RFS Advance Access published March 27, 2008

The Nature and Persistence of Buyback Anomalies

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Using recent data, we reject the hypothesis that the buyback anomalies first reported by Lakonishok and Vermaelen (1990, *Journal of Finance* 45:455–77) and Ikenberry, Lakonishok, and Vermaelen (1995, *Journal of Financial Economics* 39:181–208) have disappeared over time. We find evidence consistent with the hypothesis that open market repurchases are a response to a market overreaction to bad news: significant analyst downgrades, combined with overly pessimistic forecasts of long-term earnings. Stock prices after tender offers are set as if all investors tender their shares, but empirically they do not. Thus, the arbitrage opportunity persists because the market sets prices as if the average, not the marginal investor, determines the stock price. (*JEL* G14, G35)

The purpose of this paper is to deepen our understanding of the anomalous price behavior around open market repurchases and fixed-price tender offers. Ikenberry, Lakonishok, and Vermaelen (1995) (henceforth ILV) investigate the stock-price performance of firms that announced an open market share repurchase between 1980 and 1990. They find average abnormal buy-and-hold returns of 12.1% over the 4 years following the announcement. A more significant underreaction of 45.3% is observed for "value" stocks (high-book-to-market (BM) firms), which ILV use as a proxy to identify firms that are more likely to be undervalued at the time of the repurchase announcement. The fact that managers try to take advantage of the perceived mispricing is consistent with the CFO survey results of (Brav et al., 2005), who report that undervaluation is the most important factor driving a repurchase decision.[1]

Lakonishok and Vermaelen (1990) (henceforth LV) find that the market also underreacts to the announcements of self-tender offers. They find a trading rule that involves buying shares 6 days prior to the expiration of the offer and

We would like to thank the anonymous referee, Toby Moskowitz (the editor), and Gustavo Grullon for their suggestions, and seminar participants at the 2006 American Finance Association meetings, the 2006 European Financial Management Association meetings, the 2006 Multinational Finance Association meetings, the University of Frankfurt, the National University of Singapore, Singapore Management University, the University of Michigan, the City University of London, and the Summer Symposium on Financial Markets in Gerzensee for their comments. Address correspondence to Theo Vermaelen, INSEAD, Boulevard de Constance, 77305 Fontainebleau, France; telephone: +33-16072-4000; e-mail: theo.vermaelen@insead.edu.

[1] See their Table 3.7. Note that if the market reacted efficiently to buyback announcements, such a strategy would not work. In an efficient market, stock prices would rise to their equilibrium level after the buyback authorization announcement, the stock would no longer be undervalued, and companies would simply not complete the repurchase program. However, the empirical fact (Stephens and Weisbach, 1998) is that the overwhelming majority of repurchase programs are completed.

doi:10.1093/rfs/hhn024 Advance Access publication on xx xxxx xxxxx

tendering those shares whenever the stock price trades at least 3% below the tender price. If the company repurchases the shares, it is at the tender price. If the repurchase is oversubscribed, shares that are not repurchased are sold 12 days after the expiration date at the then prevailing market price. In the sample period of 1962–1986, this rule generated a 6.18% abnormal return (not annualized), with 89.1% of the trades resulting in positive abnormal returns.[2]

One explanation for the reported repurchase anomalies is that they could be caused by chance and may be sample specific, as argued by Fama (1998). Moreover, even if the anomalies existed in the past, once the anomalies are detected and made public, they should disappear as investors try to take advantage of them. Schwert (2003) argues that many notorious anomalies have disappeared in recent years, even if the anomalies existed in the sample period in which they were first identified. Similar cautious statements can be found in finance textbooks,[3] especially considering that the empirical results of these studies are based on data that are at least 15 years old. Moreover, open market share repurchase announcements have increased dramatically in recent years (Grullon and Michaely, 2004). If (almost) every company is repurchasing its own shares, it seems less plausible that a trading rule based on share buybacks can beat the averages.

So, as a first step, we test whether the share repurchase anomalies persist, using more recent data than in previous studies. Our basic conclusion is that, in contrast to the findings on other anomalies reported by Schwert (2003), the buyback anomalies have not gone away. Long-run excess returns after open market repurchase programs are still as large and as significant as reported by past research, especially for "value" firms. This conclusion holds, after incorporating the criticism of Fama (1998) and Mitchell and Stafford (2000), who argue that the buy-and-hold return methodology of ILV is biased. The same conclusion holds for the tender offer sample. The average abnormal return from trading around the expiration date of tender offers is 8.6% and 84% of the trades produce positive excess returns.

Why does the buyback anomaly persist for 25 years? Why aren't investors taking advantage of the mispricing? We believe that answering these questions requires a better understanding of the nature of the buyback anomalies.

In this paper, we explore three alternative hypotheses to explain the excess returns after open market repurchase programs. First, the *risk-change hypothesis*, proposed by Grullon and Michaely (2004), argues that the excess returns reflect not a signal about future cash flows, but about future risk changes.

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2 Using a similar strategy with a sample of 22 French repurchase tender offers, Lücke and Pindur (2002) report similar large excess returns of more than 8%.

3 For example, Grinblatt and Titman (2001, p. 684) write: "Of course, even a market that was inefficient in the past may not continue to be so in the future. We thus urge readers who plan to implement trading strategies to take advantage of these apparent inefficiencies to exercise caution." Ross, Westerfield, and Jaffe (2005, p. 375) write: "These papers (Ikenberry, Lakonishok, and Vermaelen, 1995; and Loughran and Ritter, 1995), *if they stand the test of time*, constitute evidence against market efficiency."

The argument is that the repurchase signals a decline in growth prospects, which should lower the risk of the stock. Second, the *liquidity hypothesis* argues that a repurchase reduces liquidity. As Pástor and Stambaugh (2003) find that their liquidity factor is priced, it is possible that the abnormal returns are due to this omitted liquidity factor. Third, the *overreaction hypothesis* assumes that the long-term excess returns are a correction of an overreaction to bad news prior to the repurchase.

We find strong support for the overreaction hypothesis. Stocks experience the most significant positive long-run excess returns if the repurchase is triggered by a severe stock-price decline during the previous 6 months. Past performance is also a better predictor of undervaluation than other proxies for undervaluation. In particular, we calculate for each buyback announcement an Undervaluation Index (U-Index). The index is a measure of the probability that the buyback is driven by an undervaluation. It is based on factors, besides past performance, which are found to be correlated with future excess returns, such as BM, size, and the stated motivation for the buyback in the press release. A strategy that invests in firms with a high U-Index does not generate a significantly higher long-term abnormal return than a simple strategy that invests in firms that experience the largest stock-price declines prior to the repurchase announcement. The results are consistent with the hypothesis that the buyback is triggered by the management's disagreement with the market's interpretation of *publicly available* information.

There is another plausible hypothesis that the repurchase signals management's inside information, which would produce abnormal future cash flows. Grullon and Michaely (2004) reject this hypothesis as they find no abnormal earnings in the 4 years after the repurchase announcement. Nonetheless, it may well be that managers' inside information is about proprietary new technologies that affect cash flows in the very long run only (say 3–15 years after the repurchase). However, this *inside information hypothesis* does not predict that future long-term abnormal returns are correlated with short-term preannouncement returns, as information about future proprietary technologies should arrive independently of past stock-price behavior. We consider the finding of a strong negative correlation between prior returns and future abnormal returns inconsistent with the interpretation that the inside information hypothesis is the predominant explanation of the open market buyback anomaly.[4]

These results then raise the immediate question: Why don't sophisticated investors arbitrage the anomaly away by buying shares of beaten-up firms that announce a repurchase? We explore two hypotheses. The first one is that the repurchase strategy is too risky. Note that event studies aggregate information over long periods of time. The fact that a strategy works on average does not mean that it will work if a portfolio manager would start a buyback fund today.

[4] Our sample period is too recent to further test the inside information hypothesis that would require measuring abnormal earnings 3–15 years after the buyback announcement.

We test the robustness of the strategy by forming a portfolio for each year, from 1991 to 2001, consisting of 50 stocks with the highest U-Index. The fact that 10 out of the 11 portfolios, each of which contains different stocks, show statistically significant 4-year excess returns of at least 40% strongly supports the notion that the buyback anomaly is time independent. Moreover, the results are quite robust with respect to the benchmark used: all 11 portfolios beat the S&P 500 3 years and 4 years after portfolio formation.

As the repurchase strategy is obviously not very risky, we explore a second hypothesis to explain the persistence of the buyback anomaly: the *analyst mistake* hypothesis. According to this hypothesis, the repurchase is a response of the company to a mistake made by financial analysts. As analysts are unlikely to admit that they made a mistake, a repurchase announcement gets no support from the analyst community and their followers. Hence, someone who buys shares after a repurchase announcement is essentially challenging the opinions of the professionals who are supposed to be the most knowledgeable about the firm. If analysts do not change their opinions after the repurchase, stocks may remain undervalued for extended periods of time. We find evidence consistent with the analyst mistake hypothesis. First we find that the typical beaten-up firm is only covered by a small number of analysts, which may explain why their opinions carry a lot of weight. Second, analysts significantly downgrade beaten-up companies around a buyback announcement, with the most significant downgrade during the buyback month. This downgrade is a result of disappointing earnings: analyst forecasts were overly optimistic prior to the repurchase announcement. However, when analysts revise their earnings forecasts, they are becoming too pessimistic. Firms take advantage of this excessive pessimism by repurchasing undervalued shares. Our study complements recent work by Bradshaw, Richardson, and Sloan (2006), who find a positive correlation between a measure of external financing based on the annual cash-flow statement and overoptimism in analyst forecasts.

When re-examining the repurchase tender offer anomaly, we find the striking result that the market sets prices during the tender offer as if every shareholder will be tendering his/her shares. This is not an unreasonable assumption, as, on average, the repurchase premium of 22% is significantly larger than the abnormal return of 8% earned by not tendering and holding the shares until after the expiration of the offer. The empirical fact, however, is that very few investors (on average, 32%) tender their shares. So, we have a somewhat peculiar anomaly here: the market assumes that shareholders tender their shares, but they do not. One reason for this behavior may be the fact that shareholders believe markets are efficient and that the low market price relative to the repurchase tender price reflects the fact that almost everyone will tender, which means that the loss from not tendering will be relatively small (as the company will repurchase only a small fraction of the shares tendered). As a repurchase is a unique event in the life of a company, individual shareholders cannot learn from their mistakes. Moreover, tender offers are a too infrequent event to attract professional arbitrageurs, which may well explain the persistence of this anomaly.

This paper is organized as follows. In Section 1, we re-examine the stock-price behavior around 3,481 open market repurchase programs announced during the period 1991–2001. In Section 2, we describe and test our three working hypotheses to explain the nature of the abnormal price behavior after open market repurchase programs. In Section 3, we test the robustness and time consistency of the buyback strategy. In Section 4, we examine the behavior of financial analysts around open market buyback programs. In Section 5, we re-examine the fixed-price tender offer anomaly using a sample of 261 announcements of fixed-price tender offers between 1987 and 2001. Section 6 concludes.

1. Long-Term Returns after Open Market Share Repurchases

In this section, we review the findings of ILV, who report long-run abnormal returns after open market share repurchase announcements in a sample between 1980 and 1990.

1.1 Sample description

The starting point for the sample selection is the Securities Data Corporation (SDC) mergers and acquisition and repurchase databases. Our sample spans the period 1991 to 2001 and includes 5,348 open market share repurchase announcements. We require that we can identify the announcement of each repurchase program in LexisNexis. This results in 3,725 events. In addition, we require that the event firms have available CRSP and Compustat data. We also exclude events where the stock price 10 days before the announcement is less than $3. Events are excluded if there was an earlier repurchase announcement by the same company within 1 month. The final sample thus consists of 3,481 events.

Table 1 reports univariate statistics for the open market repurchase sample. We find a significant 2.39% average abnormal return in the 3 days around the announcement, still positive, consistent with earlier findings (e.g., Vermaelen, 1981). Also the fraction sought in the repurchase is comparable to ILV, with 7.37% of the shares outstanding. The number of observations has increased threefold in the 11-year period we are investigating relative to ILV's period of 1980–1990. The peak years are 1998 with 682 events, followed by 1999 with 549, and 1996 with 407. Interestingly, repurchases have decreased to only 185 announcements in 2001.

1.2 Long-term abnormal returns: a re-examination of the ILV evidence

Our first test is to investigate whether there are still long-run abnormal returns after the announcement of open market share repurchases. We start by using the Fama-French (1993) three-factor model combined with Ibbotson's RATS

Table 1
Descriptive statistics on open market share repurchases

Year	Number of events	CAR[−1, +1]	Fraction sought	Prior 6-month raw returns
1991	88	2.62%	6.90%	2.57%
1992	129	2.97%	8.10%	3.70%
1993	146	2.45%	6.99%	2.04%
1994	300	1.61%	6.32%	−1.50%
1995	299	2.21%	6.10%	3.71%
1996	407	2.21%	6.61%	3.78%
1997	394	2.40%	6.98%	8.11%
1998	682	2.13%	8.09%	−4.75%
1999	549	2.64%	8.35%	−3.13%
2000	302	2.66%	7.99%	−2.95%
2001	185	3.53%	7.16%	5.12%
All years	3481	2.39%	7.37%	0.43%

Univariate statistics for 3,481 open market share repurchase announcements between 1991 and 2001. CAR[−1, +1] is the cumulative abnormal announcement return over the 3 days around the repurchase announcement date using the market model with an equally weighted CRSP index. Fraction sought is the fraction of shares that the company announced it wishes to repurchase. Prior 6-month raw return is the cumulative return of the company in the 6 months prior to the repurchase announcement.

methodology to compute abnormal returns. In this approach, security excess returns are regressed on the three Fama-French factors for each month in event time, and the estimated intercept represents the monthly average abnormal return for each event month. We consider long-run abnormal returns between 1 month and 48 months (j) after the announcement of the open market repurchase program.

The following cross-sectional regression is run each event month j ($j = 0$ is the event month in which the open market repurchase is announced):

$$(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_j SMB_t + d_j HML_t + \varepsilon_{i,t}, \qquad (1)$$

where $R_{i,t}$ is the monthly return on security i in the calendar month t corresponding to event month j. $R_{f,t}$, $R_{m,t}$, SMB_t, and HML_t are the risk-free rate, the return on the equally weighted CRSP index, and the monthly return on the size and BM factor in the calendar month t corresponding to event month j, respectively. The coefficient a_j is the result of a monthly (in event time) cross-sectional regression. The cumulative abnormal return (CAR) numbers reported in Table 2 are sums of the intercepts a_j over the relevant event-time window. The standard error (denominator of the t-statistic) for a given event window is the square root of the sum of the squares of the monthly standard errors.

The advantage of this methodology is that changes in the riskiness of the equity from before to after the buyback, e.g., due to changes in leverage, are better accounted for. The reason is that month-by-month after the buyback, the factor loadings are allowed to change—*albeit* only in the cross-sectional average, not for each firm individually.

