreaction hypothesis, the post-event AR should be negatively related to the PRECAR variable. Cox and Peterson (1994) find that the CAR[+1, +3] is negatively related to a size variable (which should be similar to our MKTSHR variable); they argue that this relationship is due a liquidity effect where small cap stocks have greater bid-ask spreads and the liquidity effect disappears in the post-October 1987 because the markets became liquid. They also find that the CAR[+4, +20] is unrelated to their size variable, but is positively related to the PRECAR variable (longer-run under reaction).

We run six versions (one for each of the six following dependent variables: $AR[+1]_{eventfirm}$, $AR[+1]_{rivals}$, $CAR[+1, +3]_{eventfirm}$, $CAR[+1, +3]_{rivals}$, $CAR[+4, +20]_{eventfirm}$ and $CAR[+4, +20]_{rivals}$) of the following regression model, where the regression equations differ only in the dependent variable:

$$\text{Dependent variable} = \alpha + \beta_1\ \text{PRECAR} + \beta_2\ \text{MKTSHR} + \beta_3\ \text{CORR} + \beta_4\ \text{HHI} + \beta_5\ \text{AVGSTD} + \varepsilon \quad (3)$$

where:

PRECAR = the event firm 21 day [−20, 0] market model AR. It could less succinctly but more accurately be denoted as the pre-event through event CAR.

MKTSHR = the ratio of the event firm's net sales to its industry's net sales in the four quarters prior to the event day.

CORR = the pre-event [−220, −21] correlation between the event firm's stock return and its rivals' stock portfolio's return.

HHI = the pre-event Herfindahl-Hirschman Index for the event firm's industry.

AVGSTD = the event firm's pre-event [−220, −21] industry average stock return standard deviation.

β_j for j = 1-5 = parameters to be estimated.

ε = error term.

III. Empirical results

A. Stock ARs around an event

Table I shows the stock ARs for each day from day -20 through day +20 for the S&P 500 event stocks and their rivals' portfolios between 1973 and 2006 (i.e. for the full period). It also shows the CARs for the day +1 through day +3 and day +4 through day +20 periods. On the event day (day 0), the event stocks have an average AR of −12.4665 percent and their rivals have a much less negative, though statistically significant, AR of −0.5143 percent (while the event stocks AR is about 24 times that of their rivals, i.e. 12.4665/0.5143, the overall $ impact on the rivals can exceed that on the event firm depending on the number and sizes of the rivals). Thus, the contagion effect dominates the competitive effect. Further evidence of the contagion effect dominance is the fact that more than 60 percent of the time, the rivals' stock portfolios' have a negative event-day AR. The event stocks' average AR is negative in all 20 pre-event days and 13 of them are statistically significant at least at the 90 percent confidence level. While the rivals' portfolios' average AR is positive for some and negative for other pre-event days, the rivals' portfolios' average AR is statistically significantly negative in four out of the five days immediately prior to the event day. There is a close industry association (contagion) in the week prior to the large price decline event day.

Event stocks experience an average AR on day +1 of 0.1717 percent (i.e. a stock price reversal), which is statistically significant at the 90 percent confidence level. However, this statistically significant positive average one day AR does not continue. The event stocks' average CARs are a statistically insignificant 0.1865 percent for the [+1, + 3] period but a statistically significant −0.8217 percent for the [+4, + 20] period. The rivals' stock portfolios' have a statistically significant negative average CAR (lagged contagion) of −0.1384 percent for the [+1, + 3] period which is mainly due to the −0.1769 percent average AR on day +1. The observation that the contagion (from the event stock to its rivals) is lagged is due to the fact that the event firms' AR[0] is more than 60 times larger than its AR in any of the three following days (that correspond to the rivals' statistically significant CAR[+1, + 3]. The event firm's resumed poor CAR[+4, + 20] puzzled Cox and Peterson (1994); our data suggest that there is a feedback response (from the rivals' stocks to the event firms' stocks) that is magnified, gradual, and a contagion over the [+4, + 20] period for which the event firms' stocks decline an additional 0.8217 percent. The gradualness may be explained by the numbers of the rivals' stock prices that are feeding back onto the event firm's stock price and the smaller rivals' stock price drop (i.e. less discernable signal) that is precipitating the feedback (roughly 0.5143 percent rather than the event firm's initial 12.4665 percent) to the event stock. The magnification is due to the numbers of the rivals' stock prices that are feeding back onto the event firm's stock price. Unlike for the event stocks, the rivals' portfolio's AR is positive and insignificant (it is 0.0431 percent) for the [+4, + 20] period. Thus, the dominance of the contagion effect (from the event firm's stock price to its rivals' stocks' prices) over the competitive effect only extends for the three

post-event days. Finally, the rivals' stocks perform statistically significantly worse than the event stocks for the [+1, + 3] period, but statistically significantly better than the event stocks for the [+4, + 20] period.

Table II shows the results for the S&P 500 event stocks and their rivals' stock portfolios for the 1995-2006 sub-period. The event day and pre-event day results are generally similar in direction and magnitude to those in Table I. The event firms' stocks and their rivals' stocks exhibit statistically significant negative average one day ARs in four out of the five days immediately prior to the event day, i.e. there is strong industry stock price comovement (contagion) in the week prior to and on the day of the event stock's large price decline. As in Table I, the event stocks statistically significantly underperform (both relative to the market and their rivals) in the [+4, + 20] period.

