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Investor Reaction to Corporate Event Announcements: Underreaction or Overreaction?*

Two conflicting behavioral models, underreaction and overreaction, have been proposed to explain long-run abnormal returns following a variety of corporate events. We test hypotheses that distinguish between these two models. We find that across four different corporate events, long-run abnormal returns exhibit a pattern that is most consistent with investor underreaction to short-term information available prior to the event and to the information conveyed by the event itself. The pattern in long-run abnormal returns is inconsistent with the overreaction model as well as with a model that postulates investor underreaction to short-term information and overreaction to long-term trends.

I. Introduction

The behavioral finance literature has proposed two contradictory models of irrational investor behavior. In the first model, investors have a tendency to overreact to information, leading to a pattern of long-term return reversals when firms announce corporate events such as new issues of stock. In the second model, investors underreact to information, leading to long-term return continuations when firms announce corporate events such as open-market share repurchases or cash-financed tender offers.

Behavioral models have been viewed with skepticism partly because they do not reconcile why investors seemingly overreact to a corporate event such as a seasoned equity offering, while seeming to underreact to an event such as a share repurchase. For in-

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stance, Fama (1998) argues that behavioral models cannot explain the long-run abnormal return evidence since the overreaction of investors to some events and underreaction to others implies that, on average, investors are unbiased in their reaction to information.

In this article, we show that investor reaction to new information is not randomly split between apparent overreaction and apparent underreaction. Our evidence is most consistent with the hypothesis that long-run abnormal returns reflect investors' tendency to underreact, first to short-term information available prior to the event and subsequently to information conveyed by the event itself. There is no evidence that the overreaction model can explain abnormal long-run returns to any of our corporate events.

The apparently random split between investor overreaction and underreaction in prior literature appears to be due to the fact that different studies have measured investor reaction to different sources of information, rather than to a common source. For instance, Loughran and Ritter (1995) argue that investor overreaction explains the negative long-run abnormal returns following a seasoned equity offering (SEO), a conclusion based on the good past performance of firms announcing an SEO. Investor reaction to the negative news conveyed by the SEO (Myers and Majluf 1984) is ignored in reaching this conclusion. Ikenberry, Lakonishok, and Vermaelen (1995) argue that investor underreaction explains the positive long-run abnormal returns following a share repurchase, a conclusion based on the information conveyed by the share repurchase itself. Investor reaction to the prior poor performance of firms announcing share repurchases is ignored in concluding that investor underreaction explains the long-run positive trend in returns.

In this study, we determine which behavioral explanation fits the long-run abnormal evidence by considering investor reaction both to the information conveyed by the event itself as well as to information available prior to the event. We formulate hypotheses that distinguish between the two competing behavioral explanations. Each behavioral hypothesis implies a pattern in long-run abnormal returns that is distinct from the pattern that would be observed under the alternate hypothesis.

We test our hypotheses across four different corporate events, seasoned equity offerings, stock-financed acquisitions, share repurchases, and cash-financed acquisitions. Testing across a variety of events enables us to determine whether there is a common behavioral explanation for the long-run anomalous return pattern subsequent to the announcement of these events. Lack of evidence for a common behavioral explanation bolsters Fama's (1998) argument that, on average, investors are unbiased in their response to information.

Across the four events, our evidence is most consistent with the investor underreaction hypothesis. We document that firms that announce a corporate event after prior negative news underperform relative to firms announcing the event after prior positive news regardless of whether the event itself conveys good or bad news. Firms that announce a stock-financed acquisition after a negative earnings surprise earn a 36-month cumulative abnormal return of

−9.15%, which is significantly lower than the positive abnormal return of 3.98% earned by firms announcing the event after a positive earnings surprise. Similarly, among firms announcing a share repurchase, the negative earnings surprise subsample significantly underperforms the positive earnings surprise subsample by 7.06% over the 36-month postannouncement period. Evidence for the cash-financed acquisitions sample is qualitatively similar. Firms announcing an SEO after a negative surprise underperform firms announcing the SEO after a positive surprise by 5.04%, but the difference is not statistically significant. Evidence in favor of the underreaction model is statistically stronger for the SEO sample when prior news is alternatively measured as the 180-day pre-event cumulative return.

We find that the pattern in long-run returns to our prior news samples is distinct from the pattern observed for the earnings drift and price momentum anomalies. Support for the underreaction model persists when abnormal returns are alternatively measured as the alpha obtained by regressing calendar-time returns on the four Fama and French factors.[1]

None of our tests support the overreaction hypothesis. The positive prior news subsample does not underperform the negative prior news subsample for any of the four events. We also find no evidence to support a more complicated behavioral model that postulates that investors underreact to new information but overreact to long-term trends.

The rest of the article is organized as follows. In Section II, we review the literature on long-run abnormal returns and develop our hypotheses. Section III describes the event samples and the methodology for computing abnormal returns. Section IV presents the results and Section V our conclusions.

II. Prior Literature and Hypotheses

Academic studies have documented significant long-run abnormal returns following a wide variety of corporate events, including share repurchases, initial public offerings (IPOs), seasoned equity offerings (SEOs), and mergers. Details of these studies are described in the appendix.

Long-run abnormal returns documented by these studies usually display one of two distinct patterns, an overreaction pattern, characterized by a long-term reversal in stock returns, or an underreaction pattern, characterized by a long-term trend in stock returns. Fama (1998) summarizes the findings of these previous studies in table 1 of his paper.

Contradictory models of investor behavior have been proposed in the empirical literature to explain these patterns. For example, stock-financed mergers and SEOs are characterized by return reversals. The average SEO is announced after a period of high returns, but these returns are reversed over a period of

1. The four Fama and French factors, constructed as in Fama and French (1996), are the excess return to the market portfolio (RMRF), the return to a zero-investment size-mimicking portfolio (SMB), the return to a zero-investment book to market mimicking portfolio (HML), and the return to a zero-investment momentum based portfolio (UMD).

up to 5 years after the announcement. Loughran and Ritter (1995, 1997) interpret this pattern as evidence that investors overreact to strong past earnings information. When an SEO is announced, investors fail to recognize that earnings will mean revert. Consequently, prices are too high at the time of the event, and the overreaction to past earnings growth is only corrected slowly in the future. By contrast, cash-financed tender offers and repurchases are characterized by return continuations. Firms announcing these events earn positive abnormal returns in the long run. Ikenberry et al. (1995) explain this pattern by arguing that investors underreact to the positive signal conveyed by the share repurchase about future performance.

Theoretical behavioral models predict an abnormal return pattern characterized by a short-term trend that is reversed over the long run. Barberis, Shleifer, and Vishny (1998) propose a model of investor behavior that is motivated by two judgment biases: conservatism and representativeness. Conservatism leads investors to update their beliefs very slowly in the face of new evidence. Representativeness leads them to give too much weight to recent trends in the data in spite of the low probability of occurrence of such a trend in the population. The conservatism bias leads investors to underreact in the short run which, in combination with the representativeness bias, leads to long-term return reversals.

Behavioral models proposed by Daniel, Hirshleifer, and Subrahmanyam (1998) and Hong and Stein (1999) also predict short-run return continuations and long-run return reversals. Daniel et al. argue that informed investors are overconfident about the private signal they receive about a stock's value. Biased self-attribution reinforces their overconfidence when public information is in agreement with their private information. When public information is not in agreement with their private signal, biased self-attribution leads to dismissal of the information as noise. The Daniel et al. model predicts that investors overreact to private information and underreact to public information signals. Hong and Stein (1999) hypothesize that the market contains two groups of investors who trade based on different sets of information. Informed investors base their trades on signals about future cash flows, while trades by technical traders are based on a limited history of prices. Information obtained by informed investors is transmitted slowly into the market, leading to an underreaction pattern in stock returns. Technical traders rely on the past history of prices and extrapolate the trend too far, pushing prices of past winners away from fundamental values, which leads to a reversal in returns.

The three behavioral models differ in their assumptions regarding investor behavior, but they all predict that investors underreact to public information and overreact to past trends. A difficulty with reconciling the theoretical models with the empirical evidence for long-run abnormal returns is that these models do not explain why investors appear to, on the one hand, overreact to corporate events such as SEOs and stock-financed acquisitions, while appearing to underreact to events such as share repurchases or cash-financed acquisitions. Further, as Fama (1998) notes, the three theoretical models suffer

from the shortcoming that they predict only postevent return reversals in response to pre-event abnormal returns and do not predict return continuations.