For the full sample of 3,481 events in 1991–2001, we find significant abnormal returns from the first month after the announcement onward. For example,

Table 2
Long-run abnormal return after open market repurchase announcements

Panel A: Fama-French IRATS

Months	Full sample		BM lowest (glamour stocks)		BM 2		BM 3		BM 4		BM highest (value stocks)	
	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic
(+1, +12)	2.67%	3.077**	1.19%	0.403	4.90%	2.519*	5.00%	2.820**	2.39%	1.557	5.80%	1.941$
(+1, +24)	10.54%	8.015***	7.18%	1.671$	10.85%	3.544***	12.70%	4.598***	7.69%	3.071**	20.63%	4.847***
(+1, +36)	18.60%	11.328***	11.00%	2.027*	14.44%	3.570***	18.84%	5.061***	17.36%	5.131***	29.11%	5.553***
(+1, +48)	24.25%	12.529***	14.87%	2.136*	17.08%	3.353***	20.42%	4.425***	19.71%	4.536***	28.89%	4.473***
Obs	3481		439		699		820		900		623	

Panel B: Fama-French calendar-time approach

	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic
12 mths	0.52%	3.11**	0.40%	1.08	0.19%	0.77	0.61%	2.74*	0.60%	3.30**	0.58%	1.71
24 mths	0.50%	3.77***	0.41%	1.36	0.37%	1.29	0.51%	2.39**	0.57%	2.97**	0.90%	3.04**
36 mths	0.45%	3.52***	0.41%	1.53	0.11%	0.56	0.48%	2.93**	0.65%	3.32***	0.84%	3.49***
48 mths	0.44%	3.56***	0.41%	1.62	0.10%	0.54	0.43%	2.70**	0.57%	3.76***	0.83%	3.74***

Panel C: Fama-French IRATS

Months around repurchase announcement	Largest firm quintile		Second largest firm quintile		Middle firm quintile		Second smallest firm quintile		Smallest firm quintile	
	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic
(+1, +12)	2.61%	2.061*	4.01%	2.447*	2.52%	1.389	2.92%	1.036	19.60%	2.444*
(+1, +24)	7.21%	3.995***	8.53%	3.499***	13.57%	4.588***	20.20%	4.820***	27.80%	2.632**
(+1, +36)	10.95%	4.788***	15.10%	4.900***	24.60%	6.670***	34.17%	6.593***	47.06%	3.283**
(+1, +48)	12.91%	4.780***	18.96%	5.183***	33.92%	7.688***	40.84%	6.883***	54.66%	3.679***
Obs	992		870		830		620		169	

Table 2
(Continued)

Panel D: Fama-French calendar-time approach

	Largest firm quintile		Second largest firm quintile		Middle firm quintile		Second smallest firm quintile		Smallest firm quintile	
	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic
12 mths	0.48%	2.29*	0.25%	0.97	0.49%	1.69	0.53%	1.68	1.08%	1.58
24 mths	0.35%	2.22$	0.49%	2.21$	0.60%	2.64*	0.77%	2.83**	0.98%	1.74
36 mths	0.36%	2.49*	0.28%	1.59	0.52%	2.34*	0.73%	2.91**	1.35%	1.78
48 mths	0.28%	2.01$	0.24%	1.43	0.58%	2.80*	0.67%	2.87**	1.38%	2.28*

Panels A and B: full sample and subsamples by book-to-market (BM) quintiles.
Panels C and D: subsamples by firm size quintiles.
Panels A and C report monthly cumulative average abnormal returns (CAR) in percent using Ibbotson's (1975) returns across time and security (IRATS) method combined with the Fama-French (1993) three-factor model for the sample of 3,481 firms that announced an open market share repurchase plus various subsamples. The following regression is run each event month *j*:

$$(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_j SMB_t + d_j HML_t + \varepsilon_{i,t},$$

where $R_{i,t}$ is the monthly return on security i in the calendar month t that corresponds to the event month j, with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t and HML_t are the monthly return on the size and BM factor in month t, respectively. The numbers reported are sums of the intercepts a_t of cross-sectional regressions over the relevant event-time periods expressed in percentage terms. The standard error (denominator of the t-statistic) for a window is the square root of the sum of the squares of the monthly standard errors. Abnormal returns (AR) are reported for subsamples based on BM and size, respectively. Firms are assigned to BM quintiles based on the BM ratio of the repurchasing firm at the fiscal year-end prior to the repurchase announcement relative to the BM ratio of all Compustat firms in that particular year. Firms are assigned to size quintiles based on their size (measured as the market value of equity in the month prior to the repurchase announcement) relative to the size of all Compustat/CRSP firms in that month. Panels B and D report monthly average AR of equally weighted calendar-time portfolios using the Fama-French (1993) three-factor model. In this method, event firms that have announced an open market repurchase in the past 12 (24, 36, 48) calendar months form the basis of the calendar-month portfolio. A single time-series regression is run with the excess return of the calendar portfolio as the dependent variable and the return on the three factors as the independent variables (the excess market return, a high-minus-low BM, and a small-minus-big capitalization factor). The significance levels are indicated by $, *, **, and ***, and correspond to a significance level of 10%, 5%, 1%, and 0.1%, respectively, using a two-tailed test. Obs (mths) refers to observations (months).

over 12 (24, 36, 48) months we find cumulative average abnormal returns of 2.67% (10.54%, 18.60%, 24.25%), all significant at the 1% level or better, as reported in panel A of Table 2.

The economic magnitude of the abnormal returns seems to have increased compared with the ILV results. However, a direct comparison is difficult since their benchmark returns are based on a portfolio of firms selected to match the size and BM ranking but not the market factor. Nevertheless, they find significant abnormal returns using buy-and-hold returns of 2.04% in the first year to 7.98% over 4 years after the announcement. Using compounded holding-period returns, ILV find an average 12.14% abnormal return over 4 years.

Our finding of a significant average abnormal return after open market share repurchase announcements is robust to two additional tests of the long-run abnormal performance, designed to alleviate the problem of clustering of events in calendar time and the associated cross-correlation problems.[5] We follow Ibbotson (1975) more closely by selecting one event per *calendar* month only to be included in the regression. This limits the maximum number of observations per regression to 132 (one event per month between January 1991 and December 2001). For example, when we estimate the abnormal return for the initial announcement month (0, 0),[6] we randomly select one event among all the events first announced in a given calendar month. We repeat this random selection for each calendar month. Thus, the regression includes events that are nonoverlapping in calendar time. For the event month (1, 1), we proceed similarly by selecting randomly among events in their first month after the announcement—again one event per calendar month. The results are qualitatively similar to those reported in panel A of Table 2 and are omitted for the sake of brevity.

The drawback of this method, as pointed out in Ibbotson (1975), is that the estimators are not minimum variance because of the heteroskedastic disturbances caused by the fact that the sampled security changes from month to month, thus having differing b_j, c_j, d_j, and $\sigma^2(\varepsilon_{i,t})$. Forming a portfolio of securities can alleviate this issue. Thus, as a second test we implement the Fama-French (1993) calendar-time portfolio approach as advocated by Fama (1998) and Mitchell and Stafford (2000). The Fama-French calendar-time portfolio methodology also does not rely on an estimation period prior to the event to compute the abnormal returns. Portfolios are formed by event month but in calendar time. The portfolio in the calendar month t contains all the stocks of firms that had an event in the prior 12 (24, 36, or 48) calendar months. A single regression is then run where the dependent variable is the time series of

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5 Fama (1998) suggests a method based on Jaffe (1974) and Mandelker (1974) where expected returns of portfolios, formed in calendar time, are estimated based on pre-event data. We do not follow this method as it might lead us to find positive abnormal returns simply because share repurchases usually increase leverage and thus the riskiness and expected return of equity after the event (e.g., Grullon and Michaely, 2004).

6 (0, 0) stands for (beginning, end) months in event time, where 0 is the month in which the initial announcement was made. (0, 0) thus refers to the return in the months of the announcement of the event.

calendar portfolio returns. The intercept represents the mean monthly excess return in the event period (e.g., [+1, +24] for the average excess return over the 24 months after the repurchase announcement month), where month 0 is the announcement month of the repurchase.

We do not follow Mitchell and Stafford's (2000) suggestion to calculate value-weighted portfolio returns. First, as pointed out by Loughran and Ritter (2000), value weighting decreases the power to identify abnormal returns as it is less likely that large companies repurchase stock because they are undervalued. Consistent with this argument, we will show below that at least three proxies for the likelihood of undervaluation are significantly negatively correlated with firm size. If anything, to increase the power of the test to detect mispricing, the weighting should be based on the *inverse* of size. Second, the weighting scheme should be determined by the economic hypothesis of interests. In this paper, we want to estimate excess returns experienced by an average firm announcing a share repurchase. We are not trying to assess the macroeconomic relevance of an anomaly or to make an inference about the general level of efficiency of the stock market. In other words, we are perfectly willing to accept the hypothesis that 99% of all stocks are priced correctly. Our aim is to investigate whether there is something systematic about the exceptions. We are simply asking whether managers are capable of buying back shares when the stock is undervalued, something that 90% of them claim to be able to do (Brav et al., 2005).

The results of the calendar-time approach are shown in panel B of Table 2. This table reports results of the time-series regression of equally weighted repurchase portfolio returns for 12 (24, 36, 48) months starting the month after the buyback announcement.

For the full sample of 3,481 events, we find highly significant average monthly abnormal returns of 0.52% (0.50%, 0.45%, 0.44%) using 12- (24-, 36-, 48-) month event windows. Thus, we conclude that the abnormal returns after the open market buyback announcements persist, regardless of the methodology employed.

Not all repurchases are motivated by undervaluation. ILV hypothesize that *ceteris paribus* value stocks are more likely to be undervalued than other stocks. Following their approach, we classify firms into quintiles according to their BM ratio using data at the fiscal year-end prior to the repurchase announcement. The quintile ranges are determined by all Compustat firms in a given year.[7] Consistent with ILV, as shown in Table 2, "value" stocks (high-BM firms) outperform "glamour" stocks. For example, after 48 months, the 623 firms in the top BM quintile display a positive and significant abnormal return of 28.89% (significant at the 0.1% level). The 439 firms in the lowest BM quintile outperform by 14.87% (significant at the 5% level). Using the Fama-French

[7] We compute the market value of all Compustat firms in the fiscal year-end month of the event firm but take the last available book value of equity for each firm.

(1993) calendar-time approach, reported in panel B of Table 2, we find that the average monthly abnormal return is 0.83% (significant at the 0.1% level) for value stocks. Glamour stocks, on the other hand, display an insignificant average monthly abnormal return of 0.41%.

If the buyback is based on inside information about future cash flows, one would expect that size is negatively correlated with long-run abnormal returns, as it seems more likely that small firms are mispriced than large firms. We assign an event firm to a size quintile based on the size of the event firm (measured by equity market value 1 month prior to the repurchase announcement) relative to the size of all Compustat/CRSP firms in that same month. Notice that the quintiles do not contain an equal number of firms since the quintiles are formed based on the full distribution of all Compustat/CRSP firms. As shown in Table 2, panels C and D, the smallest firm quintile contains only 4.8% (169) of the 3,481 event firms. However, that subsample displays the highest long-run abnormal returns (54.66%) after 48 months using Ibbotson's RATS, and an average monthly abnormal return of 1.38% (significant at the 5% level) using the Fama-French (1993) calendar-time approach. In general, there seems to be a negative relation between long-term abnormal returns and firm size. Note that the largest firms (992 event firms) also outperform the benchmark. Using Ibbotson's RATS method, there is a 12.91% (significant at the 1% level) abnormal return after 48 months. The corresponding Fama-French calendar-time approach results in a monthly average abnormal return of 0.28% (significant at the 10% level).[8]

Summarizing, markets seem to behave very similar during the last 25 years: the market underreacts to buyback announcements, in particular to the announcements made by value and small stocks.

2. The Nature of the Open Market Share Repurchase Anomaly: Theory and Evidence

In order to obtain a better understanding of why markets apparently underreact to buyback announcements during the last 25 years, we consider three hypotheses: the risk-change hypothesis, the liquidity hypothesis, and the overreaction hypothesis.

2.1 The risk-change hypothesis

According to Grullon and Michaely (2004), the repurchase signals a reduction in risk. They arrive at this conclusion after failing to find evidence of abnormal

[8] These findings clearly raise the question whether our findings of long-run abnormal returns after share repurchases are an artifact of the bad model problem (Fama, 1998), since it has been shown that the Fama-French three-factor model does not completely explain the cross section of stock returns. In particular, Fama and French (1993) find in their Table 9a that small-growth firms display a *negative* average abnormal return even after controlling for size and BM. Given their findings, it seems less likely that the model bias can explain our *positive* abnormal returns. Secondly, it is only the small-growth firms that display significant negative abnormal returns. Of the 169 firms that are in the small firm quintile in our sample, we find only eight to be also in the lowest BM quintile (i.e., growth) firms.

earnings increases during the next few years after the buyback. The argument is that the repurchase signals a decline in growth opportunities, which are assumed to be less risky than assets in place. The interesting feature of this hypothesis is that it does not require that managers have inside information about earnings 3–4 years from now. However, this hypothesis is inconsistent with the excess returns obtained with Ibbotson's RATS methodology, because it adjusts for risk changes each month after the event. In particular, the methodology computes an abnormal return each month after the event based upon the cross section of returns. Therefore, if risk systematically changes after firms repurchase shares, then the coefficients on the factors are allowed to change month by month to reflect such changes in risk. The fact that we still find excess returns shows that long-term returns cannot be explained as an underreaction to changes in risk.

2.2 The liquidity hypothesis

An alternative explanation for the abnormal returns could be caused by an omitted, priced factor. Barclay and Smith (1988) and Brockman and Chung (2001) find that stocks are less liquid after repurchases. Since Pástor and Stambaugh (2003) find that their liquidity factor is priced, it is possible that the abnormal returns are due to this omitted liquidity factor.

It should be noted that the effect of share repurchases on liquidity is a controversial issue. Singh, Zaman, and Krishnamurti (1994); Wiggins (1994); and Miller and McConnell (1995) conclude that repurchases do not affect liquidity, while Franz, Rao, and Tripathy (1995) and Cook, Krigman, and Leach (2004) find an increased liquidity. Also, Grullon and Michaely (2002) find that share repurchases improve liquidity by increasing depth on the sell-side of the market. They argue that companies can be thought of as supporting market makers and adding downside liquidity in falling stock markets.

In order to test whether a liquidity factor can explain the abnormal returns, we run the following regression:

$$(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_j SMB_t + d_j HML_t + e_j LIQ_t + \varepsilon_{i,t}, \tag{2}$$

where $R_{i,t}$ is the monthly return on security i in the calendar month t that corresponds to the event month j, with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t and HML_t are the monthly return on the size and BM factor in month t, respectively. LIQ is the monthly return on the Pástor and Stambaugh (2003) value-weighted liquidity factor. The numbers reported are sums of the intercepts a_t of cross-sectional regressions over the relevant event-time periods expressed in percentage terms. The standard error (denominator of the t-statistic) for a window is the square root of the sum of the squares of the monthly standard errors.

In Table 3, panel A, we find that the abnormal returns are basically unaffected by the inclusion of the liquidity factor. If anything, the abnormal returns are higher. Similarly, if we use the calendar-time approach, adding the liquidity factor to the three Fama-French (1993) factors, the abnormal returns are still very significant, as shown in panel B. We also find that the abnormal returns for the value stocks are still significantly positive, although smaller during the first 3 years. The biggest drop in abnormal returns can be observed in the sample of the smallest firms as defined above. However, the returns are still statistically and economically significant.

We conclude that the abnormal returns after share repurchases are not a compensation for a decline in liquidity.

2.3 The overreaction hypothesis

According to this hypothesis, the buyback is driven by the fact that the management believes that the market has overreacted to some publicly available information in the recent past. The basic prediction of this hypothesis is that (abnormal) returns in the period before the buyback should be the best predictor of long-term abnormal returns. In particular, the more a stock is beaten down in the recent past, the higher the long-term excess return. In order to test whether past returns are the "best" predictors, we compare the predictive capacity of past returns with three alternative predictors: the BM ratio, the firm size, and the stated motivation for the repurchase in the press release. The fact that BM and size are predictors was already shown in Table 2. In this section, we examine the predictive ability of two other factors: past returns and the stated motivation for the repurchase.

2.3.1 Past returns and long-run abnormal returns. When a stock has collapsed and is followed by a repurchase announcement, it may indicate that the management repurchases because it believes the market has overreacted to some presumably bad news. In order to test this hypothesis, we stratify the sample by prior returns. In particular, we allocate events to prior return quintiles based on their raw stock returns compared with all CRSP firms' raw returns in the 6 months prior to firms' repurchase announcement, ending 5 days prior to the announcement day. In other words, the quintile cutoffs are determined by the full distribution of all CRSP firms with available return data for the corresponding period. While this procedure results in a slightly uneven number of observations per quintile, it avoids the problem that the lowest return quintile is more likely to pick up events in downmarkets (see Table 1 for average raw returns per year).

Using Ibbotson's RATS method, we find that the average prior 6-month abnormal return is −9.05% for the full sample of firms that announce an open market repurchase (not tabulated). As shown in panel A of Table 4 and Figure 1, firms in the lowest prior raw return quintile experience average abnormal returns of −40.65% in the 6 months prior to the announcement of the repurchase. The

Table 3
Long-run abnormal returns including the Pástor and Stambaugh liquidity factor

Panel A: Fama-French IRATS including Pástor and Stambaugh (2003) value-weighted liquidity factor

Months	Full sample without liquidity factor		Full sample with liquidity factor		Smallest firm quintile		BM highest (value stocks)	
	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic
(+1, +12)	2.67%	3.077**	3.41%	3.922***	17.33%	2.649**	1.88%	0.695
(+1, +24)	10.54%	8.015***	11.61%	8.817***	21.62%	2.701**	13.82%	3.524***
(+1, +36)	18.60%	11.328***	19.69%	11.980***	36.82%	3.252**	23.58%	5.039***
(+1, +48)	24.25%	12.529***	25.67%	13.240***	46.02%	3.842***	30.19%	5.596***
Obs.	3481		3481		169		623	

Panel B: Fama-French calendar-time approach including the Pástor and Stambaugh (2003) value-weighted liquidity factor

	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic
12 mths	0.52%	3.11**	0.56%	3.85***	1.09%	1.56	0.62%	1.81
24 mths	0.50%	3.77***	0.55%	4.66***	1.00%	1.74	0.94%	3.67***
36 mths	0.45%	3.52***	0.48%	4.15***	1.17%	1.78	0.87%	3.84***
48 mths	0.44%	3.56***	0.47%	4.14***	1.21%	2.28**	0.86%	4.10***

Panel A reports monthly cumulative average abnormal returns (CAR) in percent using Ibbotson's (1975) returns across time and security (IRATS) method combined with the Fama-French (1993) three-factor model for the sample of 3,481 firms that announced an open market share repurchase plus various subsamples. The following regression is run each event month *j*:

$$(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_j SMB_t + d_j HML_t + e_j LIQ_t + \varepsilon_{i,t},$$

where $R_{i,t}$ is the monthly return on security *i* in the calendar month *t* that corresponds to the event month *j*, with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t and HML_t are the monthly return on the size and book-to-market factor in month *t*, respectively. *LIQ* is the monthly return on the Pástor and Stambaugh (2003) value-weighed liquidity factor. The numbers reported are sums of the intercepts a_t of cross-sectional regressions over the relevant event-time periods expressed in percentage terms. The standard error (denominator of the *t*-statistic) for a window is the square root of the sum of the squares of the monthly standard errors. Abnormal returns (AR) are reported for subsamples based on book-to-market (BM) and size, respectively. Firms are assigned to BM quintiles based on the BM ratio of the repurchasing firm at the fiscal year-end prior to the repurchase announcement relative to the BM ratio of all Compustat firms in that particular year. Firms are assigned to size quintiles based on their size (measured as the market value of equity in the month prior to the repurchase announcement) relative to the size of all Compustat/CRSP firms in that month. Panel B reports monthly average AR of equally weighted calendar-time portfolios using the Fama-French (1993) three-factor model augmented by the liquidity factor. In this method, event firms that have announced an open market repurchase in the past 12 (24, 36, 48) calendar months form the basis of the calendar-month portfolio. A single time-series regression is run with the excess return of the calendar portfolio as the dependent variable and the return on three factors as the independent variables (the excess market return, a high-minus-low BM, and a small-minus-big capitalization factor). The significance levels are indicated by $^{\$}$, *, **, and ***, and correspond to a significance level of 10%, 5%, 1%, and 0.1%, respectively, using a two-tailed test. Obs (mths) refers to observations (months).