Slight differences between the results in Tables I and II occur in the post-event period. In Table II, the average AR on day +1 is not significantly different from zero for either the event stock (there is no overreaction) or its rivals. Also in Table II, the rivals' portfolio does not exhibit a statistically significant negative AR for the [+1, + 3] period, instead, it exhibits a statistically insignificant gain (i.e. the competitive effect slightly dominates the contagion effect). Finally, in the [+1, + 3] period, the rivals did statistically significantly worse than the event stocks for Table I, whereas the opposite held for Table II. It appears that in the more recent and shorter period (1995-2006 presented in Table II, for which the stock markets were presumably more efficient), while the rivals CAR[0, 3] (approximately AR[0] + CAR[+1, + 3]) was essentially the same as for the (1973-2006) period, all of it occurred on the event day, whereas more of it occurred in the [+1, + 3] period (i.e. was lagged) for the (1973-1994) years. As a consequence, the feedback from the rivals to the event firms began immediately (and there was no temporary event stock reversal) in Table II.

Table III shows the results for the S&P 600 (i.e. small cap) event stocks and their rivals' stock portfolios between 1995 and 2006 (thus, their contemporaneous analogs are the S&P 500, large cap, results in Table II). In the pre-event period, eight of the 20 S&P 600 event stock negative average ARs are statistically significant at the 90 percent confidence level. Somewhat more slowly than for the large cap stocks, it is only in the three-day period immediately preceding the event that the rivals' stock portfolios' ARs are consistently negative and significant. On the event day (day 0), the event stocks have an average AR of − 13.9591 percent (which is 1 percent lower than the S&P 500 event stocks' AR as seen in Table II), while the rivals' stock portfolios' − 0.1266 percent average AR is less negative than the − 0.7530 percent experienced by the S&P 500 rivals' stock portfolio. Notably, the event stock's AR[0] is more than 100 times that of their rivals, i.e. 13.9591/0.1266; this ratio is roughly six times larger than it was for the large cap stock (12.9532/0.753), which suggests that the small cap rivals event-contemporaneous response is much smaller than that for the large cap stocks. Also, the 45.2 percent positive AR[0]s for the S&P 600 rivals' portfolios, is not as small as the 36.1 percent for the S&P 500 rivals' portfolios.

The short-term post-event reversal documented by Bremer and Sweeney (1991) and studied in Cox and Peterson (1994) is statistically significant for the S&P 600 event stocks. It did not disappear for the post-October 1987 period as Cox and Peterson (1994) argued. Event stockholders on day +1 experience an average return of 0.6215 percent, which is statistically significant at the 99 percent confidence level and is higher than

Day	Event firms' abnormal stock return (AR)		Rivals portfolios' abnormal stock return (AR)		Rivals portfolios' AR − event stocks' AR	
	Average (%)	Positive (%)	Average (%)	Positive (%)	Average (%)	Positive (%)
−20	−0.1059	47.4**	−0.0932*	46.4***	0.0127	50.2
−19	−0.1191	47.8*	0.0140	50.4	0.1331	52.7**
−18	−0.1645**	46.5***	0.3780***	53.6***	0.5425***	54.1***
−17	−0.2344***	44.6***	−0.0604	47.9*	0.1740**	52.4**
−16	−0.1453*	47.3**	−0.1566***	46.0***	−0.0113	50.0
−15	−0.1123	46.0***	−0.3031***	42.3***	−0.1908**	48.6
−14	−0.1154	47.7**	−0.0831	46.7***	0.0323	50.0
−13	−0.2623***	46.7***	0.1191**	51.8	0.3814***	53.6***
−12	−0.2385***	46.7***	0.2029***	52.9**	0.4414***	54.6***
−11	−0.1688**	46.5***	0.1460**	52.8**	0.3148***	53.7***
−10	−0.1499*	46.9***	0.0806	51.2	0.2305**	53.6***
−9	−0.1698*	46.7***	−0.0217	51.1	0.1481	53.6***
−8	−0.1599*	46.2***	0.1117**	52.1*	0.2717***	53.8***
−7	−0.2172**	46.5***	0.0393	51.4	0.2565***	53.6***
−6	−0.0078	49.5	0.1723***	54.8***	0.1800*	52.9**
−5	−0.1720*	46.9***	−0.1823***	45.3***	−0.0103	50.7
−4	−0.2299**	46.6***	−0.1474***	45.7***	0.0825	51.4
−3	−0.1003	47.3**	0.0274	48.7	0.1277	52.0*
−2	−0.1876*	45.5***	−0.1012*	48.5	0.0864	52.4**
−1	−0.7471***	42.1***	−0.2227***	46.3***	0.5245***	56.5***
0	−12.9532***	0.5***	−0.7530***	36.1***	12.2002***	99.7***
1	−0.0379	51.7	−0.0695	49.4	−0.0317	48.1*
2	−0.1140	48.7	0.1951***	51.4	0.3091**	51.0
3	−0.1232	47.5**	−0.0190	49.0	0.1042	50.4
4	0.0181	49.3	−0.0470	47.1**	−0.0651	50.7
5	−0.1180	48.7	−0.0902	47.0***	0.0278	51.3
6	−0.0999	47.5**	−0.0120	50.8	0.0879	51.0
7	−0.1329	46.6***	0.1799***	50.7	0.3128***	53.3***
8	0.0683	48.4	−0.0450	48.7	−0.1133	50.0
9	−0.0955	48.7	−0.0495	47.3**	0.0460	51.3
10	−0.0138	51.1	0.1694***	52.8**	0.1832*	50.6
11	−0.0620	49.7	0.0217	50.7	0.0837	50.8
12	−0.0250	49.6	0.1589***	52.5**	0.1839*	49.8
13	−0.1273	48.0*	−0.0774	48.6	0.0499	50.8
14	0.0224	49.3	0.1976***	49.2	0.1752*	50.1
15	−0.1667*	46.9***	−0.0843	47.7**	0.0824	53.0***
16	−0.0972	48.9	−0.2482***	43.7***	−0.1509	47.8*
17	0.1039	50.0	0.2673***	52.2*	0.1634	52.2*
18	0.0671	49.9	0.2407***	51.6	0.1736*	51.1
19	0.0619	48.9	−0.1760***	46.4***	−0.2378**	48.8
20	−0.1526	46.7***	−0.1231**	48.0*	0.0295	50.0
1 through 3	−0.3113	48.6	0.0992	49.6	0.4106**	0.5211*
4 through 20	−1.0751***	45.5***	0.1680	50.0	1.2431***	0.5468***