In summary, different studies of long-run abnormal returns following corporate events have assigned different roles to different pieces of information to characterize either investor underreaction or overreaction. We develop a framework that identifies a common set of stimuli and clearly distinguishes investors' net reactions to this set of stimuli under the two behavioral hypotheses. The set of stimuli includes both corporate news available in the short term prior to the event and the information conveyed by the event itself. We study how long-run returns are affected by investors' net response to both these pieces of information under the two behavioral hypotheses—underreaction and overreaction. The framework of our study also enables us to test a third alternative hypothesis that investors are unbiased in their response to information.

We sort our event samples into two groups—events that convey negative information (SEOs and stock-financed acquisitions) and events that convey positive information (repurchases and cash-financed acquisitions). We further sort the two groups into two subgroups based on whether there was good news or bad news released prior to the event announcement. At the end of this sort procedure, a firm in our sample can belong to one of four categories: a good event preceded by good news, a good event preceded by bad news, a bad event preceded by good news, and a bad event preceded by bad news. We use this four-way classification to develop our hypotheses.

Details are given in table 1. If investors underreact to public information, they should underreact both to the news conveyed by the event and to news released prior to the event. Long-run returns should be higher for firms where the news conveyed by the event and prior news are both good news; the positive trend following the release of prior good news should reinforce the positive trend following the event announcement. For firms where the event and prior information do not both convey good news, long-run abnormal returns should be lower.

If investors overreact to public information, they should overreact both to the news conveyed by the event and to news released prior to the event. Long-run returns should be lower for firms where the news conveyed by the event and prior news are both good news; the negative trend following the release of prior good news should reinforce the negative trend following the event announcement. For firms where the event and the prior information do not both convey good news, long-run abnormal returns should be higher.

A third possibility exists. If investors are unbiased and the market is efficient, investor reaction to prior news should be instantaneously incorporated into share price when prior news is announced. Hence, the conditional sort on prior news should display no difference in performance between the prior good news and prior bad news subsamples.

Thus, our testable hypotheses can be summarized as follows:

i) If investors underreact to information, the sample of firms that announce

TABLE 1 Hypotheses

		Behavioral Model					
		Long-Horizon Abnormal Returns Predicted by Underreaction			Long-Horizon Abnormal Returns Predicted by Overreaction		
		Investor Response To			Investor Response To		
Past Performance	Information Conveyed by Event	Past Performance	Event	Net Effect on Long-Run Returns	Past Performance	Event	Net Effect on Long-Run Returns
Good	Bad	+	−	?	−	+	?
Bad	Bad	−	−	−	+	+	+
Difference in long-run returns between good and bad past performance subsamples		Bad prior performance sample underperforms good prior performance sample			Bad prior performance sample outperforms good prior performance sample		
Good	Good	+	+	+	−	−	−
Bad	Good	−	+	?	+	−	?
Difference in long-run returns between good and bad past performance subsamples		Bad prior performance sample underperforms good prior performance sample			Bad prior performance sample outperforms good prior performance sample		

NOTE.—This table presents the interactions between the signs of long-horizon abnormal returns that will be observed if investors uniformly underreact or uniformly overreact both to the public information available prior to the event announcement and to the event itself, respectively. It also presents the predicted difference between the abnormal returns for the different subsamples of events for the two types of investor reactions.

a corporate event after the release of negative information should underperform the sample that announces the event after the release of positive information.

ii) If investors overreact to information, the sample of firms that announce a corporate event after the release of positive information should underperform the sample that announces the corporate event after the release of negative information.

iii) If investors are unbiased in their response to information, the sample of firms that announce a corporate event after the release of positive information should neither underreact nor outperform the sample that announces the event after the release of negative information.

III. Description of the Data and Methodology

We obtain the sample of firms announcing stock-financed acquisitions, cash-financed acquisitions/tender offers, or open-market share repurchases between January 1980 and December 1994 from the Securities Data Corporation Online Mergers and Corporate Transactions database (SDC). We obtain data on seasoned equity offerings, over the same time period, from the SDC New Issues database. We combine the mergers and tender offer samples and classify the resulting sample as stock or cash financed on the basis of whether the ratio of the value of the common stock portion of the deal to the effective value of the deal is 100% or 0%, respectively. We eliminate acquisitions that are financed by a mixture of stock and cash from the sample. For each type of corporate event, we do not eliminate firms that previously announced events of other types since we view each type of event as an independent observation.

We obtain reported earnings and analysts' estimates of earnings from the Institutional Brokers Estimate System (IBES) database. Lack of analysts' estimates on IBES prior to 1984 compresses the sample period to January 1984–December 1994. Institutional Brokers Estimate System does not report quarterly earnings announcement dates. Hence these were obtained from the quarterly Compustat tapes.

Table 2 describes the screening process by which we arrive at our final sample. Our final sample consists of 720 SEOs, 809 stock-financed acquisitions, 2,583 share repurchases, and 2,055 cash-financed acquisitions or tender offers. Earnings estimates for over 40% of the sample are missing from the IBES database, mainly because analysts had not initiated coverage of the stock at the time of the event announcement. Therefore, our final sample contains fewer small firms than the original SDC sample. This is also illustrated in table 2, which reports the mean and median market capitalization for the firms in our four event samples before and after the IBES screen. The median event firm listed on CRSP and Compustat with IBES data on earnings is about twice the size of the median event firm listed on CRSP and Compustat. Hong, Lim, and Stein (2000) document that the momentum effect is stronger among small firms with a smaller analyst following. Therefore, the lack of very small

TABLE 2 Sample Selection Criteria

Sample Criteria	Number of Firms			
	SEOs	Stock-Financed Acquisitions*	Repurchases	Cash-Financed Acquisitions*
I. Number of transactions listed by SDC announced between January 1980 and December 1994	3,687	2,079	5,083	11,273
II. Number of transactions in I listed on CRSP NYSE/AMEX/ NASDAQ monthly tapes and on Compustat	2,642	1,299	3,976	3,623
	($428)	($1,351)	($1,662)	($1,653)
	[$119]	[$396]	[$199]	[$267]
III. Number of transactions in II with IBES data†	720	809	2,583	2,055
	($605)	($1,897)	($2,420)	($2,389)
	[$229]	[$729]	[$471]	[$626]

NOTE.—This table describes the number of firms analyzed in our four event samples. The mean market capitalizations (reported in millions of dollars) of the firms in the four event samples at various stages are reported in parentheses. Medians are reported in brackets.

* Includes both mergers and tender offers.

† IBES data start from 1984.

firms in our sample should create a bias in favor of rejecting the underreaction hypothesis.

For the firms in the final sample, we use Compustat to identify the quarterly earnings announcement date closest and prior to the event announcement date. Using IBES, we obtain the mean analyst estimate of quarterly earnings per share, at a forecasting period that is closest to the earnings announcement date. We calculate the magnitude of the earnings surprise as the difference between the actual and mean analysts' estimate, expressed as a percentage of the mean estimate.

We also calculate the market capitalization and the ratio of book equity to market equity (B/M ratio) for the firms in the final sample. The market capitalization of the firm is computed as the number of shares outstanding times the month end closing price per share, as reported by CRSP, in the month prior to the event date. We compute the book value of equity as recorded by Compustat (annual data item 60) as of the fiscal year prior to the year of announcement.

We report unadjusted and adjusted returns earned during the period from -1 to $+1$ around the event announcement date.[2] Returns are adjusted using both a market-adjusted model and a market model with the value-weighted CRSP index as the proxy for the market return. The beta used in the market model is estimated using 255 days of daily returns, ending 46 days before the announcement date. Cumulative abnormal returns over a 180-day and a 750-trading-day period prior to the event announcement are also calculated

2. All our results are qualitatively similar if we alternatively define the announcement period as days 0 to $+1$ or as days 0 to $+2$.

using the market model, where the beta is estimated using 255 days of daily returns, ending 181 and 751 days, respectively, before the announcement date.

One-year and 3-year cumulative abnormal returns are computed with respect to a size-matched and a book to market–matched portfolio, formed using the sequential sort procedure employed by Rau and Vermaelen (1998). Every month, we obtain decile breakpoints for month end market capitalization of NYSE and AMEX firms listed on both CRSP and Compustat. We rank each firm on NYSE/AMEX and NASDAQ that is listed on both CRSP and Compustat into one of 10 portfolios formed on the basis of these breakpoints. The size portfolios are further sorted into quintiles on the basis of the book to market ratio. The average monthly portfolio return for each of the 50 size and B/M benchmark portfolios is calculated by equally weighting the monthly returns of firms in each portfolio. Starting in the event month, for each firm, we calculate the abnormal monthly return as the difference between the firm's monthly return and the return to its benchmark portfolio. The abnormal return for the portfolio of all firms in an event sample is the equally weighted abnormal monthly return of each firm in the sample.