Table 4
Long-run abnormal returns after open market repurchases stratified by 6-month prior returns

Panel A: Fama-French IRATS

Months around repurchase announcement	Prior return lowest		Prior return 2		Prior return 3		Prior return 4		Prior return highest	
	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic
(−6, −1)	−40.65%	−29.927***	−17.68%	−18.056***	−7.55%	−8.621***	2.26%	2.529*	21.12%	16.717***
(−5, −1)	−34.50%	−27.600***	−15.22%	−16.891***	−7.75%	−9.911***	0.64%	0.807	14.64%	13.050***
(−4, −1)	−28.88%	−25.886***	−12.60%	−15.674***	−7.14%	−10.167***	0.26%	0.37	9.51%	9.629***
(−3, −1)	−22.27%	−22.098***	−10.07%	−14.250***	−6.08%	−9.809***	−0.95%	−1.506	5.05%	6.111***
(−2, −1)	−14.87%	−18.037***	−7.57%	−12.765***	−5.13%	−9.687***	−2.27%	−4.435***	−0.48%	−0.752
(−1, −1)	−5.29%	−8.357***	−3.63%	−7.902***	−3.54%	−8.111***	−2.52%	−6.508***	−3.60%	−7.638***
(0, 0)	1.24%	1.277	−0.19%	−0.34	0.54%	1.109	−0.40%	−0.912	0.11%	0.211
(+1, +12)	3.55%	1.195	4.51%	2.286*	2.48%	1.479	1.54%	0.962	6.93%	4.025***
(+1, +24)	22.75%	5.200***	13.36%	4.459***	8.07%	3.024**	3.85%	1.561	9.97%	3.563***
(+1, +36)	42.85%	7.534***	19.88%	4.982***	14.76%	4.234***	5.26%	1.589	9.80%	2.735**
(+1, +48)	45.44%	6.192***	24.36%	4.843***	11.81%	2.647**	11.64%	2.758**	13.24%	2.761**
Observations	740		668		650		664		759	

Panel B: Fama-French calendar-time approach

	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic
12 months	0.01%	0.22	0.08%	0.31	0.21%	0.69	0.14%	0.45	0.60%	2.80*
24 months	0.55%	1.91$	0.47%	2.38*	0.33%	1.16	0.17%	0.87	0.41%	2.05$
36 months	0.96%	2.24*	0.52%	3.16**	0.35%	1.40	0.21%	1.31	0.25%	1.49
48 months	0.68%	2.55*	0.48%	3.07**	0.29%	1.28	0.25%	1.53	0.22%	1.42

Table 4
(Continued)

Panel C: Fama-French three-factor model plus momentum factor of Carhart, IRATS

Months around repurchase announcement	Prior return lowest (stratified by year)		Prior return 2		Prior return 3		Prior return 4		Prior return highest	
	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic
(−6, −1)	−38.13%	−25.532***	−15.75%	−14.676***	−6.45%	−6.627***	2.31%	2.365*	20.79%	15.300***
(−5, −1)	−31.47%	−23.132***	−13.31%	−13.448***	−6.56%	−7.494***	0.57%	0.656	14.11%	11.659***
(−4, −1)	−26.35%	−21.920***	−10.82%	−12.224***	−6.00%	−7.546***	0.10%	0.127	8.96%	8.334***
(−3, −1)	−19.70%	−18.385***	−8.32%	−10.688***	−4.91%	−6.937***	−1.16%	−1.660$	4.42%	4.873***
(−2, −1)	−13.19%	−15.107***	−6.57%	−10.164***	−4.14%	−6.730***	−2.68%	−4.641***	−1.13%	−1.615
(−1, −1)	−4.56%	−6.775***	−3.23%	−6.601***	−2.90%	−5.624***	−2.87%	−6.529***	−4.28%	−8.243***
(0, 0)	2.44%	2.464*	0.36%	0.605	0.90%	1.691$	−0.62%	−1.267	−0.86%	−1.533
(+1, +12)	9.51%	3.053**	7.73%	3.741***	5.27%	2.924**	5.73%	3.413***	10.10%	5.495***
(+1, +24)	32.01%	7.206***	19.37%	6.321***	13.29%	4.770***	11.14%	4.481***	17.60%	6.121***
(+1, +36)	50.37%	9.359***	31.13%	8.152***	25.01%	6.689***	16.80%	5.295***	20.97%	5.937***
(+1, +48)	60.69%	10.007***	42.68%	9.527***	30.34%	7.022***	24.71%	6.487***	27.07%	6.210***
Observations	740		668		650		664		759	

Table 4
(Continued)

Panel D: Fama-French three-factor model plus momentum factor of Carhart, calendar-time approach

	Prior return lowest (stratified by year)		Prior return 2		Prior return 3		Prior return 4		Prior return highest	
	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic
12 months	0.40%	1.22	0.27%	1.05	0.88%	2.41*	0.73%	3.37**	0.98%	3.83***
24 months	0.94%	3.48***	0.65%	3.19**	0.61%	2.16$	0.58%	2.92**	0.80%	4.48***
36 months	1.02%	4.45***	0.66%	3.88***	0.73%	2.09*	0.58%	3.24**	0.53%	3.80***
48 months	0.99%	5.28***	0.65%	4.09***	0.72%	2.69*	0.54%	3.38**	0.51%	3.60***

Panel A reports monthly cumulative average abnormal returns (CAR) in percent using Ibbotson's (1975) returns across time and security (IRATS) method combined with the Fama-French (1993) three-factor model for subsamples formed based on the 6-month raw returns prior to the open market share repurchase announcement. The following regression is run each event month *j*:

$$(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_j SMB_t + d_j HML_t + \varepsilon_{i,t},$$

where $R_{i,t}$ is the monthly return on security *i* in the calendar month *t* that corresponds to the event month *j*, with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t and HML_t are the monthly return on the size and book-to-market factor in month *t*, respectively. The numbers reported are sums of the intercepts a_t of cross-sectional regressions over the relevant event-time periods expressed in percentage terms. The standard error (denominator of the *t*-statistic) for a window is the square root of the sum of the squares of the monthly standard errors. The sample is stratified into "prior return quintiles" by the 6-month prior raw returns relative to the distribution of the 6-month raw returns of all CRSP firms ending 5 days before the announcement. *Prior return lowest* contains events where the prior return of the repurchasing firm is in the lowest quintile relative to the cross section of all CRSP firms over the same 6-month period. Firms are assigned to prior return quintiles based on the raw 6-month prior returns of the repurchasing firm relative to the prior 6-month returns of all firms with available CRSP data for those particular months. Panel B reports monthly average abnormal returns (AR) of equally weighted calendar-time portfolios using the Fama-French (1993) three-factor model. In this method, event firms that have announced an open market buyback in the last 12 (24, 36, 48) calendar months form the basis of the calendar month portfolio. A single time-series regression is run with the excess return of the calendar portfolio as the dependent variable and the return on three factors as the independent variables (the excess market return, a high-minus-low book-to-market, and a small-minus-big capitalization factor). The significance levels are indicated by $, *, **, and ***, and correspond to a significance level of 10%, 5%, 1%, and 0.1%, respectively, using a two-tailed test. Panels C and D augment the three-factor model with the momentum factor of Carhart (1997).

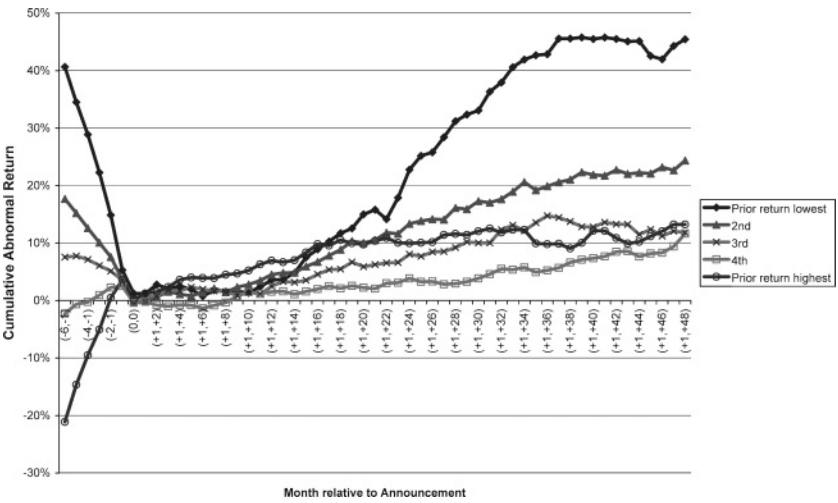

Figure 1
Prior return and long-run abnormal returns
The figure presents cumulative abnormal returns based on the Fama-French three-factor model and IRATS. For a description of the methodology, see Table 3. The portfolios (quintiles) presented are formed based on the raw returns of stocks in the 6 months prior to the open market share repurchase announcement relative to the distribution of all CRSP firms' stock returns over the same period.

quintile with the highest prior raw returns experiences an abnormal stock-price increase of 21.12%. Interestingly, we find that the firms that were beaten up the most prior to the repurchase announcement experience the highest long-run abnormal returns after the repurchase announcement. The abnormal returns in the lowest prior return quintile reach 45.44% 48 months after the repurchase. The firms with the highest prior returns reach an average abnormal return of only 13.24% over that interval. Although both average abnormal returns are significant, there is an economically significant difference between the two quintiles.[9]

These findings suggest that managers do not necessarily repurchase because of private information about the future operating performance of their company, but rather because they disagree with the hammering received in the stock market. Hence, the finding by Grullon and Michaely (2004) that operating performance does not improve after open market share repurchases can still be consistent with managers repurchasing because they believe their firm to be undervalued. However, it is not undervalued because future performance is improving, but rather because the market believes, incorrectly, that its performance will decline. Our findings also suggest that it is unlikely that the main reason for the repurchase announcement is managers' inside information about

[9] In panel B we report average abnormal returns using the Fama-French calendar-time approach. We find monthly average abnormal returns for the subsamples with the lowest (highest) prior returns of 0.68% (0.22%). Using this method, the highest prior return sample is not followed by significant excess returns.

new technologies that are earnings relevant only in the very long run. The reason is that such an inside information hypothesis does not predict a correlation between prerepurchase and postrepurchase abnormal returns—unless one is willing to make strong assumptions about the arrival of information about new technologies.

Jegadeesh and Titman (1993) also focus on a 6-month period where they calculate returns, finding that returns tend to continue in the same direction for the next 6 months. Our finding of a reversal after a big drop suggests that we might even underestimate the long-run abnormal returns if there is this momentum factor (Carhart, 1997).[10] Table 4, panels C and D, report long-run abnormal returns for samples stratified by prior return using the Fama-French (1993) three-factor model augmented with the momentum factor. Consistent with our expectation, adding the momentum factor increases the long-run abnormal returns. For example, in panel C we find that the sample of repurchase firms in the lowest prior raw return quintile displays long-run abnormal returns of 60% over 48 months (Ibbotson's RATS method). Similar implications are found for different windows and using the Fama-French calendar-time approach, as reported in panel D.

In contrast to Jegadeesh and Titman (1993), De Bondt and Thaler (1985) find reversals. However, the reversals happen after a much longer period of decline (3–5 years). Hence, long-run abnormal returns after open market share repurchases cannot be explained by momentum. But it seems possible that the long-run abnormal returns are a consequence of two effects. First, an overreaction to some kind of information prior to the repurchase that made the stock price fall below fair value. Second, an underreaction to the information contained in the share repurchase announcement.

2.3.2 Stated motivation and long-run abnormal returns. In this section, we explore whether another indicator, the stated motivation in the press release, is an indicator of potential undervaluation. The reasons for doing so are twofold. First, in order to demonstrate that past returns are the "best" predictors of future returns, we want to examine the predictive ability of other indicators besides size and BM. Second, if managers are buying back stock because they disagree with the market's overreaction to bad news, we expect that, *ceteris paribus*, managers are more likely to mention "undervaluation" as a motivation for the repurchase when the returns prior to the buyback are low.

Theoretical signaling models would not predict that managerial statements have a predictive capacity, as a credible signal requires a cost for false signaling, and "talk is cheap." However, we assume that managers care about their reputation and that lying is not a costless activity. We read all the information relating to the announcement of the open market share repurchases by searching through the sources in LexisNexis. Of the 5,348 events initially collected

[10] Notice that adding the momentum factor is one way of implementing a test whereby each event firm is matched with a firm that has a similar 6-month prior return.

from SDC, we can identify the announcement date of 3,725 events. For the remaining 1,623, we are unable to find any information at the time of the announcement relating to an open market share repurchase. As described above, further data requirements limit the sample to 3,481 events.

The statements have been read and classified into the following categories of "motivation" for the share repurchase:

1. *Undervalued*. The announcement contains an explicit mention of undervaluation of the firm's shares or refers to the low current stock price and stock-price underperformance.
2. *Best use of money*. The announcement states that the money of the company is best spent on repurchasing its own shares[11] or that the use of money is in the best interest of shareholders.
3. *Distribution of cash*. The announcement justifies the repurchase as being in the interest of shareholders primarily because cash (or excess cash) is returned to shareholders.
4. *Dilution and EPS*. The announcement states that the repurchased shares help to avoid dilution or that the repurchase strengthens earnings-per-share (EPS).
5. *ESOP*. The repurchase is made in conjunction with an employee stock option plan (Kahle, 2002).
6. *Restructuring*. The repurchase is part of a restructuring.
7. *Others*. Other reasons.

In 647 press releases, no motivation was given for the repurchase. Conversely, multiple motivations are often cited in the announcements. Table 5 gives the frequency of each motivation. In addition, it lists the frequency with which one particular motive is mentioned together with any of the other six motives. For example, only 54 announcements state "undervaluation" as a sole motive. However, 222 cite "undervaluation" together with one of the other six motives. In total, 724 announcements mention undervaluation as the reason (or one of the reasons) for the repurchase.

We select those firms that mention "undervaluation" as well as "best use of money" to be the category of firms that makes the strongest statement about being mispriced.[12] We expect the motivation of these companies to be that the current stock price is too low. In contrast, we expect that firms that motivate the repurchase as avoiding "dilution" or managing "EPS" but mention neither "undervaluation" nor "best use of money" do not repurchase shares because they feel undervalued.

[11] We include statements that say "excellent," "good," "attractive," or "best" investment or use of money in this category.

[12] While this categorization is somewhat arbitrary, it is consistent with survey evidence provided in Brav et al. (2005). They report in their Table 6 that 86.4% of the respondents find the "market price" of their stock to be an important or very important factor in the company's repurchase decision. The definition of the "market price" is "if our stock is a good investment, relative to its true value."

Table 5
Frequency distribution and announcement returns of open market share repurchases stratified by motivation

	Motivations listed in the share repurchase announcement						
Number of motivations per announcement	Undervalued	Best use of money	Distribution of cash	Dilution and EPS	ESOP	Restructuring	Other
1	54	457	149	77	378	6	8
2	222	687	363	144	274	21	1
3	244	525	425	195	293	30	1
4	169	236	228	135	166	22	0
5	32	36	35	35	29	13	0
6	3	3	3	3	3	3	0
Total	724	1944	1203	589	1143	95	10
Abnormal announcement return (AR)	3.70%***	2.87%***	2.78%**	1.41%*	1.87%**	1.17%*	0.68%

The number of observations per motivation for firms that announced an open market share repurchase between 1991 and 2001 are reported. The motivation for the repurchase is determined by reading the announcements in LexisNexis. We classify motivations into the following seven categories:

Undervalued. The announcement mentions undervaluation of the firm's shares explicitly or refers to the low current stock price or stock-price underperformance.

Best use of money. The announcement states that the money of the company is best spent on repurchasing its own shares.

Distribution of cash. The announcement justifies the repurchase as being in the interest of shareholders primarily because cash (or excess cash) is returned to shareholders.

Dilution and EPS. The announcement says that the repurchased shares help to avoid dilution or that the repurchase strengthens earnings-per-share.

ESOP. The repurchase is made in conjunction with an employee stock option plan.

Restructuring. The repurchase is part of a restructuring.

Others. Other reasons.

One announcement can refer to several (maximum seven) motivations. For example, there are 54 events where the only motivation is "undervaluation"; 222 additional events report one other motivation besides "undervaluation." 647 events do not give a motivation. AR is the abnormal announcement return measured over the 3 days around the share repurchase announcement using the market model with the equally weighted CRSP index.
*, **, and *** indicate significance levels of 10%, 5%, and 1%, respectively.

Using this simple classification, we look at the announcement and long-run abnormal returns of these subsamples. As shown in Table 5, the abnormal announcement return (AR), calculated using the market model in the 3 days around the repurchase announcement, is 2.39% for the full sample. The AR is higher for firms with a motivation of "undervaluation" or "best use of money" (or both together) with 3.70% and 2.87% (3.99%), respectively. In contrast, the AR for firms citing "dilution" or "EPS" management (but neither "undervaluation" nor "best use of money") is only 1.41% (0.34%).