Table II.
Abnormal stock returns around large stock price decline (i.e. event) days (for 1,871 events of S&P 500 stocks from 1995 through 2006)

Notes: Significance at: *0.10, **0.05 and ***0.01 levels (two-tailed test); each event stock has an at least 10 percent event-day stock price drop (i.e. the event-day return is ≤ -10 percent); its rival portfolio is equally weighted and is composed of the indexes' other stocks that have its SIC; the daily abnormal stock return on day t (where $t = -20$ to $+20$) is the difference between the actual return and the market model estimated return; the market model coefficients are estimated on the 200-day period (days −220 through −21) prior to the event day; the CRSP Value-Weighted Return Index is the market return proxy

Day	Event firms' abnormal stock return (AR)		Rivals portfolios' abnormal stock return (AR)		Rivals portfolios' AR − event stocks' AR	
	Average (%)	Positive (%)	Average (%)	Positive (%)	Average (%)	Positive (%)
−20	−0.1841***	45.6***	−0.0744*	46.0***	0.1098	51.5*
−19	−0.1111	47.2***	0.0482	49.9	0.1593**	52.9***
−18	−0.0520	47.0***	0.3904***	54.3***	0.4424***	55.1***
−17	−0.0461	46.5***	0.0865**	51.6**	0.1326*	52.8***
−16	−0.0897	46.5***	−0.1320***	46.4***	−0.0423	50.8
−15	−0.0748	47.7***	−0.2071***	44.2***	−0.1322	48.4**
−14	−0.0521	46.9***	−0.1267***	47.4***	−0.0746	50.7
−13	−0.1262**	46.9***	0.0156	52.3***	0.1418**	52.5***
−12	−0.0858	47.5***	0.1419***	51.9**	0.2277***	53.7***
−11	−0.1298*	46.5***	0.1369***	52.2***	0.2668***	53.9***
−10	−0.1407**	47.5***	0.1159***	48.1**	0.2567***	51.8**
−9	−0.0598	47.3***	0.2406***	54.5***	0.3004***	54.0***
−8	−0.0640	47.1***	0.2616***	54.4***	0.3256***	54.0***
−7	−0.2054***	45.2***	0.0324	51.2	0.2378***	53.6***
−6	−0.1161*	46.4***	0.0458	49.5	0.1620**	53.3***
−5	−0.0549	46.4***	0.0144	49.6	0.0693	52.7***
−4	−0.0453	45.6***	−0.0233	47.9***	0.0219	52.7***
−3	−0.2420**	44.3***	−0.1032***	46.1***	0.1388	53.6***
−2	−0.0563	45.7***	−0.1256***	48.5*	−0.0694	52.6***
−1	−0.2386**	44.4***	−0.1769***	48.3**	0.0617	53.7***
0	−13.9591***	0.1***	−0.1266***	45.2***	13.8325***	99.9***
1	0.6215***	53.8***	−0.1730***	45.6***	−0.7945***	45.1***
2	0.1361	48.6*	0.0440	50.7	−0.0921	50.8
3	−0.0927	46.8***	−0.0486	47.9***	0.0441	52.1***
4	0.0036	48.2**	−0.1440***	45.6***	−0.1476*	49.3
5	0.0170	47.9***	−0.1152***	46.0***	−0.1322*	49.6
6	−0.0639	46.8***	−0.0137	47.8***	0.0502	51.8**
7	−0.1985**	45.9***	0.1643***	53.0***	0.3628***	53.7***
8	−0.2305***	45.7***	−0.0545	46.0***	0.1760**	52.5***
9	−0.0946	47.2***	−0.1111***	47.0***	−0.0166	52.1***
10	−0.1192	47.3***	0.0604	50.5	0.1796**	52.8***
11	0.0119	48.4**	−0.0399	49.5	−0.0518	50.6
12	−0.0891	45.9***	−0.0084	48.4**	0.0808	52.2***
13	−0.0703	48.2**	−0.0975***	47.1***	−0.0272	49.8
14	−0.0717	47.4***	0.2617***	51.8**	0.3334***	53.1***
15	−0.0985	47.9***	0.0383	49.4	0.1368*	51.6**
16	−0.1150	47.0***	−0.2269***	44.2***	−0.1119	49.1
17	−0.1219*	46.4***	0.1709***	49.7	0.2928***	53.2***
18	−0.0489	46.6***	0.3289***	55.6***	0.3778***	55.0***
19	−0.1169	47.4***	−0.2377***	43.8***	−0.1208	49.4
20	−0.1423**	45.7***	−0.0661*	47.9***	0.0762	51.9**
1 through 3	0.6052***	52.3***	−0.1885***	48.4**	−0.7937***	0.4664***
4 through 20	−1.7889***	44.0***	−0.1222	48.8	1.6667***	0.5485***

Notes: Significance at: *0.10, **0.05 and ***0.01 levels (two-tailed test); each event stock has an at least 10 percent event-day stock price drop (i.e. the event-day return is < -10 percent); its rival portfolio is equally weighted and is composed of the indexes' other stocks that have its SIC; the daily abnormal stock return on day t (where $t = -20$ to $+20$) is the difference between the actual return and the market model estimated return; the market model coefficients are estimated on the 200-day period (days -220 through -21) prior to the event day; the CRSP Value-Weighted Return Index is the market return proxy

Table III.
Abnormal stock returns around large stock price decline (i.e. event) days (for 4,095 events of S&P 600 stocks from 1995 through 2006)

the 0.1717 percent (as seen in Table I) and the − 0.0379 (as seen in Table II) for the S&P 500 event stocks. The event firm's AR[1] and CAR[+1, + 3] represents a cumulative gradual response to the event and feedback from the rivals' response (there may be some residual bid-ask price bounce effect as well). Also potentially anomalous, the S&P 600 event stock [+4, + 20] period CAR is a statistically significant − 1.7889 percent (as seen in Table III), which is more negative than that for the S&P 500 event stocks (as seen in Tables I and II); this too represents a cumulative gradual response to the event and a feedback response from the rivals' response.