We estimate significance levels for the monthly cumulative abnormal returns (CARs) using a bootstrapping approach (see Ikenberry et al. 1995; Lyon, Barber, and Tsai 1999). Finally, we subtract the mean CAR for the empirical distribution, obtained from the bootstrapping procedure, from the CAR for the sample firm, to obtain a bias-adjusted CAR.

The procedure described above is designed to overcome various biases in measurement of long-horizon abnormal returns. We use the size and book to market ratio benchmark to bias our results away from spuriously detecting abnormal performance, since Jegadeesh (2000) finds that among a variety of benchmarks, the size and book to market ratio matched benchmark yields the lowest level of SEO underperformance. The size and B/M benchmarks are further rebalanced monthly rather than annually to accommodate changing risk characteristics of firms following a corporate event. Rau and Vermaelen (1998) document that the book to market ratio of glamour firms completing acquisitions increases sharply over the 3 years following the event.

We use equally weighted returns rather than value-weighted returns since equally weighted portfolio returns capture the extent of underperformance better than value-weighted portfolio returns. Brav, Geczy, and Gompers (2000) and Hong et al. (2000) argue that the underperformance of firms issuing equity is concentrated among small firms. Loughran and Ritter (2000) argue that value-weighted returns reduce the power of a test to detect the behavioral bias. Since our sample is biased toward larger firms, equally weighting returns is reasonable.

We use cumulative abnormal returns, calculated by summing the abnormal monthly returns of the portfolio over time, rather than buy and hold abnormal returns (BHARs) since Fama (1998) and Mitchell and Stafford (2000) show that BHARs increase spuriously as the holding period increases, even when there is no abnormal return after the initial period.

TABLE 3 Descriptive Statistics for Event Firms

	SEOs	Stock-Financed Acquisitions	Repurchases	Cash-Financed Acquisitions
A. Event firms by year of announcement:				
1984–85	61	33	97	136
1986–87	92	121	280	324
1988–89	75	98	461	368
1990–91	144	120	558	359
1992–93	260	270	569	479
1994	88	167	618	389
Total	720	809	2,583	2,055
B. Summary data on event firms:				
Earnings surprise, %	2.83 (5.26)	−3.56 (0)	−8.27 (0)	−6.35 (0)
Value of transaction, $ millions	67 (40)	182 (39)	133 (25)	152 (32)

NOTE.—The sample consists of SEOs, stock-financed acquisitions, repurchases, and cash-financed acquisitions announced by U.S. firms listed on the NYSE/AMEX or NASDAQ covered by both Compustat and CRSP, listed on the SDC Mergers and Corporate Transactions online database, between January 1984 and December 1994. Panel A reports the number of event firms by year. Panel B reports summary data on the earnings surprise and the value of the transaction. The magnitude of the earnings surprise is computed as the percentage difference between mean analyst earnings estimates and actual earnings at the earnings announcement date just prior to the event date. The value of the transaction is reported by the VAL variable in the SDC database. Medians are reported in parentheses.

We compute bias-adjusted CARs by subtracting the mean CAR for the empirical distribution from the CAR for the sample firms, to correct for the measurement, new issues, skewness, and momentum biases identified by Barber and Lyon (1997) and Rau and Vermaelen (1998). These biases affect the magnitude of the abnormal returns since the empirical distribution of CARs computed using monthly rebalancing is not centered at zero (see Rau and Vermaelen [1998] for details). The bias-adjusted CAR captures the economic magnitude of the long-horizon returns better than the unadjusted CARs without altering the statistical significance of the results.

IV. Results

A. Descriptive Statistics

Tables 3, 4, and 5 document summary statistics for our four event samples. Panel A of table 3 shows that a greater number of observations are announced in the 1990s rather than in the 1980s. Panel B documents the magnitude of the earnings surprise at the earnings announcement preceding the event announcement. The mean (2.83%) and the median (5.26%) earnings surprise are positive for the SEO sample, confirming previous evidence that the average SEO is announced following good news. For the other three events, the mean earnings surprise is negative, while the median earnings surprise is zero. Panel B also presents statistics on the value of the transaction at the event. The mean value of the transaction is the lowest for SEOs.

TABLE 4 Size and Book to Market Characteristics of Event Firms

NYSE/AMEX Size Quintile	SEOs	Stock-Financed Acquisitions	Repurchases	Cash-Financed Acquisitions
A. Size quintiles of event firms at time of announcement:				
1 (Small)	23	20	133	54
2	120	44	328	204
3	215	102	440	325
4	235	250	623	537
5 (Large)	122	391	1,055	913
Total	715	807	2,579	2,033
p-value for difference	(.00)	(.00)	(.00)	(.00)
B. Book to market (B/M) quintiles of event firms at the time of announcement:				
1 (Growth)	278	190	318	350
2	209	224	716	568
3	129	226	671	564
4	73	148	616	400
5 (Value)	22	19	258	148
Total	711	807	2,579	2,030
p-value for difference	(.00)	(.00)	(.00)	(.00)

NOTE.—Panel A reports the distribution of size quintile rankings. All firms listed on NYSE/AMEX are sorted every month into five size quintiles. Quintile 1 contains the smallest firms, while quintile 5 contains the largest firms. The hypothesis that the size distribution is uniform across the size quintiles is tested using a χ^2 one-sample test. The *p*-value of the χ^2 statistic is reported in parentheses. Panel B reports the distribution of book to market quintile rankings. All firms listed on NYSE/AMEX and NASDAQ are sorted into quintiles on the basis of the B/M ratio. Book equity is calculated using Compustat data, while the market value of equity is computed using the stock price reported by CRSP on the last trading day of the month prior to the event announcement month. The χ^2 one-sample test is used to test the null hypothesis that the B/M distribution is uniform across the B/M quintiles. The *p*-value of the χ^2 statistic is reported in parentheses.

Table 4 presents the distribution of the four samples into size and book to market quintiles. Panel A shows that across the four events, a greater proportion of the sample falls into the larger size quintiles 3, 4, and 5. Panel B shows that the SEO sample consists mainly of growth firms (B/M quintiles 1 and 2). The stock-financed sample primarily consists of firms belonging to B/M quintiles 2 and 3. The repurchase and cash-financed acquisition samples display no tendency toward being either growth or value firms. The predominance of growth firms among SEOs suggests that our tests could be biased in favor of the overreaction hypothesis. La Porta (1996) shows that investors overreact to past good performance of growth firms and become irrationally optimistic about the firm's future prospects.

Table 5 reports stock return performance over various holding intervals. The 180-day pre-event cumulative abnormal return indicates that SEOs are prior winners, while repurchasing firms and cash-financed acquirers are prior losers. Seasoned equity offerings earn a significantly positive mean CAR during the 180-day period, while repurchasing firms and cash-financed acquirors earn significantly negative CARs. Stock-financed acquirers are neither

TABLE 5 Stock Price Performance of Event Firms

Event Date	SEOs	Stock-Financed Acquisitions	Repurchases	Cash-Financed Acquisitions
Previous 180-day CAR	21.97	−.25	−11.29	−3.06
	(.00)	(.86)	(.00)	(.00)
Announcement period (−1, +1) abnormal return:				
Raw returns	−1.82	.05	1.82	1.13
	(.00)	(.75)	(.00)	(.00)
Market adjusted	−2.01	−.05	1.73	.97
	(.00)	(.72)	(.00)	(.00)
Market model	−2.56	−.31	1.67	.83
	(.00)	(.05)	(.00)	(.00)
Long-term cumulative abnormal returns:				
Size and B/M matched portfolio CAR	−1.33	−.14	9.16	1.94
Bias-adjusted size and B/M matched portfolio CAR	2.41	1.31	9.29	2.41
	(.20)	(.28)	(.00)	(.05)

NOTE.—This table reports data on the stock price performance of the four sample firms. The 180-day pre-event CAR is computed using a market model, with parameters estimated over a 255-trading-day period, ending 181 trading days before the event date. For the announcement returns, we report raw returns, market-adjusted abnormal returns, and market-model abnormal returns, during the (−1, +1) period, with the CRSP value-weighted index as the market proxy. The market-adjusted announcement period return is computed by subtracting the return to the index from the return to the sample firm. Parameters for the market model are estimated over a 255-trading-day period, ending 46 days before the event date. For long-term performance, abnormal returns are computed with reference to a size- and book to market–based benchmark portfolio, over the 3 years after the announcement of the event. The size- and B/M-matched portfolios are constructed using the sequential sort procedure employed by Rau and Vermaelen (1998). The abnormal returns are adjusted for biases by subtracting the mean of the empirical distribution (computed through bootstrapping) from the CAR. *p*-values are reported in parentheses.

prior winners nor prior losers—the prior 180-day pre-event CAR is statistically insignificant.