There are two interesting observations relating to the long-run abnormal returns reported in Table 6. First, the long-run abnormal returns using Fama-French (1993) factors with Ibbotson's RATS methodology are economically important (e.g., 31.89% over 48 months) and statistically significant (0.1% level) for the sample of "undervalued" and "best use of money" firms. The sample not expected to repurchase because of undervaluation indeed does not display any long-run abnormal returns (e.g., 9.36%, t-value of 1.137 over

Table 6
Long-run abnormal returns after an open market repurchase announcement stratified by motivation

Panel A: Fama-French IRATS

Months	All events with at least one motivation		Motivation: "undervalued" and "best use of money"		Motivation: neither "undervalued" nor "best use of money"		Motivation: "dilution" or "EPS." Neither "undervalued" nor "best use of money"		Motivation: "ESOP" only		Motivation: "ESOP" and others	
	CAR	t-statistic	CAR	t-statistic	CAR	t-statistic	CAR	t-statistic	CAR	t-statistic	CAR	t-statistic
(−6, −1)	−7.96%	−14.454***	−18.02%	−12.517***	−7.13%	−9.764***	−7.74%	−3.693***	−4.52%	−3.414***	−7.42%	−8.561***
(−5, −1)	−7.87%	−15.936***	−17.15%	−13.247***	−7.00%	−10.587***	−7.57%	−3.954***	−4.55%	−3.856***	−7.49%	−9.841***
(−4, −1)	−7.32%	−16.713***	−15.95%	−14.271***	−6.17%	−10.353***	−5.60%	−3.282**	−4.52%	−4.204***	−6.51%	−9.596***
(−3, −1)	−6.44%	−16.702***	−14.40%	−14.693***	−4.99%	−9.591***	−4.40%	−2.958**	−4.32%	−4.653***	−5.75%	−9.698***
(−2, −1)	−5.77%	−18.185***	−11.74%	−14.549***	−4.27%	−10.095***	−3.74%	−3.124**	−4.15%	−5.554***	−5.23%	−10.829***
(−1, −1)	−3.56%	−14.896***	−7.18%	−11.435***	−2.48%	−8.028***	−1.33%	−1.448	−2.11%	−3.680***	−3.07%	−8.671***
(0, 0)	0.04%	0.135	0.07%	0.074	0.20%	0.533	0.96%	0.847	0.87%	1.42	0.52%	1.377
(+1, +12)	2.88%	3.054**	2.97%	1.187	3.54%	2.970**	0.69%	0.209	7.22%	3.266**	6.17%	4.461***
(+1, +24)	10.13%	7.059***	16.19%	3.929***	9.01%	4.981***	4.73%	0.93	12.50%	3.798***	14.81%	6.899***
(+1, +36)	18.49%	10.288***	26.45%	5.006***	14.79%	6.134***	12.44%	1.910$	19.37%	4.259***	22.96%	7.976***
(+1,+48)	24.16%	11.504***	31.89%	4.597***	17.67%	5.580***	9.36%	1.137	20.06%	3.467***	23.18%	6.331***
Obs	2834		692		1456		188		378		1143	

Table 6
(Continued)

Panel B: Fama-French calendar-time approach

	Monthly average AR	t-statistic	Monthly average AR	t-statistic	Monthly average AR	t-statistic	Monthly average AR	t-statistic	Monthly average AR	t-statistic	Monthly average AR	t-statistic
12 months	0.50%	2.98**	0.61%	3.17***	0.37%	1.06	0.33%	0.95	0.69%	2.53**	0.63%	2.61*
24 months	0.58%	4.07***	0.61%	3.96***	0.22%	0.85	0.22%	0.79	0.56%	2.13$	0.55%	2.34*
36 months	0.55%	3.91***	0.56%	3.99***	0.30%	1.48	0.28%	0.80	0.54%	2.03$	0.54%	2.73**
48 months	0.51%	3.76***	0.49%	3.70***	0.33%	1.66	0.20%	0.89	0.42%	2.11$	0.47%	2.62*

Panel A reports monthly cumulative average abnormal returns (CAR) in percent using Ibbotson's (1975) returns across time and security (IRATS) method combined with the Fama-French (1993) three-factor model for subsamples formed based on the motivation for the open market share repurchase. The following regression is run each event month j:

$$(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_j SMB_t + d_j HML_t + \varepsilon_{i,t},$$

where $R_{i,t}$ is the monthly return on security i in the calendar month t that corresponds to the event month j, with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t and HML_t are the monthly return on the size and book-to-market factor in month t, respectively. The numbers reported are sums of the intercepts a_t of cross-sectional regressions over the relevant event-time periods expressed in percentage terms. The standard error (denominator of the t-statistic) for a window is the square root of the sum of the squares of the monthly standard errors. Abnormal returns are reported for six samples. First, all 2,834 firms that give at least one motivation for the share repurchase. Motivations are classified based on the stated reasons at the time of the share repurchase announcement as described in Table 5. The second subsample consists of 692 firms that motivate their repurchase by stating that they are "undervalued" and it is the "best use of money." The third subsample comprises 1,456 firms that state neither that they are "undervalued" nor that it is the "best use of money." The fourth subsample contains the 188 firms that repurchase to avoid "dilution" or manage "earnings-per-shares" (EPS) but cite neither "undervalued" nor "best use of money." The fifth (sixth) subsample contains the 378 (1,143) events where the firm motivates the repurchase by citing "employee stock option programs" as the sole reason (or as one of the reasons). Panel B reports monthly average abnormal returns (AR) of equally weighted calendar-time portfolios using the Fama-French (1993) three-factor model. In this method, event firms that have announced an open market buyback in the last 12 (24, 36, 48) calendar months form the basis of the calendar month portfolio. A single time-series regression is run with the excess return of the calendar portfolio as the dependent variable and the return on three factors as the independent variables (the excess market return, a high-minus-low book-to-market, and a small-minus-big capitalization factor). The significance levels are indicated by $, *, **, and ***, and correspond to a significance level of 10%, 5%, 1%, and 0.1%, respectively, using a two-tailed test. Obs indicates the number of observations.

48 months). Similar inferences can be drawn using the Fama-French calendar-time approach shown in panel B of Table 6. We believe this is an important finding because we have a new way of differentiating between managers that repurchase for reasons relating to undervaluation relative to those that repurchase for reasons unrelated to undervaluation: simply read the press releases. The second interesting finding, consistent with the overreaction hypothesis, is that firms that say they repurchase for reasons related to undervaluation actually experienced a bigger drop in their stock price in the 6 months prior to the repurchase announcement.

2.3.3 Are prior returns the best predictors of future returns? The previous sections show that various intuitively appealing proxies for "the likelihood of undervaluation" such as size, BM, stated motivations, and prior return can all be used to predict long-run abnormal returns. The overreaction hypothesis states that prior returns are the best predictors of long-term returns. One simple way to test this hypothesis is to compare the spread between the abnormal returns of the extreme quintiles of the different predictors after 48 months, using the results in Tables 2, 4, and 6. For example, using Ibbotson's RATS method, the spread between the highest and lowest prior return quintile (Table 6, panel A) is 32.2%, which is larger than the 14.02% difference between the top and bottom BM quintile (Table 2, panel A). It is also larger than the 22.53% difference between firms that state they repurchase shares because they are undervalued and those firms that buy back stock for poor motivations, such as EPS increases (Table 6, panel A). However, the 32.2% difference is clearly smaller than the 41.75% spread between the firms in the smallest and largest size quintiles, which suggests that firm size is a better predictor than past returns. However, this comparison is misleading as the smallest firm quintile only contains 169 stocks or 4.8% of the sample, compared to the sample of 740 stocks in the bottom prior return quintile. A more relevant comparison would be to compare the 32.2% with the weighted average spread of the smallest and second smallest firm size quintiles. The second smallest size quintile has 620 observations and a spread over the largest firm quintile of 27.93%. The weighted average spread is equal to $169/(169 + 620) * 41.75\% + 620/(620 + 169) * 27.93\% = 30.89\%$, slightly less than the 32.2% spread between the highest and lowest prior return quintiles. So, it appears that prior return is at least as good a predictor of future returns as any other intuitively appealing measure, such as firm size, BM, and stated motivation.

An interesting question is whether a combination of these characteristics results in a better proxy to predict abnormal returns than prior return only. To the extent that these indicators of undervaluation are all highly correlated, as shown in Table 7, this is not obvious. Specifically, panel B shows that firms

Table 7
Frequency of observations by size, book-to-market, prior return, and motivation

Panel A: Number of observations

		Motivation			BM					Size					
		Dilution		Undervalued	Low				High	Large				Small	By row
		1	3	5	1	2	3	4	5	1	2	3	4	5	
Low	1	64	294	81											439
	2	128	447	124											699
BM	3	133	535	152											820
	4	124	611	165											900
High	5	48	436	139											623
Large	1	190	673	129	247	323	250	132	40						992
	2	139	568	163	90	213	250	226	91						870
Size	3	105	551	174	65	111	193	281	180						830
	4	56	421	143	29	43	109	232	207						620
Small	5	7	110	52	8	9	18	29	105						169
Lowest	1	89	441	210	83	120	158	180	199	127	170	204	172	67	740
	2	74	449	145	70	119	159	173	147	188	170	150	122	38	668
Return	3	98	456	96	61	118	170	179	122	200	149	158	119	24	650
	4	109	454	101	78	138	160	196	92	223	162	148	112	19	664
Highest	5	127	523	109	147	204	173	172	63	254	219	170	95	21	759
by column		497	2323	661	439	699	820	900	623	992	870	830	620	169	

Table 7
(Continued)

Panel B: Fraction of observations (numbers reported are percentages)

		Motivation			BM					Size				
		Dilution		Undervalued	Low			High	Large					Small
		1	3	5	1	2	3	4	5	1	2	3	4	5
Low	1	14.6	67.0	18.5										
	2	18.3	63.9	17.7										
BM	3	16.2	65.2	18.5										
	4	13.8	67.9	18.3										
High	5	7.7	70.0	22.3										
Large	1	19.2	67.8	13.0	24.9	32.6	25.2	13.3	4.0					
	2	16.0	65.3	18.7	10.3	24.5	28.7	26.0	10.5					
Size	3	12.7	66.4	21.0	7.8	13.4	23.3	33.9	21.7					
	4	9.0	67.9	23.1	4.7	6.9	17.6	37.4	33.4					
Small	5	4.1	65.1	30.8	4.7	5.3	10.7	17.2	62.1					
Lowest	1	12.0	59.6	28.4	11.2	16.2	21.4	24.3	26.9	17.2	23.0	27.6	23.2	9.1
	2	11.1	67.2	21.7	10.5	17.8	23.8	25.9	22.0	28.1	25.4	22.5	18.3	5.7
Return	3	15.1	70.2	14.8	9.4	18.2	26.2	27.5	18.8	30.8	22.9	24.3	18.3	3.7
	4	16.4	68.4	15.2	11.7	20.8	24.1	29.5	13.9	33.6	24.4	22.3	16.9	2.9
Highest	5	16.7	68.9	14.4	19.4	26.9	22.8	22.7	8.3	33.5	28.9	22.4	12.5	2.8

Within each box, numbers add up to 100% in each row.
Within each box, numbers add up to 100% in each row.
The sample contains 3,481 open market share repurchase events. Each event is classified by book-to-market, size, prior return, and motivation. Book-to-market, size, and prior return are divided into quintiles. Each firm is assigned to a quintile based on its rank relative to the universe of Compustat/CRSP firms. Book-to-market is measured as the book value of equity divided by the market value of equity. Size is the market value of the equity. Prior return is the raw stock returns over the 6 months prior to the repurchase divided into quintiles based on the distribution of the 6-month raw returns of all CRSP firms ending 5 days before the announcement. Motivation is classified into three categories. Motivation class 5 represents all announcements that cite "undervaluation" and "best use of money" as motivation for the repurchase. Motivation 1 represents motivations to avoid "dilution" or for reasons of "earnings-per-share" management, but state that they repurchase neither due to "undervaluation" nor because the company thinks it is the "best use of money." All the remaining events are classified as motivation 3. See Table 5 for a description of the motivations.
Panel A shows the frequency distribution, reporting the number of observations for each pair. Panel B reports the fraction of observations in each row, per column category. For example, in the first row, of the firms with low book-to-market, 14.6% use motivation 1 (dilution), 67% motivation 3 (other), and 18.4% motivation 5 (undervalued).

are more likely to say they are undervalued[13] if they are in the highest BM quintile (22.3%) rather than in the lowest quintile (18.5%). We find an even greater difference if we focus on size. Firms that say they are undervalued are more likely to be in the smallest quintile (30.8%) than the largest (13%). Finally, firms that say they are undervalued are also more likely to be in the lowest quintile of prior returns (28.4%) than the highest (14.4%). Also evident from the table is the correlation between size, BM, and prior return quintile. Importantly, among the high-BM firms, the fraction of firms in the lowest (highest) prior return quintile is 26.9% (8.3%). Similarly, small firms are more than three times as likely to be in the lowest prior return quintile (9.1%) than in the highest (2.8%). We thus ask the question whether combining prior return, motivation, BM, and size into a measure might help to identify undervalued firms better than simply using prior return. We compute this U-Index as the sum of the ranks of the following four categories:

1. BM (ranks 1–5): the lowest-BM firms (glamour stocks) receive a 1, the highest (value stocks) a 5.
2. Size (ranks 1–5): the smallest firms score 5, the largest firms 1.
3. Prior raw return (ranks 1–5): firms with the lowest prior raw return receive a 5; those with the highest are given a 1.
4. Motivation (ranks 1, 3, 5): firms where the motivation is "undervaluation" and "best use of money" receive a 5; those firms where the motivation is "dilution" or "EPS management" but neither "undervaluation" nor "best use of money" receive a 1; the remaining firms are assigned a 3.

We then add up the ranks.[14] The empirical distribution of the U-Index is presented in Figure 2. Based on the empirical distribution, the quintile cutoffs are 9, 11, 13, and 15. The higher the U-Index, the more likely it is that the firm is undervalued according to our score. In Table 8, we report the long-run abnormal returns of the sample of firms with a U-Index <9 and a U-Index >15. These are the two samples that are at the extreme of the distribution of the U-Index.

The subsample of 517 firms with a U-Index <9 exhibits relatively lower abnormal returns. The maximum here is 13.12% (significant at the 5% level) after 48 months. However, the subsample of 446 firms with a U-Index >15 displays much larger and significant positive long-run abnormal returns. The maximum abnormal return is 51.46% achieved 41 months after the buyback announcement. After 36 (48) months, the abnormal return is 46.60% (46.10%). All these abnormal returns are significant at the 0.1% level. Using Fama-French's

[13] The category "undervalued" in the context of motivations derived from what managers say is still based on the same definition as before, i.e., if managers cite "undervaluation" and "best use of money." However, for expositional purposes, we refer to this category simply as "undervalued."

[14] This is an arbitrary rule of equally weighting the four characteristics. The idea is to test whether the correlation between the factors leads to a significant improvement in identifying undervalued firms by taking into account some potential for cross-correlation.

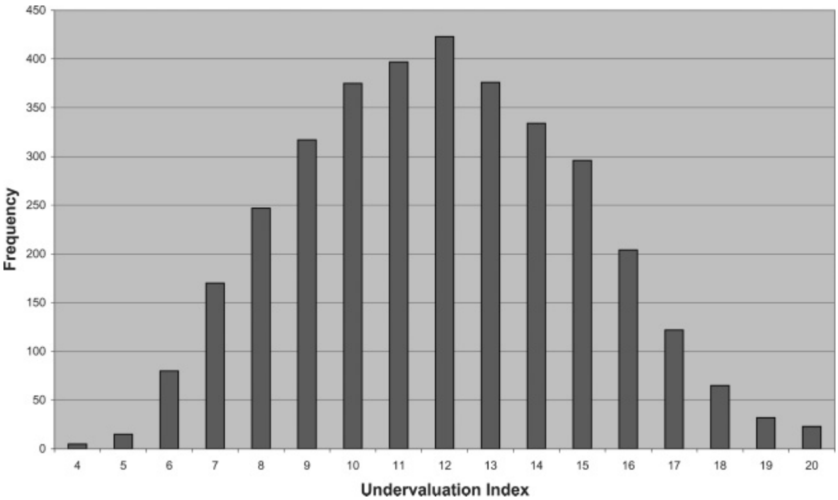

Figure 2
Empirical distribution of the Undervaluation Index
We compute the U-Index as follows for all open market share repurchases between 1991 and 2001 for which we can find an announcement in LexisNexis. The U-Index is the sum of the ranks of the following four categories: book-to-market ratios, *BM* (ranks 1–5): the lowest BM firms (glamour stocks) receive a 1, the highest (value stocks) a 5; *size* proxied by equity value at the end of the month prior to the repurchase announcement (ranks 1–5): the smallest firms score 5, the largest firms 1; *prior return quintile* (ranks 1–5): firms with the lowest prior return receive a 5 and those with the highest are given a 1. Prior return quintile cutoffs are determined based on the full distribution of all CRSP firms' 6-month return in a given month; *motivation* (ranks 1, 3, 5): firms where the motivation is "undervaluation" and "best use of money" receive a 5; those firms where the motivation is "dilution" or "EPS management" but neither "undervaluation" nor "best use of money" receive a 1; the remaining firms are assigned a 3. We then add up the ranks. Based on the empirical distribution, the quintile cutoffs are 9, 11, 13, and 15. The higher the U-Index, the more likely it is that the firm is undervalued according to the index.