Most of the S&P 600 rivals' response to the event is lagged. As noted earlier, the S&P 600 rivals' stock portfolios' average AR[0] was − 0.1266 percent (roughly only a fifth of that for the S&P 500 rivals shown in Table II). The S&P 600 rivals' stock portfolios continue to experience a significantly negative average CAR of − 0.1885 percent in the [+1, + 3] period (while the event stocks have a contemporaneous significantly positive average CAR). While the [+1, + 3] period intra-industry effect could be interpreted as a contemporaneous competitive effect, this interpretation seems less plausible than interpreting the effect as a lagged contagion effect given that the event firm's AR[0] is about 20 times as large as its CAR[+1, + 3], i.e. 13.9591/0.6052. The S&P 600 rivals' CAR continues to be negative (− 0.1222 percent) in the [+4, + 20] period. Thus, the industry contagion effect (from the event firm to its rivals) seems to be more gradual and longer lasting for the S&P 600 stocks than for the S&P 500 stocks. As with the S&P 500 stocks, the S&P 600 rivals' portfolio does not exhibit statistically a significant AR for the [+4, + 20] period. Interestingly, if one were to calculate CAR[0, 20] for the event firms and for their rivals, then divide the event firms' CAR[0, 20] by that for their rivals, the ratios would be around 30 for each table (though a bit larger for the small cap firms as may be expected). This taken together with the earlier observation that this ratio based on AR[0], was more than six times higher for the small cap stocks, suggests while the small cap response is delayed, the cumulative response over the [0, 20] period is similar.

Based on the average ARs in Tables II and III, the average CARs for the:

- event stocks;
- rivals' stock portfolios; and
- difference between the event stocks and their rivals' stock portfolios are portrayed in Figures 1 and 2.

In Figure 1, the S&P 500 event stocks begin with a − 3.7419 percent average CAR at day − 1 before it falls to − 16.2104 percent at day 0 and reaches its minimum of − 17.1315 percent at day + 16. The S&P 500 rivals' stock portfolios' average CAR in Figure 1 does not go beyond ± 1 percent for the entire 41-day period. It reaches its peak at 0.5451 percent on day − 6 and its trough at − 0.9045 percent on day + 1. The excess of the rivals' stock portfolios' CAR over the event stocks' CAR generally rises throughout the entire period with more than half the rise occurring on the event day.

In Figure 2, the S&P 600 event stocks begin with a − 2.1529 percent average CAR through day − 1 before it falls to − 15.8115 percent through day 0 and falls to − 16.5550 percent through day + 20. The S&P 600 rivals stock portfolios' average CAR in Figure 2 (like that for the S&P 500 rivals shown in Figure 1) also does not go beyond ± 1 percent for the entire 41-day period. It reaches its peak at 0.9930 percent on day − 5 and its trough at − 0.1057 percent on day + 13. The excess of the rivals' stock portfolios' CAR over the event stocks' CAR generally rises throughout the entire period

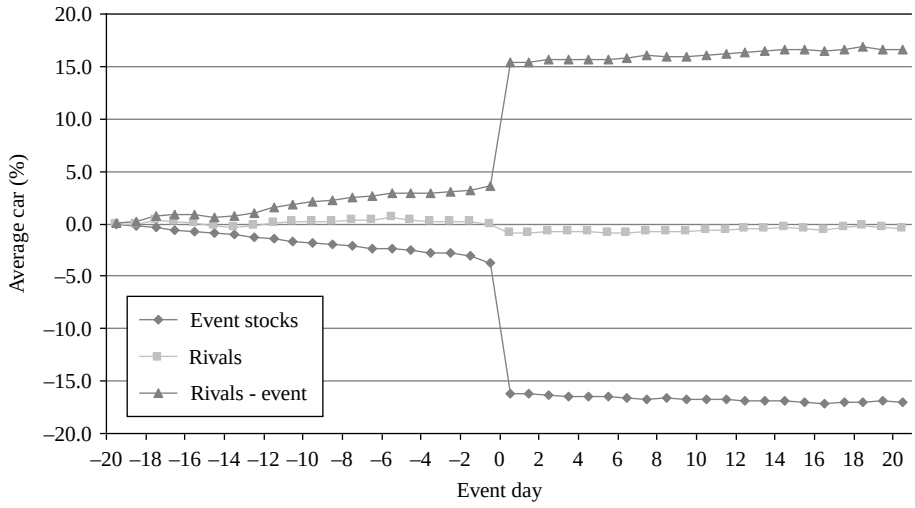

Figure 1.
Average cumulative abnormal stock returns from market model (%) around at least 10 percent stock price drop (i.e. event) days (S&P 500 stocks, 1995-2006)