Announcement period (day −1 to +1) returns in table 5 are consistent with prior evidence (see the appendix for a summary of the evidence). Announcement period abnormal returns calculated using the market model are significantly negative for SEOs and for stock-financed acquisitions, indicating that investors view these events as bad news. By contrast, share repurchases and cash-financed acquisitions are perceived as good news, as indicated by the positive and significant market-model announcement period returns for these two samples.

Table 5 also presents unadjusted and bias-adjusted CARs earned during the 36-month period following event announcement. The bias-adjusted 36-month abnormal return is insignificant for SEOs and for stock-financed acquirers. The insignificant return for SEOs contrasts with the negative abnormal return reported by previous studies. A possible explanation is that our sample contains relatively larger firms than the samples used in these studies. For example, nearly 65% of the sample studied by Brav et al. (2000) lies in the smallest two size quintiles. In contrast, less than 20% of our SEO sample lies in these two quintiles.

Firms announcing share repurchases and cash-financed acquisitions earn

significantly positive bias-adjusted abnormal returns during the 36-month post-event period. The positive long-run abnormal return for repurchases is consistent with Ikenberry et al. (1995). The combined evidence for stock- and cash-financed acquirers is consistent with Loughran and Vijh (1997).

B. Do Investors Underreact or Overreact to Information? Earnings Surprises and Cumulative Abnormal Returns

We test the two behavioral hypotheses by identifying a common piece of public information available to investors prior to the announcement of the corporate event. We classify this information as good or bad news and measure long-run abnormal returns conditional on this information. If investors consistently overreact to information, first to prior news and then to the information conveyed by the corporate event, the subsample that announces the event after good news should underperform the subsample that announces the event after bad news. However, if investors consistently underreact to information, the subsample that announces the event after bad news should underperform the subsample that announces the event after good news.

Our first measure of pre-event public information is the earnings surprise on the earnings announcement date immediately preceding the event announcement. The earnings surprise is calculated for each firm in each event sample, as the difference between the mean analysts' estimate of the earnings per share (EPS) and the actual EPS. The event samples are sorted into two subsamples on the basis of the sign of the earnings surprise. The magnitudes of the announcement returns and long run returns are compared for the two subsamples. Results are reported in tables 6 and 7 for each of the four events.

The first noteworthy piece of evidence in the tables is that about an equal number of firms announce SEOs, stock-financed acquisitions, and cash-financed acquisitions after a negative earnings surprise as after a positive earnings surprise. For share repurchases, more firms announce after a negative surprise than after a positive surprise. The almost even distribution of SEOs, stock-financed, and cash-financed acquisitions into the two subsamples suggests that the average firm does not time its event announcement to coincide with the release of good news. Hansen and Sarin (1998) similarly find that equity offerings do not coincide with a period of overly favorable earnings forecasts.

The returns earned during the earnings announcement period are also presented in panel A of table 6. They have the expected signs for the stock-financed acquisition, repurchase, and cash-financed acquisition samples; the 3-day market-adjusted returns are negative for the negative earnings surprise subsample and are positive for the positive earnings surprise subsample. For SEOs, the earnings announcement period returns are positive for both the subsamples, although the magnitude of the return is significantly higher for the positive surprise subsample than for the negative surprise subsample.

Panel B of table 6 reports unadjusted, market-adjusted, and market-model

TABLE 6 Announcement Period Stock Price Performance for Event Firms Sorted on Earnings Surprise

	SEOs			Stock-Financed Acquisitions			Repurchases			Cash-Financed Acquisitions		
	Negative	Positive	*p*-Value	Negative	Positive	*p*-Value	Negative	Positive	*p*-Value	Negative	Positive	*p*-Value
A. Description of subsamples:												
N	226	388		254	369		1,178	975		863	841	
Average surprise (%)	−62.64	37.95		−41.96	19.20		−46.05	33.47		−41.89	26.26	
Earnings date (−1, +1) CAR	.63%	2.73%	.01	−.71%	.93%	.01	−2.05%	.81%	.00	−1.38%	.65%	.00
B. Announcement period (−1, +1) CARs:												
Raw returns	−1.97%	−1.70%	.64	−.15%	.28%	.06	2.04%	1.78%	.21	.99%	1.09%	.46
	(.00)	(.00)		(.60)	(.24)		(.00)	(.00)		(.00)	(.00)	
Market adjusted	−2.08%	−1.98%	.95	−.27%	.08%	.13	1.95%	1.67%	.09	.80%	.98%	.23
	(.00)	(.00)		(.36)	(.71)		(.00)	(.00)		(.00)	(.00)	
Market model	−2.49%	−2.62%	.52	−.47%	−.20%	.21	1.98%	1.53%	.02	.75%	.73%	.91
	(.00)	(.00)		(.12)	(.37)		(.00)	(.00)		(.00)	(.00)	

NOTE.—This table presents announcement period and long-term cumulative abnormal returns for event samples, sorted into two groups on the basis of the sign of the earnings surprise. The earnings surprise is computed as the percentage difference between mean analysts' earnings estimates and actual earnings at the earnings announcement date just prior to the event date. Panel A describes the subsamples. Panel B reports returns, market-adjusted and market-model abnormal returns, computed using the CRSP value-weighted index as the market proxy. Parameters for the market model are computed using a hold-out period 255 days in length, ending 46 days before the announcement date. *p*-values are in parentheses. The *p*-value for the difference is computed using the Wilcoxon rank sum test.

returns for the two subsamples during the 3-day period (−1 to +1) around the event announcement date. The magnitude of the CARs earned by the firm at the event announcement is unrelated to the sign of the earnings surprise. For firms announcing SEOs after a negative earnings surprise, the market-model CAR is −2.49%, while the CAR for firms announcing SEOs after a positive surprise is −2.62%, a difference that is statistically insignificant. Similarly, both the subsamples of firms announcing stock-based acquisitions earn negative but insignificant market-model CARs around the announcement date. Announcement returns for repurchases and cash-financed acquisitions are significantly positive regardless of the earnings surprise preceding the event announcement. The results are qualitatively similar using unadjusted and market-adjusted announcement period returns.

In contrast to announcement returns, panel A of table 7 shows that long-run bias-adjusted abnormal returns and the sign of the earnings surprise are related. The magnitude of 36-month CARs is higher for the positive surprise subsamples across all four events. For SEOs, firms that announce after a negative earnings surprise earn marginally significant CARs of −5.65% over the 3 years after the announcement, while firms that announce after a positive earnings surprise earn insignificant abnormal returns of −0.61% over the same period. We note that the CARs are negative for the two subsamples, while table 5 shows that the 36-month CAR for the entire sample of SEOs is positive but insignificant. This is due to the exclusion of firms for which the earnings surprise is zero. For these firms, we find that the 36-month CAR is positive but is not statistically significant.

For stock-financed acquisitions, panel A of table 7 shows that the 36-month CAR is significantly negative for the negative surprise subsample while it is positive and marginally significant for the positive surprise subsample. For share repurchases, both the subsamples report significantly positive 36-month CARs, but the magnitude of the CAR is larger for the positive surprise subsample. Finally, firms announcing cash-financed acquisitions after a negative earnings surprise earn significantly negative 36-month CARs, whereas firms announcing after a positive earnings surprise earn significantly positive 36-month CARs.

We test the statistical significance of the difference between long-horizon CARs earned by the positive and the negative surprise subsamples using a Wilcoxon rank sum test. We use a nonparametric test since the distribution of long-run CARs is nonnormal (see, e.g., Barber and Lyon 1997). Over a 12-month interval, the difference in abnormal returns between the two subsamples is statistically significant across all four events, although only marginally so for SEOs (p-value = .10). Over a 36-month interval, the difference in abnormal returns between the two subsamples is statistically significant for stock-financed acquisitions, for share repurchases, and for cash-financed acquisitions and is statistically insignificant for SEOs. We conjecture that the lack of statistical significance for SEOs is due to the absence of small-capitalization firms in this sample.