(1993) calendar-time approach, we also find significant average abnormal returns. For example, over 36 (48) months, the equally weighted portfolios result in a monthly average abnormal return of 0.77% (0.92%), significant at the 1% (0.1%) level, as shown in panel B of Table 8. If we compare the abnormal return of 46.60% (46.1%) after 36 (48) months to the abnormal return of the lowest prior return quintile sample of 42.85% (45.44%) after 36 (48) months, we conclude that creating the U-Index and using it to select a portfolio increases the long-run abnormal return, but only marginally. This can also be inferred from Figure 3, which shows the cumulative abnormal return for the high- and low-U-Index samples. The similarity between the pattern of abnormal returns of the high-U-Index sample in Figure 3 and the lowest prior return quintile of Figure 1 is striking. This is consistent with the joint hypothesis that (1) prior return is the most significant predictor of returns and (2) there is a strong correlation between prior return, motivation, BM, and size. It seems reasonable that prior return affects the measures of BM and size relatively mechanically. The motivation, however, is an interpretation by the managers of the value of the company. According to the long-run abnormal return results, the motivation seems to be,

Table 8
Long-run abnormal returns stratified by undervaluation index

Panel A: Fama-French IRATS

	U-Index < 9		U-Index > 15	
Months relative to repurchase announcement	CAR	*t*-statistic	CAR	*t*-statistic
(−6, −1)	13.89%	10.267***	−34.17%	−19.040***
(−5, −1)	10.24%	8.647***	−29.56%	−17.988***
(−4, −1)	7.10%	6.664***	−24.30%	−16.288***
(−3, −1)	3.53%	3.844***	−19.97%	−14.857***
(−2, −1)	−0.74%	−1.059	−15.03%	−14.057***
(−1, −1)	−2.26%	−4.247***	−7.11%	−8.468***
(0, 0)	−1.52%	−2.540*	6.14%	4.539***
(+1, +12)	1.54%	0.784	3.48%	0.805
(+1, +24)	4.14%	1.438	28.26%	4.627***
(+1, +36)	8.08%	2.074*	46.60%	5.949***
(+1, +48)	13.12%	2.518*	46.14%	4.496***
Observations	517		446	

Panel B: Fama-French calendar-time approach

	Monthly average AR	*t*-statistic	Monthly average AR	*t*-statistic
12 months	0.28%	1.23	0.12%	0.25
24 months	0.23%	1.17	1.04%	2.39**
36 months	0.23%	1.37	0.77%	2.50**
48 months	0.19%	0.94	0.92%	3.48***

We compute the U-Index for all open market share repurchases between 1991 and 2001 as follows. The Index is the sum of the ranks of the following four categories: *BM* (ranks 1–5): the lowest BM firms (glamour stocks) receive a 1, the highest (value stocks) a 5; *size* (ranks 1–5): the smallest firms score 5, largest firms 1; *prior return* (ranks 1–5): firms with the lowest prior return receive a 5; those with the highest are given a 1; *motivation* (ranks 1, 3, 5): firms where the motivation is "undervaluation" and "best use of money" receive a 5; those firms where the motivation is "dilution" or "EPS management" but neither "undervaluation" nor "best use of money" receive a 1; the remaining firms are assigned a 3. We then add up the ranks. Based on the empirical distribution, the quintile cutoffs are 9, 11, 13, and 15. The higher the Index, the more likely it is that the firm is undervalued. Panel A reports monthly cumulative average abnormal returns (CAR) in percent using Ibbotson's (1975) returns across time and security (IRATS) method combined with the Fama-French (1993) three-factor model for subsamples formed based on the U-Index. The following regression is run each event month *j*:

$$[(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_j SMB_t + d_j HML_t + \varepsilon_{i,t},$$

where $R_{i,t}$ is the monthly return on security *i* in the calendar month *t* that corresponds to the event month *j*, with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t and HML_t are the monthly return on the size and book-to-market factor in month *t*, respectively. The numbers reported are sums of the intercepts a_t of cross-sectional regressions over the relevant event-time periods expressed in percentage terms. The standard error (denominator of the *t*-statistic) for a window is the square root of the sum of the squares of the monthly standard errors. Panel B reports monthly average abnormal returns (AR) of equally weighted calendar-time portfolios using the Fama-French (1993) three-factor model. In this method, event firms that have announced an open market buyback in the last 12 (24, 36, 48) calendar months form the basis of the calendar-month portfolio. A single time-series regression is run with the excess return of the calendar portfolio as the dependent variable and the return on three factors as the independent variables (the excess market return, a high-minus-low book-to-market, and a small-minus-big capitalization factor). The significance levels are indicated by $, *, **, and ***, and correspond to a significance level of 10%, 5%, 1%, and 0.1%, respectively, using a two-tailed test.

at least partially, driven by the prior returns. This is exactly the prediction of the overreaction hypothesis: the buyback is a response to a market overreaction to bad news, not necessarily a signal that managers have inside information about future cash flows in the next 2–4 years. So when companies repurchase shares

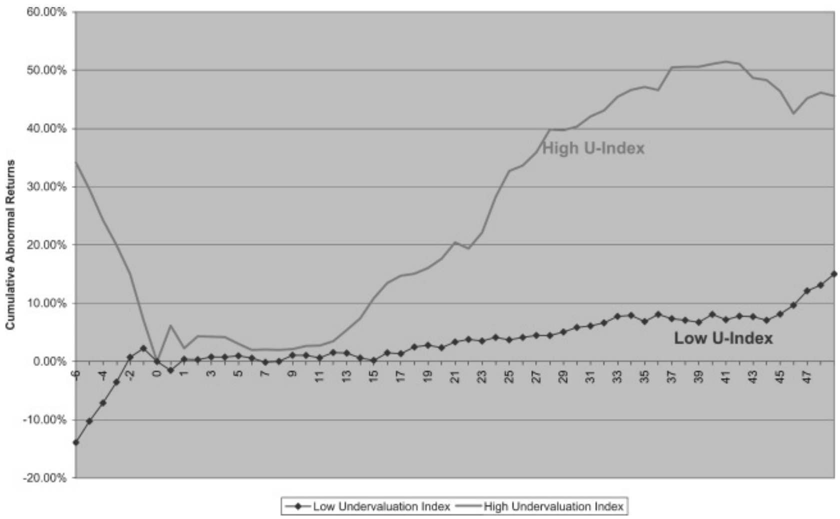

Figure 3
Long-run abnormal returns for high- and low-Undervaluation-Index samples
The figure presents cumulative abnormal returns based on the Fama-French three-factor model and IRATS. For a description of the methodology, see Table 3. We compute the U-Index as follows for all open market share repurchases between 1991 and 2001 for which we can find an announcement in LexisNexis. The U-Index is the sum of the ranks of the following four categories: *BM* (ranks 1–5): the lowest BM firms (glamour stocks) receive a 1, the highest (value stocks) a 5; *size* (ranks 1–5): the smallest firms score 5, the largest firms 1; *prior return* (ranks 1–5): firms with the lowest prior return receive a 5 and those with the highest are given a 1; *motivation* (ranks 1, 3, 5): firms where the motivation is "undervaluation" and "best use of money" receive a 5; those firms where the motivation is "dilution" or "EPS management" but neither "undervaluation" nor "best use of money" receive a 1; the remaining firms are assigned a 3. We then add up the ranks. Based on the empirical distribution, the quintile cutoffs are 9, 11, 13, and 15. The higher the U-Index, the more likely it is that the firm is undervalued according to the index. The high- (low-) U-Index sample consists of firms with a U-Index of more (less) than 15 (9).

because they are "undervalued," they are not doing so because they expect earnings to increase; rather, they are buying back stock because they disagree with the market's forecast that earnings will *decline* in future years.

3. The Time-Consistency of the Open Market Share Repurchase Anomaly

It remains puzzling why such long-run abnormal returns are still observed even after previous studies have shown simple strategies to outperform the benchmark. One possible explanation is that implementing a buyback strategy is very risky because the performance depends on when the strategy is implemented. An event study aggregates data over a very long time period. The fact that such a strategy works, on average, does not mean that the strategy will work if a portfolio manager wanted to start a buyback fund today. This is of particular relevance for the buyback anomaly as it requires investors to be patient: the largest and significant excess returns are observed only 3–4 years after the buyback. We test for the stability as well as the practical feasibility of the strategy by forming a buyback portfolio every year for the period 1991–2001. The strategy incorporates our findings that during the first year after the buyback announcement, on average, no abnormal returns are observed. As a result, it is possible to invest in a diversified portfolio of buyback stocks at a particular point in (calendar) time.

All stocks of firms that announced an open market repurchase in a given calendar year are eligible for the buyback portfolio. We select the 50 stocks with the highest U-Index, but require that the index be at least 14 (the cut-off for the second highest quintile is 13).[15] All stocks selected are used to form an equally weighted portfolio on February 1 of the following year.[16] The long-run abnormal returns of these 11 portfolios, using the Fama-French (1993) three-factor model with Ibbotson's RATS methodology, are shown in Figure 4. The portfolios are labeled according to the year in which they are purchased (i.e., 1 year after the firms actually announced the buyback). Ten out of eleven portfolios show significant positive cumulative abnormal returns over 48 months of 40% or higher. The star performers are the 2000 and 2001 portfolios, followed by the 1994 and 1995 portfolios, all delivering more than 80% cumulative abnormal returns over 48 months. The two star performers are portfolios formed during the Internet bubble when many "old economy" companies repurchased shares because they (correctly) believed they were undervalued. Only the portfolio entered into in 1993 delivers an insignificant long-run abnormal return over 48 months. It is interesting to note that in the first 12 months, two portfolios, 1993 and 2002, display negative abnormal returns. However, only the 1993 portfolio has significantly negative abnormal returns with −29%. Over 24 months, only the 1993 portfolio still displays negative CAR. However, by month 48, even the 1993 portfolio has returned to a zero abnormal return. While the repurchase strategy is not risk free, the odds are such that risk would not seem to be the main deterrent for markets to take advantage of the long-run abnormal returns, provided the investor has a long investment horizon.

Another explanation for the persistence of the anomaly could be that the strategy beats the Fama-French (1993) three-factor model, but not more commonly used benchmarks, such as the Standard & Poor's 500 Index (S&P Index). However, Figure 5 shows that all 11 buyback portfolios beat the S&P 500 Index 3 years and 4 years after portfolio formation.

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[15] With the exception of the 1992–1994 and 2002 portfolios, we can always find 50 stocks with a U-Index of at least 14. For 1992–1994, the number of firms is 29 for each year (by coincidence the same number every year). In 2002, it is 43.

[16] Interestingly, if we started in January, the abnormal returns would be almost uniformly higher since the January portfolio abnormal returns are all positive with the exception of 1998 and 1999, where they are −0.64% and −2.80%, both insignificant. The conclusions are robust to changes in the strategy. For example, when we buy stocks the month after the announcement of an open market repurchase conditional on the firm's U-Index being at least 14, and we buy until we have 50 different firms in our portfolio before "closing" the fund, we also find no instance of negative abnormal returns over 48 months.

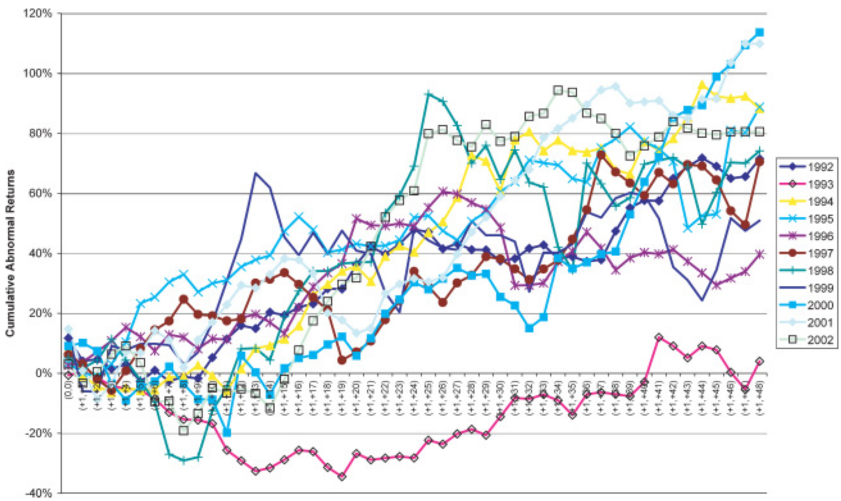

Figure 4
Long-run abnormal returns of portfolios selected every calendar year based on the Undervaluation Index
The figure presents cumulative abnormal returns based on the Fama-French three-factor model and IRATS. See Table 6 for a description of the methodology. The portfolio returns presented are formed based on the U-Index. Every calendar year, a portfolio is formed consisting of the 50 stocks with the highest U-Index (minimum index required is 14). The U-Index is the sum of the ranks of the following four categories: *BM* (ranks 1–5): the lowest BM firms (glamour stocks) receive a 1, the highest (value stocks) a 5; *size* (ranks 1–5): the smallest firms score a 5, the largest firms a 1; *prior return* (ranks 1–5): firms with the lowest prior return receive a 5 while those with the highest are given a 1; *motivation* (ranks 1, 3, 5): firms where the motivation is "undervaluation" and "best use of money" receive a 5; those firms where the motivation is "dilution" or "EPS management" but neither "undervaluation" nor "best use of money" receive a 1; the remaining firms are assigned a 3. We then add up the ranks. The higher the U-Index, the more likely it is that the firm is undervalued. The portfolios are purchased on February 1 and held for 48 months. Month 0 is January and its abnormal return is not cumulated in the graph. Adding it results in long-run abnormal returns of portfolios purchased at the beginning of January.

4. Financial Analysts and Open Market Repurchase Programs

In this section, we explore a possible explanation for the persistence of long-term excess returns after share repurchases of beaten-up companies. We call this hypothesis the *analyst mistake* hypothesis. It argues that the buyback is a company response to mistakes made by analysts, who are at least partially responsible for the decline in the stock price. Buying shares of a beaten-up company after an open market repurchase then involves going against the opinion of those people who are generally perceived as experts on company valuation. To the extent that analysts do not change their opinion after the repurchase, the stock may well remain undervalued for extensive periods of time.

This hypothesis makes four predictions. First, analyst opinions have to be taken seriously. We believe that this will be the case if there are relatively few analysts following the company. A small following is usually associated with small risky firms where there is a lot of information asymmetry. Second, analysts downgrade beaten-up companies before the buyback, and as a result

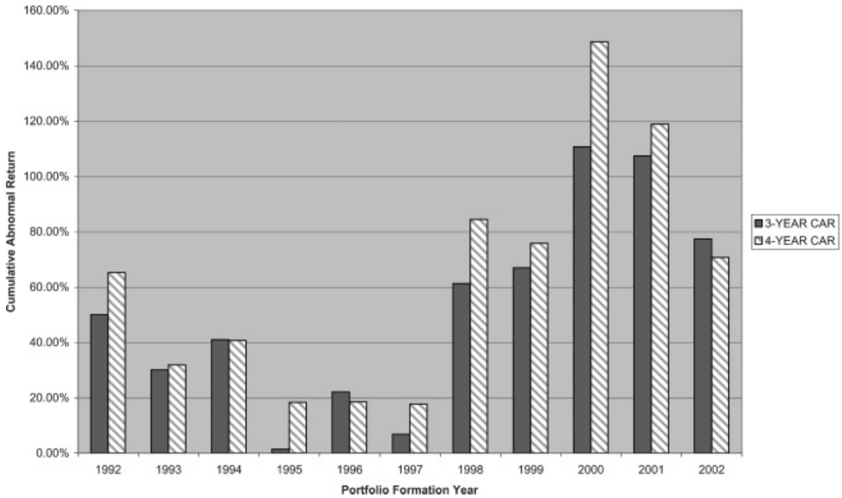

Figure 5
Long-run abnormal returns of portfolios selected every calendar year based on the Undervaluation Index using the S&P 500 as a benchmark
The figure presents buy-and-hold cumulative abnormal returns relative to the S&P 500 Index for an equally weighted sample of firms with the highest U-Index in each year. Every calendar year a portfolio is formed consisting of the 50 stocks with the highest U-Index (minimum index required is 14). The U-Index is the sum of the ranks of the following four categories: *BM* (ranks 1–5): the lowest BM firms (glamour stocks) receive a 1, the highest (value stocks) a 5; *size* (ranks 1–5): the smallest firms score 5, the largest firms 1; *prior return* (ranks 1–5): firms with the lowest prior return receive a 5 while those with the highest are given a 1; *motivation* (ranks 1, 3, 5): firms where the motivation is "undervaluation" and "best use of money" receive a 5; those firms where the motivation is "dilution" or "EPS management" but neither "undervaluation" nor "best use of money" receive a 1; the remaining firms are assigned a 3. We then add up the ranks. The higher the U-Index, the more likely it is that the firm is undervalued. The portfolios are purchased on February 1 and held for 36 or 48 months.

they are at least partially responsible for the stock price decline that triggers the buyback. Third, analysts do not change their minds (i.e., by upgrading their recommendations) as a result of the buyback announcement. Fourth, to the extent analysts have based their downgrades on earnings forecasts, their forecasts after the repurchase announcement are too pessimistic. We test these predictions by matching our open market repurchase sample with data from IBES (Institutional Brokers' Estimate System). In a first test, we study the analyst following and analyst recommendations issued. The second test uses information on analyst EPS forecasts. Our study complements recent work by Bradshaw, Richardson, and Sloan (2006). They use the information from the cash-flow statement to compute an annual, firm-level measure of net external financing and find a positive relation with analyst overoptimism. We use the announcement date of the open market repurchase to study changes in analyst forecasts before and after the event—information that is masked when using cash-flow statement information. As we will argue below, looking at changes around the announcement is important, as much of the analyst forecast changes happen in the months prior to the repurchase announcement.