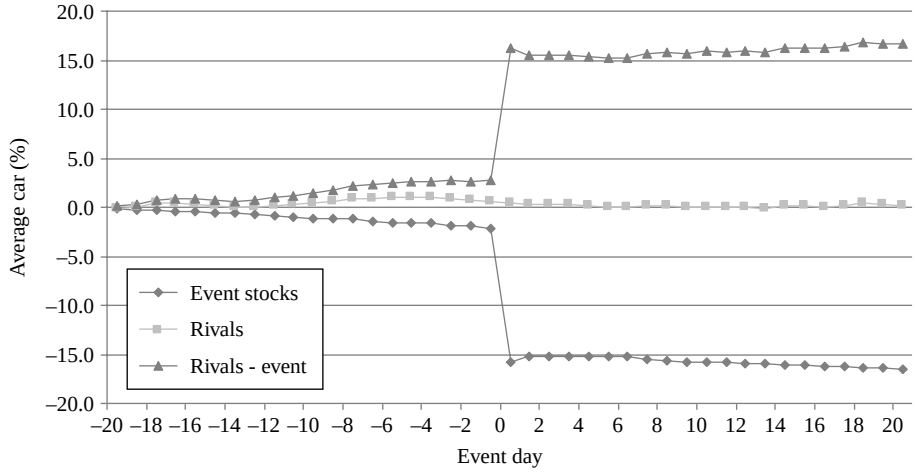

Figure 2.
Average cumulative abnormal stock returns from market model (%) around at least 10 percent stock price drop (i.e. event) days (S&P 600 stocks, 1995-2006)

(though not as consistently as for the S&P 500 stocks) with more than half the rise occurring on the event day.

B. The relation between the post-event ARs and the prior variables

Table IV shows the relation between the prior variables and the post-event AR (and CARs) for the S&P 500 event stocks (Panel A), their rivals' stock portfolios (Panel B), and the differential between the two (Panel C) from 1973 through 2006. We begin with the event stocks' regressions (Panel A). None of the explanatory variables' coefficients are significant in the AR[+1] and CAR[+1, + 3] regressions. However, the PRECAR, MKTSHR, and CORR (AVGSTD) coefficients are positive (negative) and statistically significant in the CAR[+4, + 20] regression. They suggest that the event stock's CAR[+4, + 20] is worse:

	AR [+1] Coefficient	*p*-value	CAR [+1, + 3] Coefficient	*p*-value	CAR [+4, + 20] Coefficient	*p*-value
Panel A: dependent variable: event firm's post-event market model AR and CARs						
Intercept	0.0046	0.2144	0.0084	0.1072	0.0046	0.5973
PRECAR	0.0026	0.6414	0.0039	0.6278	0.0472	0.0003***
MKTSHR	−0.0002	0.9873	0.0138	0.5212	0.0631	0.0773*
CORR	−0.0036	0.5354	−0.0022	0.7919	0.0387	0.0046***
HHI	−0.0018	0.9253	−0.0222	0.4031	−0.0451	0.3055
AVGSTD	−0.0338	0.7093	−0.2070	0.1070	−1.0227	0.0000***
Sample size	3,070		3,070		3,070	
F-stat.	0.2131	0.9571	0.9699	0.4347	11.6144	0.0000***
Panel B: dependent variable: rival portfolio's post-event market model AR and CARs						
Intercept	−0.0020	0.2353	−0.0023	0.4166	0.0152	0.0067***
PRECAR	−0.0014	0.5837	−0.0026	0.5415	0.0260	0.0023***
MKTSHR	−0.0068	0.3231	−0.0007	0.9533	−0.0415	0.0734*
CORR	−0.0037	0.1542	−0.0079	0.0727*	0.0025	0.7806
HHI	−0.0023	0.7851	−0.0218	0.1244	0.0517	0.0704*
AVGSTD	0.1082	0.0080***	0.2030	0.0032***	−0.2535	0.0668*
Sample size	3,070		3,070		3,070	
F-stat.	6.0594	0.0000***	8.5119	0.0000***	2.9688	0.0112**
Panel C: dependent variable: rival portfolio's − event firm's						
Intercept	−0.0065	0.0885*	−0.0106	0.0496**	0.0106	0.2312
PRECAR	−0.0040	0.4945	−0.0065	0.4357	−0.0212	0.1186
MKTSHR	−0.0065	0.6813	−0.0145	0.5184	−0.1045	0.0044***
CORR	−0.0001	0.9845	−0.0057	0.5027	−0.0362	0.0099***
HHI	−0.0005	0.9781	0.0003	0.9906	0.0967	0.0326**
AVGSTD	0.1420	0.1333	0.4100	0.0022***	0.7692	0.0005***
Sample size	3,070		3,070		3,070	
F-stat.	1.1900	0.3114	3.5269	0.0035***	8.3730	0.0000***

Table IV.
Regression analysis of cumulative residuals of event stocks and rival portfolios on event stock and industry characteristics – S&P 500 Universe (1973-2006)

Notes: Significance at: *0.10, **0.05 and ***0.01 levels; the event stocks include one-day price drops of 10 percent or more between January 1973 and December 2006 of S&P 500 Index constituents; rival portfolios are equally weighted portfolios with S&P 500 Index constituents with same four-digit SIC code of the event stock; PRECAR is the 21-day (− 20, 0) market model cumulative residual and MKTSHR is the pre-event percentage of industry sales of the event stock; CORR measures the pre-event (− 220, − 21) return correlation between event stock and rival portfolio; HHI measures the industry's pre-event sales concentration and AVGSTD is the industry's average standard deviation of pre-event (− 220, − 21) daily returns

- the worse the event stock's pre-event through event CAR, (opposite of what is implied by the overreaction hypothesis);
- the lower the event stock's pre-event market share;
- the lower the event stock's pre-event return correlation with its rivals; and
- the higher the pre-event industry average standard deviation.

Panel B shows that the PRECAR, HHI, MKTSHR, and AVGSTD coefficients are statistically significant in the rivals' stock portfolios' CAR[+4, + 20] regression; the PRECAR and HHI coefficients are positive, while the MKTSHR and AVGSTD coefficients are negative. Thus, the rivals' CAR[+4, + 20 is worse:

- the worse the event stock's pre-event through event CAR;
- the lower the pre-event market concentration (HHI);
- the higher the event firm's pre-event market share; and
- the higher the pre-event industry average standard deviation.