TABLE 7 Long-Horizon Stock Price Performance for Event Firms Sorted on Earnings Surprise

	SEOs			Stock-Financed Acquisitions			Repurchases			Cash-Financed Acquisitions		
	Negative	Positive	*p*-Value	Negative	Positive	*p*-Value	Negative	Positive	*p*-Value	Negative	Positive	*p*-Value
A. Long-horizon bias-adjusted CARs relative to a benchmark portfolio matched on size- and book to market ratio:												
1–12 months	−1.73%	4.16%	.10	−3.27%	1.70%	.01	−.26%	4.95%	.00	−.09%	5.30%	.00
	(.26)	(.02)		(.06)	(.15)		(.40)	(.00)		(.48)	(.00)	
1–36 months	−5.65%	−.61%	.25	−9.15%	3.98%	.01	4.03%	11.09%	.01	−4.37%	4.01%	.00
	(.10)	(.44)		(.01)	(.09)		(.02)	(.00)		(.02)	(.03)	
B. Long-horizon cumulative abnormal returns relative to a benchmark portfolio matched on size and earnings surprise:												
N	214	374		239	355		1,133	921		838	798	
1–12 months	−2.01%	.58%	.24	−2.65%	.26%	.14	.42%	3.21%	.05	.95%	3.42%	.06
	(.22)	(.40)		(.12)	(.44)		(.37)	(.01)		(.21)	(.00)	
1–36 months	−9.72%	−5.89%	.26	−9.62%	2.08%	.01	5.47%	10.41%	.05	−3.44%	2.17%	.05
	(.02)	(.05)		(.01)	(.25)		(.01)	(.00)		(.07)	(.14)	

NOTE.—Panel A reports long-horizon cumulative abnormal returns (CARs), calculated by subtracting, each month, the return to a size- and book to market matched portfolio from the returns to the event portfolio and cumulating this difference over 12 and 36 months, respectively. These returns are bias-adjusted by subtracting the mean CAR of 1,000 simulated portfolios, obtained through a bootstrap procedure, from the CAR of the event sample. *p*-values of the CARs (reported in parentheses) of each subsample are computed with respect to the empirical distribution generated by the bootstrap procedure. The *p*-value for the difference is computed using the Wilcoxon rank sum test. Panel B reports the long-horizon cumulative return to the sample portfolio minus the cumulative mean return of portfolios in a pseudo-universe. Each portfolio in the pseudo-universe consists of firms matched on size quintile and sign of earnings surprise to the firms in the event sample. The pseudo-universe is generated through a bootstrap procedure by repeating the portfolio generation process 1,000 times. *p*-values of the CARs (reported in parentheses) and of the difference between the two subsamples are computed with respect to the empirical distribution generated by the bootstrap procedure.

Figure 1 graphs the time series of bias-adjusted CARs earned by the positive and negative surprise subsamples. The graphs indicate that the underperformance of the negative surprise subsample persists across the entire 36-month horizon; for each type of corporate event, firms announcing events after a negative surprise underperform in every month during the 36-month period.

The positive relation between long-run CARs and earnings surprise is consistent with the underreaction hypothesis. It is also consistent with the earnings drift anomaly. Ball and Brown (1968) and Bernard and Thomas (1989) document a positive relation between the sign of unexpected earnings information and abnormal stock returns for the 6 months after the earnings announcement. It is possible that the return pattern in table 7, panel A, is due entirely to the drift in stock returns following an earnings announcement.

We next determine whether the pattern in long-run CARs is distinct from the earnings drift anomaly. For each corporate event, we create an empirical distribution of returns to firms matched on size and on the sign of the earnings surprise to our event firms. Specifically, for each firm in the event sample, we randomly draw with replacement a firm listed on NYSE/AMEX and NASDAQ that did not announce the corporate event in the previous 3 years, is in the same NYSE/AMEX size quintile, and has the same sign for the earnings surprise at the earnings date immediately prior to the event date. We create an equally weighted portfolio of these matched firms and repeat this procedure 1,000 times, giving us an empirical distribution of cumulative 12- and 36-month returns. The mean of this empirical distribution is subtracted from the cumulative return of the sample firm. The earnings-drift-adjusted CARs are reported in table 7, panel B. The *p*-values reported in the table are calculated with respect to the empirical distribution generated by the bootstrap procedure.[3]

Across each of the four events, the negative surprise subsample underperforms the positive surprise subsample. The statistical significance of the difference between the CARs to the two subsamples is determined using the distribution of the return difference obtained from the 1,000 simulations. Panel B of table 7 shows that the difference between the 36-month CARs to the positive and negative surprise subsamples is statistically significant for all events except SEOs. For SEOs, although the negative surprise subsample underperforms the positive surprise subsample, the difference in returns is not significant either at the 12-month or at the 36-month horizon. These results indicate that except for SEOs, the pattern in long-run CARs for the positive and negative surprise subsamples is distinct from the earnings-drift anomaly.

C. Do Investors Underreact or Overreact to Information? Price Momentum and Cumulative Abnormal Returns

Chan, Jegadeesh, and Lakonishok (1996) find that a momentum strategy based on past stock returns differs from a strategy based on earnings surprise since

3. We thank the referee for suggesting this methodology.

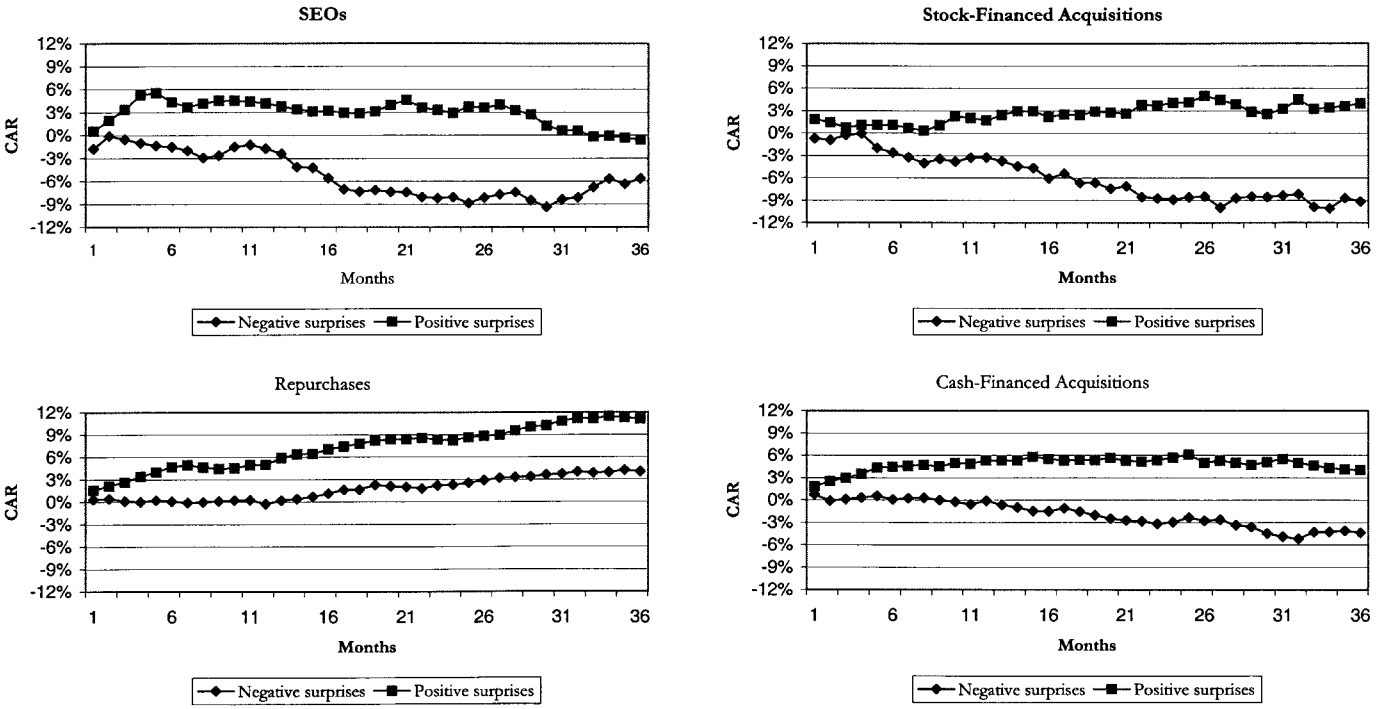

FIG. 1.—The long-horizon bias-adjusted size and book to market adjusted cumulative abnormal returns earned by firms after experiencing a positive or negative earnings surprise.

the two strategies exploit market underreaction to different pieces of information. While a momentum strategy based on earnings surprise exploits investors' tendency to underreact to short-term earnings, a momentum strategy based on past return performance benefits from the market's sluggish reaction to a broader set of information.