4.1 Analysts following and prior return

We are able to identify 1,836 event firms in IBES for which we get information on the number of analysts recommending the stock, as well as the average recommendation of the analysts per month and event firm. On average, there are 6.5 analysts with recommendations for a given event firm. This average increases slightly from 5.5 (48 months prior) to 6.6 (48 months after) around the repurchase event. We first ask whether the average number of analysts issuing recommendations is different between firms in the lowest versus the highest prior return quintile. We find that the average number of recommending analysts is significantly different at the 5% level, with an average of 5.7 for the sample with the lowest relative to 6.8 for the highest prior return sample. However, the differences are much larger for the other measures. The smallest firms are only followed by an average of 1.3 analysts relative to 12.2 for the largest firms. This difference is significant at the 0.1% level. Similarly, there are significant differences for high (3.6) versus low (10.2) BM and high (3.0) versus low (10.8) U-Index firms.

While stocks of repurchasing firms are relatively well followed on average, the firms that show the highest abnormal returns after the buyback and the biggest drop before the buyback are also those that attract less analyst coverage. This is consistent with the first hypothesis that these firms are more characterized by information asymmetry, which should increase the relevance of analysts' opinions.

4.2 Analyst recommendations

The average recommendation of the stocks in the month of the repurchase announcement by the analysts is 2.09, with a scale from 1 to 5 representing a strong buy (buy, hold, underperform, sell). Thus, the average recommendation is slightly below a buy recommendation. As shown in Figure 6, the average recommendation drops significantly during the month of the repurchase announcement. This drop in average recommendation from 2.05 to 2.09 is the largest drop in the ± 48 months around the repurchase announcement with a t-statistic of 7.1. Interestingly, recommendations of repurchasing firms have been dropping for about 6 months prior to the event. The average recommendation 6 months prior was 1.99. In addition, recommendations keep on dropping even after the repurchase. Forty-eight months after the event, the recommendations are down to an average of 2.3. These patterns suggest that analysts do not view a repurchase announcement as positive news about future returns, or they do not like to be told by the management that they are wrong to lower their recommendation.

When we focus on firms with the lowest prior return and highest U-Index (Figure 7), we find a large downgrade in their recommendations in the 6 months prior to the repurchase—from about 1.9 to 2.25. Note that this downgrade is

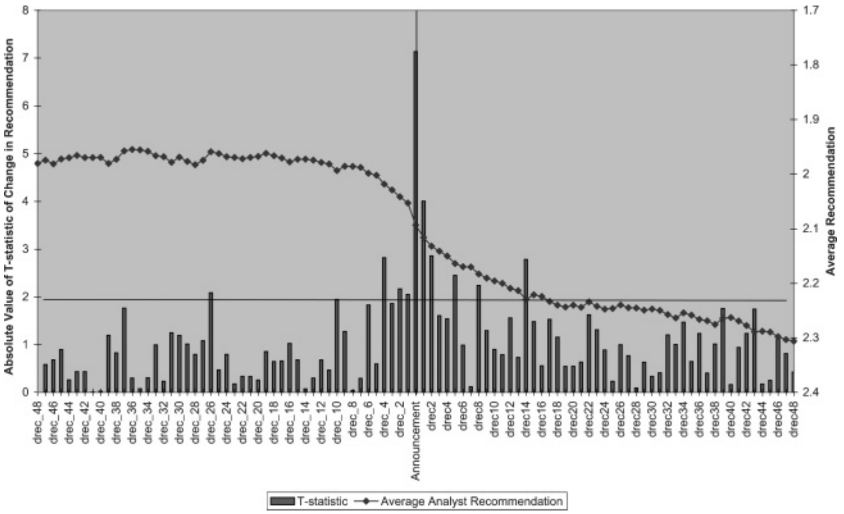

Figure 6
Analyst recommendations for stocks that announce an open market buyback
The figure displays the average recommendation for a given month relative to the month in which the firm announced an open market share repurchase. We report average recommendations starting 48 months prior (indicated with drec_) to the announcement until 48 months after (indicated by drec). The recommendations are taken from IBES. Out of the 3,481 events, 1,836 stocks are covered by analysts who are recorded in IBES. The right scale indicates the average recommendation (1 = strong buy; 2 = buy; 3 = hold; 4 = sell; 5 = strong sell). The left scale indicates the *t*-statistic for the change in the average analyst recommendation. The *t*-statistic is computed as the monthly change in average recommendation divided by the ratio of the standard deviation of the monthly change to the square root of the number of observations per event month. The standard deviation is based on the cross-sectional distribution of each event firm's change in average recommendation from $t-1$ to t (measured in months). A line is drawn at the level of 2 for the *t*-statistic.

largely permanent as these firms remain at their recommendation level for about 36 months before experiencing a short-lived improvement.[17]

The fact that analysts downgrade stocks that have declined in the 6 months before the buyback announcement does not prove that analysts cause the price decline. It could be that analysts simply respond to bad news such that the stock would have declined even if they had not downgraded it. In order to test whether analysts are at least partially responsible for the stock price decline, we perform the following tests. First, we test whether indeed analysts are more likely to downgrade stocks that have a low prior return (high U-Index). We select recommendation changes in the 6 months prior to the repurchase announcement by analysts who have issued a prior recommendation for this company. Figure 8 shows the fraction of the changes that are downgrades, upgrades, and no-change. In the full sample of 2,062 events, we find an increase

17 For completeness we note that the high prior return quintile and low-U-Index subsamples display no significant change in average analyst recommendations prior to the repurchase. However, the average recommendation after the repurchase is slowly drifting down, consistent with the pattern reported in Figure 6. Given that the repurchases in these subsamples are less likely a reaction to perceived undervaluation, it is less obvious how to interpret these results in the context of our hypothesis.

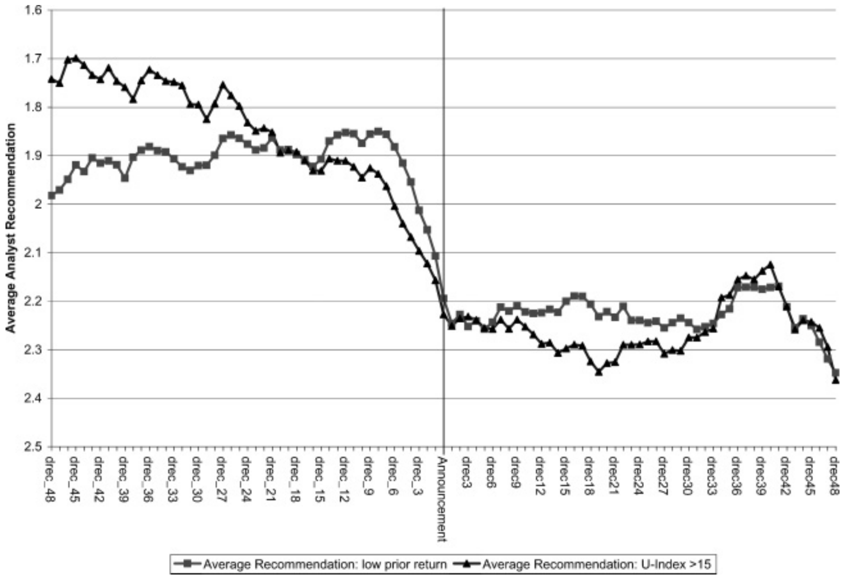

Figure 7
Analyst recommendations for subsamples of stocks that announce an open market buyback
The figure displays the average analyst recommendation for a given month relative to the month in which the firm announced an open market share repurchase. We report average recommendations starting 48 months prior (indicated by drec_) to the announcement until 48 months after (indicated by drec). The recommendations are taken from IBES. Out of the 3,481 events, 1,836 stocks are covered by analysts who are recorded in IBES. The scale indicates the average recommendation (1 = strong buy; 2 = buy; 3 = hold; 4 = sell; 5 = strong sell). Two subsamples of firms classified as undervalued at the time of the repurchase are displayed: low prior return quintile and firms with a U-Index >15.

in the fraction of downgrades from the time of 180–90 days to 45–0 days prior to the repurchase from 43 to 51% of the recommendation changes. For the firms classified as high-U-Index or low prior return firms, the fraction and the increase of downgrades is even more pronounced—from 52 to 63% and 59 to 71%, respectively. This supports the hypothesis that analyst recommendation changes are at least correlated with the stock-price performance prior to the repurchase. In the second test, we perform an event study where the event is the recommendation change by an analyst in the 6 months prior to the repurchase announcement. Table 9 shows that the 3-day CAR around a recommendation change is −2.73% for the full sample of 2,062 events. The CAR for the subsample of 1,502 events that have no contemporaneous news releases by the company is −2.27%. Both CARs are significant at the 1% level. When we split the sample according to the direction of the recommendation change, we find a much stronger stock market reaction to downgrades than to upgrades. More interestingly, downgrades for stocks with a high U-Index experience a negative stock market reaction of −11.99% (−10.78%) for the sample including (excluding) contemporaneous news releases, relative to downgrades of stocks

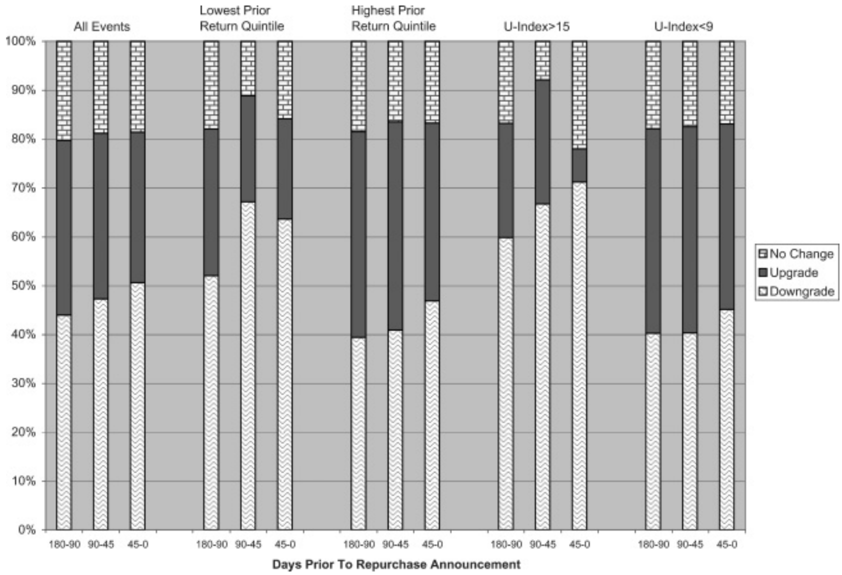

Figure 8
Analyst recommendation changes prior to the repurchase announcement
The sample consists of 2,062 recommendation changes in the 6 months prior to the repurchase announcement. Recommendation downgrades (upgrades) are changes in recommendation from a low number to a higher number (high number to a lower number). The scale of the recommendation goes from 1 to 5: 1 = strong buy; 2 = buy; 3 = hold; 4 = sell; 5 = strong sell. The figure shows the fraction of recommendation changes that are neutral (no change), upgrades, and downgrades depending on the time prior to the repurchase announcement and separately for subsamples based on the U-Index and the 6-month prior return quintile of the repurchasing firms. A description of the U-Index (prior 6-month return quintile) is given in Table 8 (Table 4). The fraction of recommendation changes are reported in three different time windows: 180–90, 90–45, and 45–0 days prior to the repurchase announcement.

with a low U-Index, where the reaction is −2.75% (−4.18%). We find a similar asymmetry in the reaction for the subsample of the lowest versus the highest prior return quintile. One possible explanation is that the magnitude of the recommendation changes differs systematically between these subsamples. To control for this, we show regression results in Table 10. The dependent variable in the OLS regressions is the CAR. The independent variable is the change in the recommendation. A downgrade by one point is converted into a negative number (e.g., a downgrade from a strong buy (=1) to buy (=2) is a change in recommendation of −1). We show the results separately for the full sample and the sample excluding contemporaneous news releases. A one-unit change in recommendation is associated with a stock-price change of 2.6% (2.2%) for the sample including (excluding) contemporaneous news events. More importantly, we find that a one-unit recommendation change has a significantly higher impact on the stock price for firms classified as undervalued (i.e., high U-Index and low prior return quintile). For example, a one-unit change in recommendation for high-U-Index firms affects the stock price by 4.5% (sum of

Table 9
Event study of analyst recommendation changes prior to the repurchase

	All recommendation events			Excluding recommendation events with contemporaneous news releases		
	Number of observations	CAR [−1, 1]	*t*-statistic	Number of observations	CAR [−1, 1]	*t*-statistic
All recommendations						
Full sample	2062	−2.73%	11.12***	1502	−2.27%	8.71***
U-Index ≥ 15	229	−8.09%	7.46***	167	−6.79%	5.93***
U-Index ≤ 9	803	−0.35%	1.29	563	−1.00%	3.11***
Lowest prior return quintile	553	−7.06%	10.99***	387	−5.60%	7.95***
Highest prior return quintile	479	−0.52%	1.14	345	−0.93%	1.88*
Downgrades only						
Full sample	964	−6.62%	15.78***	674	−5.83%	12.87***
U-Index ≥ 15	148	−11.99%	7.99***	98	−10.78%	6.33***
U-Index ≤ 9	334	−2.75%	5.66***	120	−4.18%	4.37***
Lowest prior return quintile	328	−11.80%	13.27***	206	−10.74%	10.44***
Highest prior return quintile	201	−4.02%	4.87***	140	−4.55%	5.10***
Upgrades only						
Full sample	696	1.88%	7.04***	516	1.64%	5.39***
U-Index ≥ 15	45	1.38%	1.29	40	0.67%	0.65
U-Index ≤ 9	328	1.96%	5.58***	222	1.27%	3.14***
Lowest prior return quintile	139	1.82%	2.41**	110	1.73%	2.05**
Highest prior return quintile	194	2.98%	5.30***	139	2.49%	3.79***

The sample consists of 2,062 analyst recommendation events covered by IBES in 6 months prior to the open market repurchase announcement. Recommendations of new analysts are excluded. The change in recommendation is computed as the difference between the last recommendation by the same analysts for the same firm and the latest recommendation. Recommendation downgrades (upgrades) are changes in recommendation from a low number to a higher number (high number to a lower number). The scale of the recommendation goes from 1 to 5: 1 = strong buy; 2 = buy; 3 = hold; 4 = sell; 5 = strong sell. The cumulative abnormal announcement return (CAR) is computed using the market model where the market return is the equally weighted CRSP index. The event window covers the 3 days around the recommendation event [−1, 1]. The table shows average CAR for the full sample and separately for subsamples based on the U-Index and the 6-month prior return quintile of the repurchasing firms. A description of the U-Index (prior 6-month return quintile) is given in Table 8 (Table 4). Separately, average CAR is shown for the subsamples of recommendation downgrades and upgrades. The same statistics are given for the subsample of events where no contemporaneous news was released by the firm in the 3-day event window. *** and ** indicate significance at the 1% and 5% levels, respectively.

two coefficients: 2.4% and 2.1%), whereas the same unit change in low-U-Index firms only affects the stock price by 1.4% (sum of two coefficients: 2.4% and −1.0%). Our findings suggest that analysts have a significant impact on stock prices, especially when they downgrade the stock and even if there is no contemporaneous news about the company. We conclude that these results are consistent with the interpretation that analysts are at least partially responsible for the stock price effect prior to the repurchase.

Given that the samples of firms with the lowest prior return and highest U-Index outperform the market the most over the following 48 months, our analysis suggests that analysts do not incorporate those effects when recommending stocks to investors. As Figure 7 shows, the average recommendations in the weeks following the buyback announcement are not changing. One reason might be that analysts of downgraded stocks interpret the buyback as a

Table 10
Analyst recommendation changes prior to the repurchase: multivariate analysis

	CAR[−1, 1]					
Dependent variable	All recommendation events			Excluding recommendation events with contemporaneous news releases		
Change in recommendation	0.026	0.029	0.015	0.022	0.024	0.013
	(10.21)***	(7.71)***	(7.42)***	(11.14)***	(8.68)***	(4.31)***
Change in recommendation × high U-Index		0.030			0.021	
		(2.24)**			(3.16)***	
Change in recommendation × low U-Index		−0.015			−0.010	
		(3.20)***			(2.41)**	
Change in recommendation × lowest prior return quintile			0.035			0.032
			(4.46)***			(6.49)***
Change in recommendation × highest prior return quintile			0.006			0.007
			(1.17)			(1.56)
Constant	−0.023	−0.020	−0.020	−0.020	−0.018	−0.018
	(7.32)***	(7.14)***	(7.16)***	(7.74)***	(7.25)***	(7.34)***
Adjusted R-squared	0.08	0.11	0.11	0.08	0.09	0.10
p-value of F-test: high = low		0.000	0.000		0.000	0.000

The sample consists of 2062 analyst recommendation events in the 6 months prior to the open market repurchase announcement. We show OLS regression results where the t-statistics (reported in parentheses) are based on robust standard errors that are adjusted for clustering at the firm level. The dependent variable is the cumulative abnormal announcement return (CAR) in the 3 days around the analyst recommendation change from the day before to the day after the announcement [−1, 1]. The independent variable is the magnitude of the recommendation change multiplied by −1 such that a positive value indicates an increase in the recommendation (i.e., a better recommendation). The range is between +4 and −4. The original scale of recommendation is 1 = strong buy; 2 = buy; 3 = hold; 4 = sell; 5 = strong sell. The change in recommendation is interacted with dummy variables equal to 1 if the event firm's U-Index is greater than or equal to 15 (high U-Index), less than or equal to 9 (low U-Index), 6-months prior return is in the lowest quintile (lowest prior-return quintile), or the 6-month highest prior return quintile (highest prior return quintile). A description of the U-Index (prior 6-month return quintile) is given in Table 8 (Table 4). Separately, we show regression results excluding events where the firm made a contemporaneous (in the 3-day event window) news announcement. *** and ** indicate significance at the 1% and 5% levels, respectively. p-values of F-tests are shown where the null hypothesis is the quality of the interaction variables in the respective regressions.

criticism of their analyst ability. They do not like to change their mind given that they only recently downgraded the stock and, on average, the stock price fell by more than 10% as a result of the downgrade (Table 9). Whether such behavior is rational or not is left for future research. However, it should be obvious that such behavior does not help to make the market more efficient.