The CORR and AVGSTD are statistically significant for at least one of the other regressions (AR[+1] or CAR[+1, + 3]), but opposite in sign of what they were in the CAR[+4, + 20] regression; the rivals' short-term post-event performance is worse the: higher their pre-event return correlation with the event stocks and the lower the pre-event industry average standard deviation.

Panel C shows the relation between the prior variables and the excess of the rival portfolio's return over that for the event firms. The rival-event firm return differential is positively related to AVGSTD for both the [+1, + 3] and [+4, + 20] periods. The rival-event firm return differential in the [+4, + 20] period is also positively related to the degree of industry concentration (HHI) but negatively related to the event firms' market share (MKTSHR) and its pre-event stock return correlation (CORR) with that of its rivals. The rivals' performance relative the event firm in the post-event period (primarily [+4, + 20]) is better: the lower the event firm's pre-event market share, the lower their pre-event return correlation with the event stocks, the higher the pre-event market concentration, and the higher the pre-event industry average standard deviation. Since Panel C is essentially Panel B-Panel A, the Panel C coefficients that are statistically significant tend to be the same as those in Panels A and B; moreover, their Panel C signs tend to be the same as those in Panel B and opposite of those in Panel A, as expected.

Table V presents the relationships between the prior variables and the post-event AR (and CARs) for the S&P 500 event stocks (Panel A), their rivals' stock portfolios (Panel B), and the return differential between rivals' stock portfolio and event stock (Panel C) between 1995 and 2006. These results are similar to, though generally weaker than, those in Table IV (those for the longer, i.e. 1973-2006, period).

Table VI is the small cap stock analog (i.e. it shows the results for the S&P 600 stocks) to Table V (which shows the results for the S&P 500 stocks). For the event firms' stocks (Panel A), these S&P 600 results are similar in sign and significance to (though somewhat stronger than) the S&P 500 results in Tables IV and V. One difference is that the S&P 600 PRECAR's coefficient is negative and significant in the AR[+1] and CAR[+1, + 3] regressions (i.e. there is support for the overreaction hypothesis, though we have a new explanation for why it occurs), whereas it was insignificant for the S&P 500 regressions. Also in the AR[+1] and CAR[+1, + 3] regressions, the CORR variable's coefficient is negative and significant in the S&P 600 regressions, whereas it was insignificant for the S&P 500 regressions. Finally, for the CAR[+4, + 20] regression; the S&P 600 CORR's coefficient is insignificant whereas it was significant for the S&P 500. Thus, for the S&P 600 event firms:

- the worse the event stock's pre-event through event CAR, the better its AR[+1] and CAR[+1, + 3] followed by a worse CAR[+4, + 20];
- the lower its pre-event market share, the lower its CAR[+4, + 20];
- the higher the pre-event return correlation with its rivals, the lower its post-event AR[+1] and CAR[+1, + 3];

	AR [+1] Coefficient	*p*-value	CAR [+1, + 3] Coefficient	*p*-value	CAR [+4, + 20] Coefficient	*p*-value
Panel A: dependent variable: event firm's post-event market model AR and CARs						
Intercept	0.0025	0.6373	0.0007	0.9215	0.0019	0.8816
PRECAR	−0.0064	0.3611	−0.0008	0.9382	0.0485	0.0048***
MKTSHR	−0.0236	0.2610	−0.0018	0.9524	0.0716	0.1651
CORR	0.0010	0.8904	0.0052	0.6332	0.0602	0.0012***
HHI	0.0176	0.5104	−0.0125	0.7467	−0.0472	0.4731
AVGSTD	−0.0241	0.8269	−0.1333	0.4025	−1.2066	0.0000***
Sample size	1,854		1,854		1,854	
F-stat.	0.8370	0.5233	0.4468	0.8158	10.5221	0.0000***
Panel B: dependent variable: rival portfolio's post-event market model AR and CARs						
Intercept	0.0005	0.8235	0.0058	0.1360	0.0146	0.0761*
PRECAR	0.0010	0.7245	−0.0046	0.3825	0.0358	0.0012***
MKTSHR	−0.0099	0.2655	−0.0198	0.2080	0.0022	0.9474
CORR	−0.0059	0.0639*	−0.0139	0.0135**	0.0003	0.9815
HHI	0.0076	0.5029	0.0049	0.8057	0.0077	0.8551
AVGSTD	0.0830	0.0764	0.1164	0.1583	−0.2579	0.1388
Sample size	1,854		1,854		1,854	
F-stat.	2.6282	0.0224**	5.2213	0.0001***	2.7357	0.0181**
Panel C: dependent variable: rival portfolio's − event firm's						
Intercept	−0.0020	0.7130	0.0051	0.5122	0.0127	0.3240
PRECAR	0.0074	0.2994	−0.0038	0.7155	−0.0127	0.4623
MKTSHR	0.0137	0.5251	−0.0180	0.5643	−0.0695	0.1804
CORR	−0.0070	0.3665	−0.0191	0.0874*	−0.0599	0.0013***
HHI	−0.0100	0.7153	0.0174	0.6614	0.0549	0.4061
AVGSTD	0.1071	0.3428	0.2497	0.1274	0.9487	0.0005***
Sample size	1,854		1,854		1,854	
F-stat.	0.6112	0.6913	1.4011	0.2208	6.7661	0.0000***

Table V.
Regression analysis of cumulative residuals of event stocks and rival portfolios on event stock and industry characteristics – S&P 500 Universe (1995-2006)

Notes: Significance at: *0.10, **0.05 and ***0.01 levels; the event stocks include one-day price drops of 10 percent or more between January 1995 and December 2006 of S&P 500 Index constituents; rival portfolios are equally weighted portfolios with S&P 500 Index constituents with same four-digit SIC code of the event stock; PRECAR is the 21-day (−20, 0) market model cumulative residual and MKTSHR is the pre-event percentage of industry sales of the event stock; CORR measures the pre-event (−220, −21) return correlation between event stock and rival portfolio; HHI measures the industry's pre-event sales concentration and AVGSTD is the industry's average standard deviation of pre-event (−220, −21) daily returns

- the lower the pre-event industry concentration (HHI), the higher its CAR[+4, + 20]; and
- the lower the pre-event industry average standard deviation, the higher its CAR[+4, + 20].