We reexamine the evidence for underreaction using the 180-day CAR in the pre-event period as the measure of prior news. As shown in table 1, if investors underreact both to this broader information set and to the event, the subsample with the lowest prior returns should underperform the subsample with the highest prior return. However, if investors overextrapolate the trend in prior returns, the highest prior return subsample should underperform the lowest prior return subsample.

The price momentum effect documented by Jegadeesh and Titman (1993, 2001) complicates the tests of the behavioral hypotheses. In the presence of price momentum, the low prior return subsample should underperform the high prior return subsample for each event, even if investors correctly respond to the information conveyed by the event itself. Therefore, we adjust the long-run abnormal returns following event announcement by recomputing 1-year and 3-year long-horizon cumulative abnormal returns relative to a benchmark portfolio matched on size, book to market ratio, and prior 6-month momentum. We rank each firm that is listed on the NYSE/AMEX and NASDAQ and listed on both CRSP and Compustat into one of five size-sorted portfolios, based on the market capitalization of NYSE and AMEX firms only. This quintile breakpoint formation and ranking procedure is repeated every month. The five size portfolios are further sorted, using the book to market ratio, into quintiles. Finally, each book to market portfolio is sorted into three sections based on the prior 6-month holding period return for each firm. At the end of this procedure, we have 75 ($5 \times 5 \times 3$) size, B/M ratio, and momentum portfolios in every month between January 1984 and December 1997. The average returns to these portfolios are our benchmarks. Abnormal returns are calculated for each firm relative to its benchmark for the following 36 months, starting in the event month. As before, we estimate significance levels for the monthly CARs using a modification of the bootstrapping approach. The firms in our pseudo-portfolios now consist of firms listed on the NYSE/AMEX or NASDAQ that have the same size, book to market, and prior 6-month momentum ranking as the sample firm, as of the event announcement month.

The event samples are sorted into three equal subsamples, on the basis of the 180-day pre-event CAR. In table 8, we report announcement period and long-run CARs for firms with the lowest (prior losers) and the highest (prior winners) 180-day pre-event CAR. For SEOs, stock-financed acquisitions, and cash-financed acquisitions, announcement period CARs are unrelated to the 180-day pre-event CAR. For share repurchases, prior winners in fact have lower market-model and market-adjusted abnormal returns than prior losers.

There is a stronger relation between long-run CARs and the 180-day pre-event CAR. Both the 12-month and the 36-month CARs are higher in mag-

TABLE 8 Firm Performance for Event Firms Sorted on Abnormal Returns Earned in the 180 Trading Days prior to Event Announcement

	SEOs			Stock-Financed Acquisitions			Repurchases			Cash-Financed Acquisitions		
	Lowest	Highest	*p*-Value	Lowest	Highest	*p*-Value	Lowest	Highest	*p*-Value	Lowest	Highest	*p*-Value
N	204	203		262	261		839	838		654	653	
A. Announcement period (−1, +1):												
Raw returns	−1.53%	−1.96%	.45	.30%	−.05%	.27	2.10%	1.90%	.28	1.01%	1.19%	.60
	(.00)	(.00)		(.36)	(.89)		(.00)	(.00)		(.00)	(.00)	
Market adjusted	−1.78%	−2.19%	.36	.13%	−.05%	.50	2.11%	1.77%	.07	.91%	1.01%	.96
	(.00)	(.00)		(.67)	(.87)		(.00)	(.00)		(.00)	(.00)	
Market model	−2.25%	−2.74%	.27	−.06%	−.36%	.31	2.05%	1.69%	.06	.83%	.76%	.40
	(.00)	(.00)		(.83)	(.30)		(.00)	(.00)		(.00)	(.00)	
B. Long-horizon bias-adjusted CARs relative to a size, book to market and momentum–matched portfolio:												
1–12 months	−4.74%	2.03%	.04	−1.46%	−.72%	.16	1.54%	5.08%	.04	1.45%	5.83%	.01
	(.03)	(.26)		(.25)	(.37)		(.13)	(.00)		(.18)	(.00)	
1–36 months	−8.39%	−1.75%	.08	−5.21%	2.78%	.06	5.19%	9.64%	.05	−3.26%	3.19%	.09
	(.05)	(.37)		(.08)	(.21)		(.02)	(.00)		(.11)	(.09)	

NOTE.—This table reports announcement period and long-term size, book to market, and price momentum–matched CARs for sorts of the sample on the basis of the market-model CARs earned by the firm during the 180 trading days prior to the event date. The table reports results for the highest and lowest abnormal return terciles only. Panel A reports returns, market-adjusted and market-model abnormal returns, computed using the CRSP value-weighted index as the market proxy. Parameters for the market model are computed using a hold-out period 255 days in length, ending 46 days before the announcement date. Panel B reports long-horizon CARs with reference to a size, book to market, and price momentum–based benchmark portfolio. These returns are bias adjusted by subtracting the mean CAR of 1,000 simulated portfolios obtained through a bootstrap procedure, from the CAR of the event sample. *p*-values of the CARs (reported in parentheses) of each subsample are computed with respect to the empirical distribution generated by the bootstrap procedure. The *p*-value for the difference is computed using the Wilcoxon rank sum test.

nitude for prior winners than for prior losers. For SEOs, the difference between the 12-month return to prior winners and to prior losers is statistically significant at the 5% level, while the 36-month return difference is significant at the 10% level. Similarly for cash-financed acquisitions, the 12-month return difference is significant at the 1% level while the 36-month return difference is significant at the 10% level. For share repurchases, both the 12-month and the 36-month return differences are significant at the 5% level. Finally, for stock-financed acquisitions, only the 36-month return difference is significant at the 10% level. The positive relation between long-run CARs and prior returns is consistent with the underreaction hypothesis. Comparing our results to those in tables 6 and 7, the statistical significance of the differences for SEOs here may indicate that investors are underreacting to a broader set of information than that conveyed by the earnings surprise prior to the event.

The evidence to this point is consistent with the underreaction model. There is strong support for underreaction for all events except SEOs, when the earnings surprise is the measure of pre-event information. Among SEOs, the evidence for underreaction is stronger when the 180-day pre-event CAR is used to measure pre-event information. Significantly, neither of the two measures of pre-event information yields any evidence to support the overreaction model of investor behavior.

D. Robustness Checks

We examine the robustness of the evidence using returns at the earnings announcement as the measure of prior news. The sign of the return at the earnings announcement can differ from the sign of the earnings surprise if there is a systematic bias in investors' responses. Kinney, Burgstahler, and Martin (1999) show that for roughly 45% of firms, the earnings surprise and the return at the earnings announcement have opposite signs.

We sort the event sample into three equal subsamples on the basis of the magnitude of the earnings announcement return. We compare size and B/M adjusted 36-month CARs for the two extreme subsamples. We find that the subsample with negative earnings announcement returns significantly underperforms the subsample with positive earnings announcement returns only for share repurchases and cash-financed acquisitions. For SEOs and stock-financed acquisitions, there is no statistically significant difference in returns. The weaker results appear to be due to the fact that if investors underreact to the information released at the earnings announcement, the announcement return itself incorporates some of this bias.

A second robustness check was to exclude NASDAQ firms from the event samples. When the resultant event samples are sorted on earnings surprise, the negative surprise subsample significantly underperforms the positive surprise subsample for all events except for SEOs.

E. Underreaction and Calendar-Time Returns

The results obtained so far have been based on event time returns. As an alternative, we employ a calendar-time approach, which incorporates the correlation between overlapping returns to sample firms that are clustered in calendar time.

For each corporate event, in each month starting in January of 1984 and ending in December of 1994, we construct two equally weighted portfolios of all firms that announced the event during the previous year. One portfolio consists of all firms that announced the corporate event after a negative earnings surprise, while the other consists of all firms announcing the event after a positive earnings surprise. Similarly, we construct two sets of portfolios every month for firms sorted on the basis of the prior 180-trading-day CAR. The two portfolios are rebalanced monthly to drop firms that reach the end of their 1-year period and to add firms that recently announced a corporate event.