4.2.1 Analyst earnings-per-share forecast changes around repurchase announcement. One explanation for the analyst downgrades before and during the repurchase announcement month is that analysts revise their earnings forecast based upon new information and the same information leads them to lower their stock recommendation.

Figure 9 displays the average change in the fiscal year-end EPS forecast between the repurchase announcement month and each of the prior 6 months using data from IBES's analyst forecast database. We are able to match 2,114 firms. In particular, we compute $[EPS_1(t - x) - EPS_1(t)]$/share price($t$), where t is the month of the repurchase announcement, EPS_1 is the average analyst

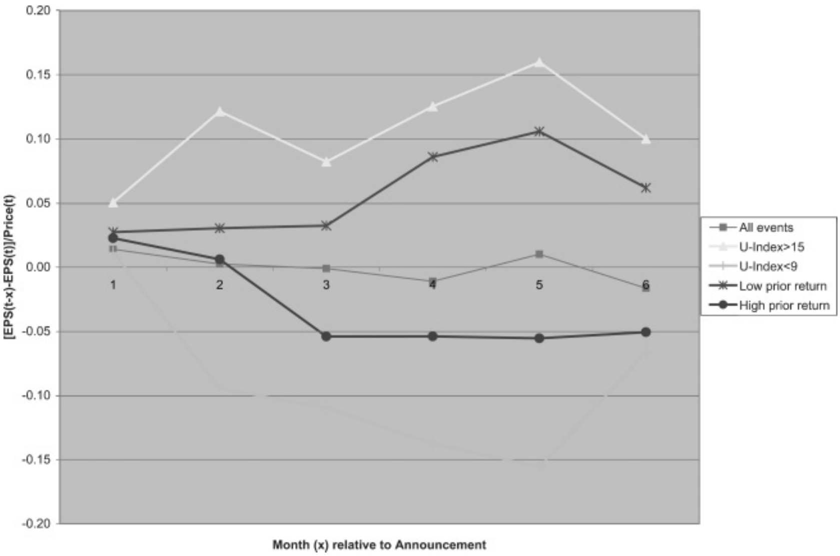

Figure 9
Analyst earnings-per-share forecast change in the 6 months prior to the repurchase announcement
The figure displays the average change in the earnings-per-share (EPS) forecast for the fiscal year-end between month $t - x$ and month t, where month t is the month of the open market repurchase announcement and x is between 1 and 6 months. The average change in the EPS forecast is computed as $[EPS(t - x) - EPS(t)]$/share price(t), where EPS is the average analyst EPS forecast for the fiscal year-end. The sample contains events where the change in EPS refers to the same fiscal year-end. The full sample ("all events") contains 2,197 (2,073, 1,862, 1,660, 1,472, 1,273) observations for the 1- (2-, 3-, 4-, 5-, 6-) month change. The subsample of U-Index >15 contains 207 (191, 170, 153, 136, 113) observations, the subsample of U-Index <9 contains 370 (366, 322, 294, 243, 211) observations, the subsample of low prior return contains 452 (419, 373, 333, 304, 271) observations, the subsample of high prior return contains 497 (470, 411, 372, 327, 277) observations for the 1- (2-, 3-, 4-, 5-, 6-) month change. A description of the U-Index (prior 6-month return quintile) is given in Table 8 (Table 4). The number of observations is decreasing since the fiscal year-end pass.

EPS forecast for the 1-year-ahead fiscal year-end,[18] and x is between 1 and 6 months.[19]

Figure 9 shows that, on average, the event firms do not experience a significant change in the EPS forecast except between the last month prior to and the month of the repurchase announcement when analysts revise the EPS forecast downward. However, when we split the sample into high- versus low-U-Index firms, we find that firms with a U-Index >15 (U-Index <9), i.e., firms classified as undervalued (not undervalued), experience a significant drop (increase) in the average forecasted EPS throughout most of the 6 months prior to the announcement. Similarly, firms with low prior returns (high prior returns) experience a significant drop (increase) in the average forecasted EPS. This pattern

[18] The fiscal year-end is held constant while x increases. If the firm has a fiscal year-end during the 6 months prior to the repurchase announcement, the event is dropped at the time where the 1-year-ahead fiscal year-end date changes.

[19] The inferences are unaffected by the use of $EPS(t)$ as the denominator if we exclude negative, zero, and very small EPS ratios of less than 0.001.

is consistent with the interpretation that analysts lower their recommendations because of a downward revision in earnings forecasts. This downgrade generates a stock-price decline, but the stock repurchase announcement suggests that managers do not agree with the market and/or the analyst. The analyst mistake hypothesis predicts that analysts have overreacted to new information and lowered their EPS forecasts too much. If the market uses analyst information, at least to some degree, to determine the price, analysts could be at the root of the market's over- and underreaction.

We start by testing whether analysts overreact by lowering their EPS forecasts too much. We study the change in the forecast error around the repurchase announcement for EPS forecasts made 1–4 years ahead. To get EPS forecast, we again use IBES data. For the 1-year-ahead fiscal year-end EPS forecast, we are able to find 2,114 firms with matching data.[20] Fewer event firms receive EPS forecasts 2–4 years ahead.

We first investigate whether analysts change their EPS forecasts around the month of the repurchase announcement. In Table 11, we show the average change in EPS forecast computed as $[EPS(t+1) - EPS(t-1)]$/share price(t), where t is the repurchase announcement month and EPS is the EPS forecast for the 1-, 2-, 3-, and 4-year fiscal year-end, holding the fiscal year-end constant. For the full sample, we find that the 1-, 2-, and 3-year forecasts are significantly downward revised around the repurchase month. This is consistent with the trend in Figure 9 where we found that the EPS forecast dropped significantly from the month before to the month of the repurchase announcement. It is also consistent with the interpretation that the repurchase announcement does not convey positive news about future EPS in the eyes of the analysts. Furthermore, the forecast error diminishes around the repurchase month. While analysts are still significantly overoptimistic in the month prior to the repurchase, they are less overoptimistic in the month after the repurchase announcement. However, they are, on average, still overoptimistic.

When we split the sample using the U-Index or the prior return, we find that firms classified as undervalued experience a larger and significant drop in forecasted EPS than firms with a U-Index of less than 9. More interestingly, we find that those downward revisions are too extreme such that the forecast after the repurchase announcement is too pessimistic. While the forecast error is only significantly negative for the 2- and 3-year-ahead fiscal year-ends, it suggests that analysts contribute to the overreaction prior to and the underreaction after the repurchase announcement by lowering their EPS forecasts in those particular firms by too much. This is surprising given the large literature that documents positively biased forecasts for analysts, especially for high BM and small firms (e.g., Eames, Glover, and Kennedy, 2002; and Eames and Glover,

[20] We winsorize the data at the first and 99th percentile. The number of observations shown in Table 11 is after winsorizing the data.

Table 11
Analyst earnings-per-share forecast change around month of open market repurchase announcement

		EPS forecast horizon			
		One year	Two years	Three years	Four years
All events	Average change	−0.0046**	−0.0039**	−0.015*	−0.002
	Observations	2072	1915	584	210
	Forecast error before	0.0053**	0.0084**	0.026**	0.0182**
	Forecast error after	0.0007	0.0045*	0.011**	0.0162**
U-Index > 15	Average change	−0.0079**	−0.0129***	−0.072**	−0.0007
	Observations	204	149	21	3
	Forecast error before	0.0061**	0.0090**	0.042*	0.0204*
	Forecast error after	−0.0018	−0.0039*	−0.03*	0.0197*
U-Index < 9	Average change	−0.0015	−0.0022	−0.014*	−0.0005
	Observations	391	369	173	65
	Forecast error before	0.0021	0.0054*	0.018*	0.0170*
	Forecast error after	0.0006	0.0032*	0.004	0.0165*
Low prior return	Average change	−0.0080**	−0.0091**	−0.041**	−0.0280*
	Observations	456	404	105	20
	Forecast error before	0.0059**	0.0069**	0.028**	0.0203*
	Forecast error after	−0.0021*	−0.0022*	−0.013*	−0.0077
High prior return	Average change	−0.0020	−0.0013	−0.019*	−0.0010
	Observations	526	454	145	44
	Forecast error before	0.0026	0.0057**	0.021**	0.0129*
	Forecast error after	0.0006	0.0044**	0.002	0.0119*

The table uses analyst EPS forecast data from IBES for the sample of firms that make an open market share repurchase announcement. Reported are the average changes in the EPS forecasts from the calendar month before to the calendar month after the repurchase announcement for 1–4 years ahead of fiscal year-end forecasts. The average change is computed as the average of [meanest$(t+1)$ − meanest$(t-1)$]/share price(t), where t is the month of the repurchase announcement and meanest is the average EPS forecast from IBES for a given fiscal year (1–4 years) and firm. The forecast errors in the month before and the month after the event are again for 1–4 years ahead. The forecast error is defined as the average of [meanest(x) − actual]/share price(t), where t is the month of the repurchase announcement and x is either $t-1$ or $t+1$. Actual is the realized EPS reported in IBES for a given firm and forecast end date. The statistics are shown for four subsamples: the high and low U-Index) and low (rank 1) and high (rank 5) prior return samples. The Index is the sum of the ranks of the following four categories: *BM* (ranks 1–5): the lowest BM firms (glamour stocks) receive a 1, the highest (value stocks) a 5; *size* (ranks 1–5): the smallest firms score 5, largest firms 1; *prior return* (ranks 1–5): firms with the lowest prior return receive a 5; those with the highest are given a 1; *motivation* (ranks 1, 3, 5): firms where the motivation is "undervaluation" and "best use of money" receive a 5; those firms where the motivation is "dilution" or "EPS management" but neither "undervaluation" nor "best use of money" receive a 1; the remaining firms are assigned a 3. We then add up the ranks. Based on the empirical distribution, the quintile cutoffs are 9, 11, 13, and 15. The higher the Index, the more likely it is that the firm is undervalued. Observations are the number of observations with available forecasts. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

2003). Firms with a U-Index <9 and high prior return firms, on average, do not experience a negative forecast error.

We conclude that analysts are revising their EPS forecasts downward rightfully so, but for the subsamples with low prior returns and U-Index >15, the correction is too big. In addition, analyst recommendations go down for these subsamples prior to the repurchase, and do not recover even around or after the repurchase announcement. Such biases might well contribute to the overreaction by the market to beat up certain stocks and prevent a fast recovery after the buyback announcement.

5. The Repurchase Tender Offer Anomaly

We end our investigation of buyback anomalies with a re-examination of the "buy-and-tender" anomaly first discovered by LV.

5.1 Sample description

We draw our initial sample from SDC mergers and acquisition database and supplement it with data from SDC's repurchases database. There were 261 self-tender offer announcements between 1987 and 2001. We do not include Dutch auction tenders[21] and repurchases where the firm intends to go private (i.e., repurchasing all shares outstanding).

We further limit our analysis to repurchases of common stock (excluding 35 events, mostly repurchases of warrants) and also exclude repurchases announced by closed-end funds (17 observations). We eliminate repurchases where the stock price 5 days prior to the announcement was less than \$3, since bid-ask spreads could lead us to find relatively large returns without the possibility for an arbitrageur to exploit such returns. This leaves us with a sample of 188 announcements. Of those, we have incomplete information on the repurchase offer for 11 events. Finally, we exclude 15 odd-lot repurchases (i.e., repurchases announced with the intention of buying back shares from stockholders with less than (usually) 100 shares). These repurchases are made exclusively from small shareholders. The maximum fraction sought in those repurchases was 2% of the shares outstanding. The usual repurchase size in such odd-lot repurchases is less than 1% of the shares outstanding.

Finally, there are 19 events where the firm does not complete the repurchase. Eleven of the tenders withdrawn were related to either a successful acquisition of the firm or a failure to be acquired. Of the remaining eight events, three were withdrawn because they did not meet the conditions set by the company, and one company cited regulatory issues. Four did not give a reason for withdrawing. Except for one event, the three others were withdrawn soon after the announcement. One company withdrew the offer only 3 days before the initial expiration date.[22]

This leaves us with a sample of 141 self-tender offers that are completed and have data available. The descriptive statistics for the sample are given in Table 12. Compared to the tender offers described in LV, we find about the same premium being paid (22.18% relative to their 21.79%). However, in our

[21] Kadapakkam and Seth (1994) report statistically significant average abnormal returns of 2.89% by trading around the expiration date of Dutch auction tender offers. Note that trading strategies are likely to be less profitable and more risky as investors determine the repurchase price, not the company, which merely specifies the maximum and minimum price range. In order to verify whether these trading profits still exist, we select Dutch auction tender offers in the years 1987–2001 from SDC. Of the 200 events with available data, we find an average abnormal return of 2.9% with a t-statistic of 4.31. This involves buying shares 6 days prior to the expiration date and tendering those shares at the price paid. If the final Dutch auction price is higher, the shares are repurchased (if oversubscribed, we assume prorating); any shares not repurchased are sold 12 days after the final expiration date. The abnormal return is calculated by subtracting the market return over the corresponding days.

[22] Including this event does not alter the inferences drawn from the following analysis.

Table 12
Descriptive statistics for sample of self-tender repurchase offers

	Mean	Min	Max
Panel A: Full sample of 141 self-tender repurchase offers			
Premium $(P_T - P_{-5})/P_{-5}$	22.18%	0%	82%
Fraction of shares sought	29.42%	2.2%	90%
Fraction of shares purchased	25.87%	0.8%	90%
Fraction of shares purchased relative to shares tendered	79.98%	10%	100%
CAR $(P_{\text{ann}-1\text{ day}}, P_{\text{ann\_1 day}})$	8.73%	−14.9%	53.3%
CAR $(P_{\text{ann}-5\text{ day}}, P_{\text{ex}+1\text{ day}})$	8.08%	−56.9%	65.0%
Panel B: Descriptive statistics for self-tender repurchase offers withdrawn			
Premium $(P_T - P_{-5})/P_{-5}$	24.49%	0%	60%
Fraction of shares sought	28.68%	2.5%	80%

Univariate statistics for a sample of 141 self-tender offers between 1987 and 2001. The premium offered is measured as the difference between the tender price (P_T) and the stock price 5 days before the announcement (P_{-5}). The fraction of shares sought is the number of shares the company seeks to repurchase relative to the number of shares outstanding before the repurchase. The fraction of the shares purchased is the number of shares repurchased divided by the number of shares outstanding prior to the repurchase. CAR($P_{\text{ann}-1\text{day}}$, $P_{\text{ann\_1 day}}$) and CAR($P_{\text{ann}-5\text{days}}$, $P_{\text{ex}+1\text{day}}$) are based on daily, market-model-adjusted, abnormal returns. It is the cumulative abnormal return from 1 day (5 days) prior to the announcement to 1 day after the announcement (final expiration date) of the tender offer.
Panel B reports statistics for the 19 events excluded from our analysis because they were withdrawn after the announcement but before the expiration date (only one event was withdrawn within 6 days prior to the initial expiration date).

sample, the fraction sought and the fraction repurchased are higher than in LV. We find that the average repurchasing firm seeks 29.42% of the shares outstanding (LV: 17.06%) and ends up repurchasing on average 25.87% (LV: 16.41%). Thus, the ratio of the fraction repurchased to the fraction tendered (F_P/F_T) has decreased slightly from 86.61% in LV to 79.98% more recently. Note also that the repurchase premium of 22.18% is significantly larger than the 8.08% abnormal return to the nontendering shareholders.

Panel B shows descriptive statistics for the 19 events where a repurchase was not completed. It is interesting to note that these events display very similar average repurchase premiums and fractions sought, alleviating concerns that these offers differ systematically *ex ante*.