For the S&P 600 rivals' stock portfolios (Panel B), the CORR variable's coefficient is negative and significant in both the AR[+1] and the CAR[+1, + 3] regressions. Also for the CAR[+1, + 3] regression, the MKTSHR's coefficient is negative (and significant), while the HHI's coefficient is positive (and significant). When these S&P 600 results are compared to the S&P 500 results for those explanatory variables that are statistically significant in at least one of the tables, the signs are almost always the same in each table.

	AR [+1]		CAR [+1, + 3]		CAR [+4, + 20]	
	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
Panel A: dependent variable: event firm's post-event market model AR and CARs						
Intercept	0.0061	0.2018	0.0079	0.2318	0.0142	0.2259
PRECAR	−0.0131	0.0018***	−0.0232	0.0001***	0.0321	0.0019***
MKTSHR	−0.0001	0.9965	−0.0121	0.5958	0.0773	0.0568*
CORR	−0.0216	0.0056***	−0.0260	0.0158**	0.0122	0.5262
HHI	−0.0053	0.8016	0.0104	0.7209	−0.0867	0.0936**
AVGSTD	0.0792	0.4214	0.0352	0.7961	−1.0363	0.0000***
Sample size	4,035		4,035		4,035	
F-stat.	3.7230	0.0023***	4.4995	0.0004***	7.4246	0.0000***
Panel B: dependent variable: rival portfolio's post-event market model AR and CARs						
Intercept	0.0007	0.6750	0.0069	0.0166**	0.0067	0.3344
PRECAR	0.0008	0.5907	0.0005	0.8566	0.0031	0.6029
MKTSHR	−0.0082	0.1670	−0.0285	0.0039***	−0.0361	0.1298
CORR	−0.0052	0.0624*	−0.0165	0.0004***	−0.0103	0.3592
HHI	0.0053	0.4818	0.0220	0.0809*	0.0459	0.1309
AVGSTD	0.0053	0.8814	−0.0237	0.6879	−0.0356	0.8029
Sample size	4,035		4,035		4,035	
F-stat.	2.2066	0.0509*	6.9961	0.0000***	0.8207	0.5347
Panel C: dependent variable: rival portfolio's − event firm's						
Intercept	−0.0054	0.2785	−0.0010	0.8821	−0.0076	0.5488
PRECAR	0.0139	0.0013***	0.0237	0.0001***	−0.0289	0.0091***
MKTSHR	−0.0081	0.6355	−0.0164	0.4905	−0.1133	0.0092***
CORR	0.0164	0.0426**	0.0095	0.3974	−0.0225	0.2742
HHI	0.0106	0.6273	0.0116	0.7022	0.1326	0.0168**
AVGSTD	−0.0739	0.4693	−0.0589	0.6790	1.0006	0.0001***
Sample size	4,035		4,035		4,035	
F-stat.	2.9250	0.0122**	3.4640	0.0040***	7.1836	0.0000***

Notes: Significance at: *0.10, **0.05 and ***0.01 levels; the event stocks include one-day price drops of 10 percent or more between January 1995 and December 2006 of S&P 600 Index constituents; rival portfolios are equally weighted portfolios with S&P 600 Index constituents with same four-digit SIC code of the event stock; PRECAR is the 21-day (−20, 0) market model cumulative residual and MKTSHR is the pre-event percentage of industry sales of the event stock; CORR measures the pre-event (−220, −21) return correlation between event stock and rival portfolio; HHI measures the industry's pre-event sales concentration and AVGSTD is the industry's average standard deviation of pre-event (−220, −21) daily returns

Table VI.
Regression analysis of cumulative residuals of event stocks and rival portfolios on event stock and industry characteristics – S&P 600 Universe (1995-2006)

The only variable whose coefficient is statistically significant in all three tables is the CORR variable for the CAR[+1, + 3] regression. When the pre-event correlation between the stock returns for the event firm and its rivals' is high, the rivals' stocks' CAR[+1, + 3] is low.

For the rivals portfolio's-event stock's return differential (Panel C), the results tell nearly the same story as the previously discussed Panel A results; essentially the same variable coefficients are significant in each Panel and the signs in Panel C are opposite of those in Panel A; this makes sense since Panel C is essentially Panel B-Panel A.

Overall (across Tables IV-VI), for the event stock return and the rival-event firm return differential, the prior variables' coefficients are most frequently statistically significant in the CAR[+4, + 20] regression. This is surprising in that this is farthest from the event; however, it does cover a longer period than do the AR[+1] and the

CAR[+1, + 3] periods. For the rivals' stock portfolios, the pre-event variables' coefficients are most frequently statistically significant in the CAR[+1, + 3] regression.