Calendar-time excess returns are calculated by subtracting the return earned on the 1-month T-bill from the monthly portfolio return. These excess returns are regressed on the Fama and French factors. The factors are the excess return to the market portfolio, a size factor captured by the difference between a portfolio of "small" stocks and "big" stocks, a book to market factor captured by the difference between a portfolio of "high" and "low" B/M stocks, and a momentum factor captured by the difference between a portfolio of stocks with the highest and lowest returns, respectively, in the previous 10 months.[4] The regression intercept (alpha) measures the average monthly abnormal return to the portfolio of event firms. The statistical significance of the difference in alphas is tested using the *F*-statistic proposed by Jegadeesh (2000). Results are reported in table 9.

The alphas presented in table 9 support the underreaction hypothesis. For firms announcing SEOs and share repurchases, the alphas obtained by regressing 1-year calendar-time portfolio returns on the Fama and French factors are significantly higher (at the 5% level) for the positive surprise subsample than for the negative surprise subsample. For firms announcing stock-financed acquisitions, the difference in alphas is significant at the 10% level. For the sort on prior 180-day CARs, the alphas are not significantly different for the subsamples of prior winners and prior losers.

We also form calendar-time portfolios by including firms that announced the event during the previous 3 years rather than during just the previous 1 year. The 2-year calendar-time portfolios are meant to capture abnormal returns, if any, over the longer 3-year postevent period. Table 9 shows weaker support for the underreaction hypothesis using alphas obtained by regressing 3-year calendar-time portfolio returns on the Fama and French factors. While the magnitude of the alphas for the positive surprise subsample is higher than

4. Our results are qualitatively similar if we use the Fama and French three-factor model.

TABLE 9 Calendar-Time Fama and French Factor Model Portfolio Regressions

	1-Year Calendar-Time Portfolios						3-Year Calendar-Time Portfolios					
	Earnings Surprise			180-Day Pre-event CAR			Earnings Surprise			180-Day Pre-event CAR		
	Negative	Positive	*p*-Value	Lowest	Highest	*p*-Value	Negative	Positive	*p*-Value	Lowest	Highest	*p*-Value
SEOs	−.51%	.38%	.03	−.54%	.05%	.23	−.24%	.17%	.13	−.28%	.10%	.20
	(−1.65)	(1.43)		(−1.95)	(.13)		(−1.14)	(1.02)		(−1.46)	(.40)	
Stock-financed acquisitions	−.13%	.61%	.07	.31%	−.10%	.37	−.16%	.25%	.08	−.12%	.10%	.43
	(−.44)	(2.08)		(.86)	(−.34)		(−.81)	(1.58)		(−.54)	(.45)	
Share repurchases	.12%	.72%	.00	.35%	.27%	.74	.20%	.42%	.06	.32%	.30%	.89
	(.74)	(4.80)		(1.90)	(1.40)		(1.92)	(4.21)		(2.28)	(2.43)	
Cash-financed acquisitions	.02%	.35%	.23	.11%	.37%	.34	−.08%	.14%	.13	−.10%	.20%	.07
	(.11)	(2.14)		(.49)	(1.93)		(−.63)	(1.30)		(−.76)	(1.48)	

NOTE.—The dependent variables are event portfolio returns in excess of the 1-month T-bill rate, observed at the beginning of the month. Each month we form equally weighted portfolios of all sample firms that have announced the event within either the previous 1 year or the previous 3 years. The event portfolio is rebalanced monthly to drop all companies that reach the end of their calendar-time periods and add all companies that have just announced an event. The independent variables are the returns to the Fama and French factors. The factors are zero-investment portfolios representing the excess return of the market; a size factor, computed as the difference between a portfolio of "small" stocks and "big" stocks; a book to market factor, computed as the difference between a portfolio of "high" book to market stocks and "low" book to market stocks, as constructed by Fama and French (1993); and a momentum factor, computed as the difference between a portfolio of stocks with the highest and lowest returns, respectively, over the previous 10 months. The intercept measures the average monthly abnormal return. *T*-statistics for the alphas are in parentheses. The statistical significance of the difference in alphas is tested using the *F*-statistic proposed by Jegadeesh (2000).

that of alphas obtained for the negative surprise subsample across the four events, the difference in alphas is significant (at the 10% level) only for share repurchases and stock-financed acquisitions. Similarly, the alphas obtained for the subsamples of prior winners are significantly higher (again at the 10% level) than the alphas obtained for the subsample of prior losers only for the sample of cash-financed acquisitions. There is, however, no evidence that the pattern in calendar-time alphas is consistent with the overreaction model for any of the four events.

The weaker results with the 3-year calendar-time model are not surprising. The 3-year calendar-time portfolios suffer from the disadvantage that they include firms that just announced an event as well as firms that announced the event 3 years ago. It is well known that factor loadings of event firms change through time; the factor loadings of firms that just announced an event should be different from those of firms that announced the event 3 years ago. The factor loadings obtained by regressing the 3-year calendar-time portfolio returns on the Fama and French factors is an average of the factor loadings of the individual firms in the portfolio and, therefore, does not adequately measure the true risk of the portfolio.

F. Cross-sectional Regression Evidence

We next estimate cross-sectional regressions to test the behavioral hypotheses. For each corporate event, we estimate a generalized method of moments (GMM) regression with the 36-month postevent CAR as the dependent variable. The independent variables include announcement-period CARs and proxies for information available prior to the event announcement. We use GMM rather than ordinary least squares (OLS) to allow for both contemporaneous and time-series correlation in the residuals.

If investors underreact to the information conveyed by the earnings surprise preceding the event announcement, the long-run CAR should be positively related to the earnings surprise. We include three different variables to proxy for the information conveyed by the earnings surprise. The first variable is an earnings surprise dummy that takes a value zero if the earnings surprise preceding the event announcement is negative and one otherwise. The second variable is the actual magnitude of the earnings surprise, and the third variable is an interactive variable, where the earnings surprise dummy is interacted with the logarithm of the size of the firm. We include the interactive variable to test whether underreaction, if present, is a small firm effect.

If investors underreact to the information conveyed by the event itself, the announcement period abnormal return should be a positive fraction of the long-run CAR (Daniel et al. 1998; Kang, Kim, and Stulz 1999). Therefore, we include the 3-day announcement period market-model cumulative abnormal return as one of the independent variables. Other independent variables are the number of analysts following the stock at the time of the event announcement and the cumulative abnormal return earned by the firm over the

prior 180 trading days before the announcement. We include the number of analysts based on the evidence in Hong et al. (2000), who show that the momentum effect is most pronounced for small stocks with low analyst following. We include the prior 180 trading-day CAR to allow for the possibility that markets underreact to the marginal information conveyed by prior performance (Chan et al. 1996).

The control variables in the regressions include the logarithm of the market capitalization of the firm at the announcement of the event, the book to market ratio, and the value of proceeds associated with the event (obtained from SDC). We include the value of proceeds, as there is evidence, particularly for repurchases, that the size of the repurchase is related to the magnitude of long-run returns.

Regression results are reported in table 10. For SEOs, the coefficient on the earnings surprise dummy is positive and statistically significant at the 5% level, indicating that long-run abnormal returns are higher for firms with a positive or a neutral earnings surprise. The second regression for SEOs shows that the statistical significance of the earnings surprise dummy improves slightly when it is interacted with size. The third regression for SEOs shows that the coefficient on the magnitude of the earnings surprise is not significant.

The coefficient on the earnings surprise dummy is positive and significant for the other three corporate events as well. Similarly, the coefficient on the earnings dummy interacted with size is also significant for the other three events, while the coefficient on the magnitude of the earnings surprise is not significant for stock-financed acquisitions and repurchases and is marginally significant for cash-financed acquisitions.

The other significant coefficient in the regressions is the coefficient on announcement returns. With the exception of stock-financed acquisitions, the coefficient is positive and statistically significant at the 5% level for the other three events. The positive relation is consistent with the hypothesis that announcement returns capture only a part of the information conveyed by the event. The information is fully incorporated only in long-run returns. When placed in the context of results in tables 6 and 7, which showed no relation between announcement returns and sign of the earnings surprise, this evidence shows that underreaction to the earnings surprise is not corrected a short while later at the event announcement but is corrected only over the long-run 36-month period.

The control variables, size and B/M ratio, are significant in some regressions and not in others. The coefficient on the CAR earned over the prior 180 days is significant only for share repurchases. Investors appear to underreact more to the earnings surprise preceding the event than to prior 180-day returns.