5.2 Trading around the expiration date of the tender offer: results

We replicate the LV trading rule around the expiration date of the tender offer. It involves buying shares prior to the first expiration date of the offer and tendering those shares to the company. If the repurchase is undersubscribed (i.e., the fraction of shares tendered, F_T, is less than the fraction of shares sought by the company), the company repurchases all shares that are tendered or extends the offer period.[23] In the case of oversubscription, the company either repurchases all shares tendered, i.e., more than it initially wanted to repurchase,

[23] Of the 141 events, 25 extend the offer period once, 5 twice, and 1 four times.

or it prorates. Thus, only a fraction F_P/F_T is repurchased. Since the maximum price one can obtain by tendering is P_T, we only enter the trading strategy if the stock price 6 days prior to the first expiration date is at least 3% below P_T (this should also cover transaction costs). There are 80 events where this is the case. We buy shares 6 days prior to the first expiration date and tender the shares to the company.[24] If they are purchased fully, we receive the repurchase price. If the shares are prorated, we sell the remaining shares 12 days after the final expiration date.[25] The return to this strategy is calculated as follows:

$$\text{Return} = [F_P/F_T \times P_T + (1 - F_P/F_T) \times P_{12}]/P_{-6} - 1, \qquad (3)$$

where F_P is the fraction of shares outstanding that the company repurchased, F_T is the fraction of shares outstanding that is tendered, P_T is the tender price, and P_{12} (P_{-6}) is the stock price 12 (6) days after (before) the final (first) expiration date. To compute the abnormal return, we subtract the market return (equally weighted CRSP index) over the corresponding period. Qualitatively similar results are obtained if we subtract returns computed based on the market model (not shown).

Table 13 reports the results. The average abnormal return from this strategy is 8.6%, and significant with a t-statistic of 5.5. The median return is 4.1% and also significant at the 1% level. Eighty-four percent of the trades generate positive returns. The abnormal returns in the period 1987–2001 are comparable to the period 1962–1986 investigated in LV. They find an average (median) abnormal return of 6.18% (4.64%), with 89.1% of the trades generating a positive abnormal return. Thus, we conclude that the anomaly around the self-tender offer expiration date still exists today.

5.3 Possible explanations

LV investigate two possible explanations for the observed abnormal trading gains of this strategy. The first is related to the fact that managers have some discretion over how many shares to repurchase in an oversubscribed tender. If the price prior to expiration was lower relative to the tender price, managers may repurchase more shares than initially sought to further strengthen the signal. If this was the case, the observed returns might be difficult to achieve for an arbitrageur since this person might increase the price prior to the tender expiration, thus reducing the propensity of management to repurchase more shares than initially sought. LV find a negative but statistically insignificant relation between the ratio of the price prior to expiration and the tender price (P_{-6}/P_T) and F_P/F_T. In our sample, we find a significant positive correlation

[24] 25 events extend the tender period.

[25] The choice of buying 6 days prior to expiration is driven by the usual settlement procedure by which an investor becomes the owner of the stock five business days after the purchase date. The 12 days after are chosen because the *pro rata* decision is not final until 10 days after expiration (see LV for more details). However, our findings are almost identical if we assume to sell 2 days after expiration, at P_2, instead of P_{12} (not tabulated).

Table 13
Abnormal returns from trading strategy around the expiration date of self-tender offers

Sample period (observations)	Mean	t-statistic	Median	% Positive
Panel A: Cumulative abnormal returns based on marginal pricing rule				
1987–2001 (80 obs)	8.6%	5.5	4.1%***	84%
1987–1995 (51 obs)	8.2%	5.3	5.1%***	87%
1996–2001 (29 obs)	9.3%	2.8	3.0%**	79%
Panel B: Cumulative abnormal returns based on average pricing rule. Selling 12 days after the final expiration date				
1987–2001 (80 obs)	1.54%	1.52	1.27%	58%
1987–1995 (51 obs)	2.47%	2.26	2.73%**	62%
1996–2001 (29 obs)	0.00%	0.00	−0.004%	48%
Panel C: Cumulative abnormal returns based on average pricing rule. Selling 2 days after the final expiration date				
1987–2001 (80 obs)	1.67%	2.64	1.25%**	64%
1987–1995 (51 obs)	2.69%	3.44	2.23%**	74%
1996–2001 (29 obs)	0.03%	0.04	−0.005%	47%

Reported are cumulative abnormal returns following the strategy of buying shares 6 days prior to the first expiration date, tendering the shares and selling those shares not repurchased by the company on the market 12 (2) days after the final expiration date. The strategy is only executed if the price 6 days prior to the first expiration date is at least 3% below the repurchase tender price. This results in 80 events. Panel A calculates the returns using the marginal pricing rule where return = $[F_P/F_T \times P_T + (1 - F_P/F_T) \times P_{12}]/P_{-6} - 1$. F_P (F_T) is the number of shares repurchased (tendered) relative to the number of shares outstanding prior to the repurchase. P_T, P_{12} (P_{-6}) are the tender offer price and the stock price 12 days after (6 days prior to) the final (first) expiration date. We report the cumulative abnormal returns by subtracting the market return during the period from the strategy's return. Panels B and C report expected returns if the market priced the stock according to an average pricing rule $E(\text{return}) = [F_P \times P_T + (1 - F_P) \times P_{12}] / P_{-6} - 1$, i.e., where the market assumes all shares are tendered (with $F_T = 1$). *** and ** indicate significance levels of 1% and 5%, respectively. Obs is observations.

in the subsample of oversubscribed events where P_{-6} is at least 3% below P_T. Thus, the data do not seem to support this potential explanation in our sample period either.

The second reason investigated was whether liquidity dropped after the repurchase announcement. LV find an increase and conclude that the market is liquid and the strategy feasible. Ahn, Cao, and Choe (2001) reach similar conclusions by showing that during the offer period bid-ask spreads fall and trading volume and quotation depth increase.

Table 14 also reports abnormal trading volume in the 21 days around the expiration of the tender offer. In the period between 10 and 2 days prior to the expiration date, trading volume is significantly greater than the average trading volume computed between 50 and 25 days prior to the tender offer announcement.

We add to this by investigating whether the abnormal returns are lower in more liquid stocks. We use two proxies for liquidity. First, we take the average of the shares traded divided by shares outstanding in the period between 50 and 25 days prior to the tender offer announcement (a proxy for normal trading volume). Second, we take the average of the ratio of actual trading volume to the normal volume over the 10 days prior to the first expiration date. We

Table 14
Abnormal trading volume around repurchase tender offer expiration date

Day	−10	−9	−8	−7	−6	−5	−4
Mean	2.87***	2.41***	3.20***	2.95***	2.54***	4.88***	3.79***
Median	1.27	0.89	1.18	0.91	0.93	0.75	1.26
Day	−3	−2	−1	0	1	2	3
Mean	3.30***	4.81***	7.42***	3.01***	2.89***	2.61***	1.26
Median	1.31	1.13	0.86	0.88	0.84	1.11	0.73
Day	4	5	6	7	8	9	10
Mean	0.97	1.29	1.40	1.14	1.10	0.95	0.88
Median	0.58	0.52	0.57	0.65	0.45	0.52	0.57

The table reports average and median trading volume (number of shares traded) relative to normal trading volume, where normal trading volume is the average daily trading volume between days −50 and −25 before the announcement of the self-tender offer. Day indicates the trading day relative to the first tender offer expiration date (day 0). The sample contains 80 events where the stock price 6 days prior to the first expiration of the repurchase offer is at least 3% below the repurchase tender price. An average ratio of 1 is expected under the null hypothesis. Due to the highly skewed distribution of the trading volume ratio, the median ratio for normal periods is less than 1. *** indicates significance at the 1% level.

then correlate these proxies of liquidity with the trading strategy returns. The correlation turns out to be positive and significant. For the first (second) proxy, the correlation coefficient is 0.45 (0.19), significant at the 1% (5%) level. Thus, our tests strongly reject the notion that the abnormal returns are merely a reflection of illiquidity.

Another possibility might be that the dollar gains from this arbitrage strategy might be too small for professional investors to exploit. However, if we assume that the abnormal trading volume on day 6 prior to the first expiration (which is 2.54)[26] is entirely due to arbitrageurs buying, then we find that the dollar gain, on average (median), is $1.32 million ($0.35 million).[27] This would seem to be the lower limit of possible arbitrage gains as it is based on only 1 day of trading. As shown in Table 14, abnormal trading volume is high throughout the period from 10 days to 1 day prior to the first expiration of the self-tender offer (comparable to LV, Table V). The abnormal trading volume in the days just before the tender offer expiration also suggests that the strategy's excess returns are not determined by just a few sellers in an illiquid market. In contrast, more liquidity is available just prior to the expiration of the tender period.

Gray (2003) argues that the excess returns overstate "*ex ante* implementable excess returns." His argument is that when arbitrageurs buy and tender, F_T increases and abnormal returns fall. On average, in our sample, an arbitrageur could have made a nontrivial $1.32 million by buying and tendering the abnormal trading volume on the sixth day prior to expiration, which represents a trivial fraction (1.04%) of the percentage of shares outstanding. Of course,

[26] LV find that the average trading volume 6 days prior to the expiration date is 2.72 times the average trading volume measured over 25 days, 25 days prior to the announcement. We compute abnormal trading volume the same way. The findings are robust to a longer measurement period for normal trading (not shown) over 180 days ending 25 days prior to the announcement day.

[27] The dollar gain per firm is computed as follows: (number of shares traded on day −6 − the average number of shares traded) × P_{-6} × strategy abnormal return.

if the individual buys up more shares, the marginal return from tendering will decrease as the fraction of shares tendered increases. However, Gray's argument is somewhat internally inconsistent: on one hand he makes the reasonable assumption that arbitrageurs care about wealth maximization, not return maximization, but on the other hand he is concerned about the fact that when wealth increases, excess returns to the arbitrageur fall. This decline in marginal returns cannot explain why wealth-maximizing arbitrageurs do not arbitrage away the anomaly.

5.4 Investors' tendering behavior

Table 12 shows that the repurchase premium of 22% is significantly higher than the cumulative excess return of 8.08% to the nontendering shareholders. So, it seems that investors should tender their shares, rather than holding them. Although investors, when they have to decide to tender or to hold, do not know the stock price after the expiration of the offer, they observe that the stock price after the announcement, but before the expiration, is significantly below the tender price. This implies that the market expects the stock price after the expiration of the offer to be significantly below the tender price. So, investors should tender.

If markets assume that investors tender, P_{-6} is determined by the following relation:

$$P_{-6} = [F_P \times P_T + (1 - F_P) \times P_{12}]. \tag{4}$$

In other words, investors still weigh P_T by F_P/F_T, but assume that $F_T = 1$. If the market followed this logic, then the expected return from buying shares 6 days prior to the first expiration date and tendering (selling those not repurchased by the company at P_{12}) would be as follows:

$$E(\text{return}) = [F_P \times P_T + (1 - F_P) \times P_{12}]/P_{-6} - 1. \tag{5}$$

The results are reported in Table 13, panel B. Over the whole period from 1987 to 2001, the average expected return is an insignificant 1.54%.[28] Interestingly, the early part of the sample did still display significant returns (1987–1995: 2.47%), while the latter half of the sample shows an average expected return of 0.00%, with 48% of the observations being positive. Note that we get similar results if we shorten the event window by assuming that we can sell 2 days after the final expiration date (panel C in Table 13). While the magnitudes of the returns are very similar, the standard errors are smaller, so that the average return for the full sample is significant again. When we compare

[28] We chose to report returns and not abnormal returns in panels B and C. Subtracting the market return from the expected return results in an average expected abnormal return of 0.8% (for the early part 2.0% and the later part −1%). All averages are insignificant.

returns across the two event windows, we find that the minimum (maximum) is −15.4% (49%) for the longer window and −8.9% (19%) for the shorter event window. Nevertheless, the second half of the sample period displays again a zero average expected return.

These findings are consistent with the interpretation that, especially in recent years, the market sets prices assuming that all shares will be tendered, which one might expect to be in the interest of investors. So, one way to interpret the results is that the market assumes investors are tendering, but in reality they are not: only 32.3% of all outstanding shares are tendered, so that 80% of all the tendered shares are repurchased by the company. Another way of stating this is that the market sets prices as if the average investor, not the marginal investor, determines the stock price.[29] From this perspective, two things are puzzling. One, why are not all shares tendered? Two, why would anyone be willing to sell their shares at such a discount from fair value rather than tendering to the company?

Capital gain taxes and corporate control issues might explain why not all shares are tendered, although it does not explain why shareholders sell their shares rather than tendering them. If we assume that those issues are less important for institutional investors, then we expect that excess returns are lower if institutional ownership is higher prior to the self-tender offer announcement. First, institutional owners would be more likely to tender, thus increasing F_T toward 1. Second, institutions hold diversified portfolios and would be more familiar with a repurchase tender offer, a rather unique event in a company's history. For example, the 141 tender offers in our sample are placed by 135 different companies, with only six companies making more than one tender offer. Hence, stocks should be priced more efficiently during the tender period if they are held by institutions.

We collect information on institutional ownership from 13f filings with the SEC (Thomson Financial). On average, in the quarter prior to the repurchase announcement, 30.3% of the shares of the companies in our sample are owned by institutions. We find that the institutional ownership fraction is negatively but insignificantly correlated with F_P/F_T (a correlation of −0.18, with a p-value of .11). Furthermore, we find that the strategy's excess returns are positively (0.17) but insignificantly correlated with institutional ownership. In sum, stocks that have a larger institutional ownership fraction are neither more likely to have a higher F_T nor are they priced more efficiently. This is inconsistent with the assumption that capital gain taxes or control issues can explain the low percentage of shares tendered.

The literature on merger arbitrage (e.g., Mitchell and Pulvino, 2001; and Baker and Savasoglu, 2002) suggests that individual investors would sell during

[29] Since the fraction repurchased, F_P, is not known exactly 6 days prior to expiration, we have recomputed the results of Equation (3) with the fraction sought, F_S. Not surprisingly, the implications are the same (not tabulated separately), since the average fraction sought and fraction repurchased are very similar (see Table 12).

the tender period because they are not willing to bear the event risk. In particular, during merger tender offers, there is a significant chance that the merger will fail, making the stock drop in value. Investors who are not willing to bear this risk will sell to arbitrageurs, who are able to purchase the shares at a discount, on average, similar to the findings in our self-tender offer sample. However, the key difference lies in the risk: there is only one self-tender offer that got canceled within 6 days prior to the initially announced expiration date in all the 15 years. And even in that event, the stock price did not drop after the cancellation. Therefore, there is no reason to believe that investors in the self-tender offer events would need to pay for a service as offered by merger arbitrageurs.

We can think of only one reason why an *individual* investor may not want to tender: if the individual believes the markets are efficient, a low stock price relative to the tender price indicates that the offer will be heavily oversubscribed and prorated. So, the opportunity cost from not tendering is relatively small. Of course, if every investor behaves this way, we have a kind of free-rider problem where every investor is holding on to his/her shares, while the optimal decision is to tender. As a result, nontendering shareholders as a group are worse off. Moreover, as a repurchase tender offer is a relatively unique event in the life of a company, shareholders do not learn from their mistakes. At the same time, because a repurchase tender offer is such a rare event, there are no professional arbitrageurs (unlike in the takeover market) who specialize in buyback tender offer arbitrage. Thus, markets continue to assume shareholders tender whereas shareholders are assuming markets are efficient, and as a result an arbitrage opportunity remains unexploited! Regardless of these "explanations," we are left to conclude that these excess returns are an anomaly that the market has not (yet) arbitraged away.

6. Conclusions

The abnormal price behavior related to tender offer and open market share repurchases documented in LV and ILV still persists. The analysis of open market share repurchases in the period 1991–2001 shows that there are still significant long-run abnormal returns in the 48 months following the buyback announcement. This underreaction is consistent with the survey results of Brav et al. (2005), who report that 90% of all CFOs "agree or strongly agree" with the statement that they repurchase stock when their shares are undervalued. Without underreaction, such a strategy could not be successful.

The biggest underreaction is observed in the sample of firms that experience a high drop in their stock price in the 6 months prior to the announcement. Moreover, using past returns to predict future excess returns works as well as using a U-Index, which combines past returns with other indicators, such as firm size, market-to-book, and stated motivation. Given that firms whose stock price has been beaten down show the largest long-run abnormal returns, it seems likely that managers react to an overreaction of the market to some publicly available information. Such an "overreaction to publicly available information" hypothesis is more consistent with the data than the hypothesis that managers have proprietary information about new technologies and hence long-term earnings.

Investors in turn are only slowly correcting their mistake, and underreact to the managers, repurchase decision. This despite the fact that it is possible to construct portfolios that systematically beat popular benchmarks, such as the Fama-French (1993) three-factor model and the S&P 500 Index. Why does such an anomaly persist? We find one potential explanation: the repurchase is essentially a criticism of downgrades by analysts. These downgrades are found to be based on overly pessimistic earnings forecasts of beaten-down companies. Considering that the repurchase is essentially a critique on the analyst community, it is extremely unlikely that analysts then would turn around and change their recommendation. Moreover, as the firms in which the anomaly prevails are relatively small and followed by few analysts, analyst opinions are considered to be an important source of information, to which investors pay (too much) attention as evidenced by the large average stock-price reactions of around −10% to analyst downgrades prior to the repurchase announcement for the subsample of firms classified as undervalued.

We find that the trading rule around the expiration date of fixed-price tender offers generates an average abnormal return of about 9% in a very short time span. The market seems to set prices assuming that all shares will be tendered, although empirically only 32.3% of shares are tendered on average. An argument can be made that, considering the large gap between the repurchase premium and the price after expiration, most shareholders should tender. Hence, prices are set assuming investors are tendering, but they are not. On the other hand, individual shareholders may believe markets are efficient, and that most shares will be tendered. This leads to large prorationing, which in turn makes it less relevant for the shareholder to tender. The fact that the event is rare and that there are no professional repurchase tender offer arbitrageurs may well "explain" why this anomaly persists during the last 25 years.

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