IV. Conclusion

Overall for the event stocks, we find the following. Similar to the literature (Cox and Peterson, 1994; Lang and Stulz, 1992), in the [− 3, − 1] period, event stocks generally experience statistically significant negative ARs. The negative pre-event daily ARs are followed by about − 13 percent event-day ARs. For the [+1, + 3] period, S&P 600 stocks exhibit statistically significant abnormal reversals; this potentially anomalous EMH result conflicts with the Cox and Peterson (1994) observation that the [+1, + 3] price reversal disappears by the October 1987 stock price crash and weakens their argument that the reversal was due to illiquidity effects that diminished as the markets became more liquid. Their failure to find significant reversal in the post-October 1987 period may be due to their short post-October 1987 period. Similar to Cox and Peterson (1994), for both S&P 500 and 600 stocks, event stocks statistically significantly continue their event-day poor performance in the [+4, + 20] period and the S&P 600 stocks' underperformance is more severe.

Overall for the event firms' rivals' stock portfolios, we find the following results which are all reasonably consistent with the literature. They experience statistically significant pre-event day [generally day − 3 through day − 1] and event-day negative ARs, though these negative ARs begin about two days later for the small cap stocks than they do for the large cap stocks. Thus, the contagion effect dominates the competitive effect. There is somewhat anomalous evidence (strong for the S&P 600, but weak for the S&P 500 stocks) that the rivals' negative ARs (i.e. the contagion) continues into the [+1, + 3] period (i.e. there is lagged contagion. There is also some evidence of lagged contagion for the [− 20, − 1] period.). The lagged contagion (from the event firm's stock to its rivals' stocks) is consistent with the gradual dissemination of information which is accentuated for small cap stocks because they have fewer analysts following them so that their price adjustments are slower. The [+1, + 3] period continuity for the rivals' stock returns is an interesting contrast to the event firms' contemporaneous return reversal (where each are more significant for small cap than large cap stocks). It could be the result of a competitive effect feeding back from the rivals to the event firm (or from a residual bid-ask price bounce effect). Finally, consistent with the EMH, there is no statistically significant intra-industry effect (from the event firm to its rivals) for the [+4, + 20] period.

The event firms' stocks performed statistically significantly worse than their rivals' stock portfolios in the [+4, + 20] period for both the S&P 500 and 600 firms. This result also apparently violates the EMH. As far as we know, this issue has not been previously directly addressed in the literature. Typically, performance has been measured relative to the market and for a shorter post-event period.

Consistent with the overreaction hypothesis, and unlike Cox and Peterson (1994), we find that the small cap event stocks' CAR[+1, + 3] (and AR[+1]) is negatively related to their pre-event through event CAR when the MKTSHR variable was included in the regression as an explanatory variable. This also weakens the Cox and Peterson (1994) arguments that:

- the overreaction hypothesis was unjustified since the CAR[+1, + 3] and PRECAR terms were unrelated when the size term was included as an explanatory variable; and

- the reversal was due to illiquidity effects that diminished as the markets became more liquid by the 1987 stock market crash.

The event firm's CAR[+4, + 20] is worse:

- the worse its pre-event through event CAR (i.e. there is under reaction. Cox and Peterson (1994) did not find these variables to be significantly related but they considered short periods, i.e. four-year periods);
- the smaller its pre-event market share (like Cox and Peterson, 1994);
- the less the pre-event closeness to its rivals;
- the less competitive the industry; and
- the riskier the industry.

These results extend the Cox and Peterson (1994) findings that the event firm's CAR[+4, + 20] is worse, the smaller the event stock's capitalization. Industry factors beyond the market share (size) effect the event firm's longer period AR continuity. Factors 3-5 have not been examined in the literature as factors affecting the event firm's CAR[+4, + 20].

The rivals' CAR[+1, + 3] is worse, the greater their pre-event closeness to the event firm. Their CAR[+4, + 20] is better (significantly for large cap firms, insignificantly for small cap firms), the higher the event firm's pre-event through event CAR.

All of the statistically significant CAR[+4, + 20] results discussed above seem to contradict the weak form EMH. Traders have had at least three days to process and act upon this publicly available event and pre-event information. Also the 17 day return period is long. One can also argue that the [+1, + 3] period results violate the weak form EMH; however, given its shorter period and closer proximity to the event, the contradiction to the EMH seems less compelling. Our explanation for these results is as follows.

Our data show that the event firms' stock prices fall about 13 percent on the event day, while their rivals' stock prices fall roughly only about a 30th as much (roughly 0.4 percent). Moreover, much of the rivals' stocks' price fall is delayed for up to a couple days (less so for the large cap stocks than for the small cap stocks since the large cap stocks are followed more closely by analysts). In part, the rivals' stocks' prices presumably fall much less than the event firms' stock prices because there are many rivals for each event stock. While the average rivals' stock price drop is a small percentage (roughly 0.4 percent), due to the numbers of rivals, the dollar effect on the industry can be very large. This prompts a feedback response upon the event firms' stocks that can be competitive for a couple days [+1, + 3] (mostly noticed for small cap stocks), but is magnified, gradual, and a contagion over the longer [+4, + 20] period for which the event firms' stocks decline an additional 0.8-1.8 percent (again less so for the large cap stocks than for the small cap stocks since the large cap stocks are followed more closely by analysts). The gradualness may be explained by the numbers of the rivals' stock prices that are feeding back onto the event firm's stock price and the smaller rivals' stock price drop (i.e. less discernable signal), that is precipitating the feedback to the event firm's stock price (roughly 0.4 percent rather than the event firm's initial 13 percent). The magnification is due to the numbers of the rivals' stock prices that are feeding back onto the event firm's stock price. Thus, while we observe the event firm's resumed stock price drop in the [+4, + 20] period that was observed in Cox and

Peterson (1994), we provide an intra-industry effects and feedback explanation. This explanation is bolstered by the fact that the event firm's CAR[+4, + 20] is better the: smaller the event, smaller the event firm's pre-event market share, more correlated the event firm and rivals' stock prices in the pre-event period, less concentrated the industry, and less risky the industry.

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