The coefficient on the number of analysts is not significant in any regression, which is inconsistent with the evidence in Hong, Lim, and Stein (2000). This could be because the earnings surprise subsumes the effect of the number of analysts. In other words, positive or negative earnings surprises are more likely for firms followed by fewer analysts.

TABLE 10 Cross-sectional Regressions of Long-Horizon Abnormal Returns

	SEOs			Stock-Financed Acquisitions			Repurchases			Cash-Financed Acquisitions		
	(i)	(ii)	(iii)	(i)	(ii)	(iii)	(i)	(ii)	(iii)	(i)	(ii)	(iii)
Number of observations	615	615	534	790	790	743	2,535	2,535	2,459	1,971	1,971	1,858
Intercept	.56	.61	.86	−.70	−.61	−.34	.64	.69	.71	−.19	−.12	−.07
	(.21)	(.17)	(.10)	(.11)	(.16)	(.44)	(.05)	(.03)	(.05)	(.41)	(.61)	(.76)
Earnings surprise dummy	.13			.14			.09			.12		
	(.02)			(.00)			(.00)			(.00)		
Earnings surprise dummy × size		.01			.01			.01			.01	
		(.01)			(.00)			(.00)			(.00)	
Magnitude of earnings surprise			−.03			.01			.00			.02
			(.38)			(.89)			(.76)			(.08)
Announcement period $CAR_{-1,+1}$	1.39	1.39	1.09	.59	.58	.97	.70	.69	.64	1.30	1.30	1.67
	(.02)	(.02)	(.10)	(.25)	(.25)	(.05)	(.01)	(.01)	(.01)	(.00)	(.00)	(.00)
CAR earned over prior 180 days	.02	.02	.02	.09	.09	.10	.10	.10	.14	.02	.02	.02
	(.73)	(.72)	(.69)	(.21)	(.20)	(.22)	(.01)	(.01)	(.00)	(.62)	(.62)	(.56)
Number of analysts	.02	.01	.02	.00	.00	.01	.01	.01	.01	.00	.00	.00
	(.29)	(.31)	(.16)	(.80)	(.78)	(.30)	(.16)	(.16)	(.10)	(.47)	(.48)	(.73)
B/M ratio	.17	.17	.03	.43	.43	.33	−.06	−.06	−.04	.01	.01	.00
	(.01)	(.01)	(.74)	(.00)	(.00)	(.00)	(.23)	(.23)	(.36)	(.16)	(.16)	(.23)
Market capitalization of firm	−.06	−.07	−.08	.03	.02	.01	−.05	−.05	−.05	.01	.01	.01
	(.11)	(.09)	(.10)	(.39)	(.49)	(.77)	(.08)	(.06)	(.08)	(.55)	(.75)	(.72)
Value of transaction (in $millions)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
	(.12)	(.13)	(.34)	(.02)	(.02)	(.05)	(.22)	(.22)	(.23)	(.72)	(.73)	(.44)
Adjusted R^2 (%)	2.55	2.68	.26	5.93	5.81	4.11	1.43	1.36	.70	2.63	2.58	2.47

NOTE.—This table reports generalized method of moments (GMM) regression estimates of a regression of earnings surprises against the long-horizon CARs for four corporate events, announced between January 1984 and December 1994. The dependent variable is the 36-month abnormal return. The earnings surprise is a dummy variable, equal to zero if the earnings surprise was negative or one otherwise. Controlling variables used in the regression are the announcement period market-model CAR over the (−1, +1) period, calculated as in table 6, $CAR_{-1,+1}$, the CAR earned by the firm over the prior 180 trading days, computed as in table 5, the number of analysts following the stock, the ratio of book equity to market equity, the market capitalization of the stock, and the value of the transaction in dollars (in $millions). *p*-values are reported in parentheses.

G. Underreaction to Short-Term Information and Overreaction to Long-Term Trends?

So far, we have only considered how investors respond to the information conveyed by the event and to information available in the short term prior to the event announcement. We did not examine investor response to long-term trends in past performance. The theoretical models described in Section II argue that investors overreact to long-term trends in performance. Consistent with this, De Bondt and Thaler (1985) and Jegadeesh and Titman (2001) document long-term return reversals for prior winners and losers over the 13–60 months following the portfolio-formation month.

What pattern in long-run abnormal returns is implied by investor overreaction to long-term trends and underreaction to short-term information? Overreaction should be corrected through a reversal in long-run returns, and underreaction should be corrected by a positive trend in returns. The two opposing patterns should cancel each other if the long-term trend and short-term information both convey positive news or both convey negative news. For instance, for a bad news event preceded by a negative trend, there should be no abnormal long-run returns; the positive long-run returns due to reversal of the negative past trend should cancel the negative trend due to momentum following the release of bad news. By a similar argument, there should be no abnormal long-run returns for a good news event preceded by a positive trend.

Abnormal long-run returns are predicted, however, if the long-term trend and short-term information contradict each other. For instance, a positive news event preceded by a negative long-term trend should lead to positive long-run abnormal returns; the reversal of the negative long-term trend should reinforce the positive momentum following the release of good news. By a similar argument, long-run abnormal returns should be negative for a negative news event preceded by a positive long-term trend. The implication of these arguments is that firms that announce an event subsequent to a negative long-term trend (prior losers) will outperform firms that announce the event subsequent to a positive trend (prior winners).

We test this hypothesis by sorting our event samples on the basis of the 750-day pre-event CAR into terciles. We find that for SEOs, prior losers (in the lowest tercile of 750-day pre-event CARs) do outperform prior winners, though the difference between the returns to the two subsamples is not statistically significant. For the other three events, prior winners outperform prior losers, a contradiction of the null hypothesis. These results thus show no support for the hypothesis that investors overreact to long-term past trends and underreact to short-term information.

V. Conclusions

We develop a methodology for identifying the behavioral bias underlying long-run abnormal returns following four different corporate events. We study corporate events that include events apparently driven by underreaction (share repurchases), events apparently driven by overreaction (seasoned equity offerings), and events that fall into neither category (acquisitions).

Across the four events, firms that announce a corporate event after the release of good news earn higher long-run abnormal returns than firms announcing the event after the release of bad news. On balance, our results are most consistent with the underreaction model. Investors appear to underreact to prior information as well as to information conveyed by the event, leading to the different patterns, return continuations and return reversals, documented in long-horizon returns. We find no support for the overreaction hypothesis using any testing technique.

The evidence does not support the conclusion of a more complicated behavioral model which predicts that investors overreact to long-term trends and underreact to short-term information. We stress however, that these results on behavioral biases pertain only to long-run investor reaction to corporate events. We do not address the broader issue of why investors might underreact to public information, nor do we address whether a different behavioral explanation underlies other phenomena such as the size and book to market effects.

An important implication of our evidence is that it may be premature to draw inferences regarding managerial behavior around corporate events. Researchers (see, e.g., Rangan 1998) have suggested that investors do not adjust for managerial manipulation of reported earnings prior to the announcement of an SEO and naively extrapolate pre-issue earnings. The evidence presented in this article does not justify earnings management activities if investors underreact to good information. It may be necessary to reinterpret the evidence in these papers. This is left as an area for future research.

Appendix

Summary of Academic Literature on the Market Reaction to Announcements of Corporate Events

TABLE A1 Summary of Academic Literature on the Market Reaction to Announcements of Corporate Events

Study	Calculated Over	Abnormal Returns: Annual Period	Abnormal Returns: Long-Term
A. Seasoned equity offerings:			
Asquith and Mullins (1986)	1 day	−2.57%	
	480 days		−6%
Loughran and Ritter (1995)	5 years		−8% per year
Spiess and Affleck-Graves (1995)	5 years		−30%
Lee (1997)	2 days	−3%	
	3 years		Secondary issuers where insiders sell equity underperform
B. Stock and cash financed mergers and tender offers:			
Travlos (1987)	2 days	−1.47% (S) +.24% (C)	
Loughran and Vijh (1997)	5 years		−25% (S) +61.7% (C)
Rau and Vermaelen (1998)	3 years		−4.0% (M) +8.9% (T)
C. Repurchases:			
Ikenberry, Lakonishok, and Vermaelen (1995)	5 days	+3.54%	
	4 years		+12.10%

NOTE.—C = cash-financed acquisitions; S = stock-financed acquisitions; M = mergers; and T = tender offers.

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