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Do Corporate Managers Know When Their Shares Are Undervalued? New Evidence Based on Actual (and Not Just Announced) Stock Buybacks

by Amy Dittmar, University of Michigan, and Laura Casares Field, University of Delaware

Critics of corporate stock buybacks have described them as a form of financial engineering whose primary aim is to boost reported earnings per share. If such payouts of corporate cash have any “real” effects on long-run operating efficiency and value, according to such critics, it is the negative effect of reducing the amount of funds available for promising investments.

Defenders of stock repurchases respond to this claim by arguing that buybacks give companies a tax-efficient way of paying out capital that cannot be profitably reinvested inside the firm. What’s more, by paying out such capital, companies are likely to be increasing the value of their shares just by preventing management from taking on low-return projects, such as diversifying acquisitions, which are likely to reduce corporate returns on capital and destroy value.

Besides paying out excess capital and possibly exerting pressure on management to make more efficient use of it,¹ share repurchases are also said to provide corporate managers with an opportunity to create value for their shareholders by buying back undervalued shares—that is, shares whose current price does not reflect the value of the firm as perceived by management (and perhaps the company’s most sophisticated or far-sighted investors). To the extent managers are able to identify such opportunities, they are effectively transferring wealth from the shareholders who sell to those who choose to stay.

Moreover, many corporate managers, when considering the possibility of stock buybacks, evaluate them as a kind of alternative “investment” with a projected return on capital that can be different from the market’s current expected rate of return. (If the company’s stock is “fully” or correctly valued at the time of the repurchase, then the projected return should be identical to the firm’s cost of capital—in which case, there would be no transfer of value between selling and remaining shareholders.) And according to a survey conducted by John Graham and colleagues at Duke’s Fuqua School in 2005,² over 86% of the 400 corporate CFOs who responded to the survey said that they “agree” or “strongly agree” with the statement that “companies repurchase when their stock is a

good value relative to its true value.” Moreover, about half of the CEOs who participated in follow-up interviews said that their companies keep track of their repurchase timing and have been able to beat the market consistently, with some CFOs claiming success in outperforming the market by \$1 or \$2 a share during the course of a year.

In a study published recently in the *Journal of Financial Economics*, we attempted to determine whether companies that buy back their own stock earn more (or less, as many critics have charged) than a market return on such “investments.” Since 2004, the SEC has required U.S. publicly traded companies to disclose the number of shares repurchased each month, the average price paid for repurchases over the month, and whether the shares were repurchased as part of a public plan. We used this disclosed data to evaluate both the ability of companies in general to time the market and to detect any “cross-sectional” patterns that would help us identify the kinds of companies—and the circumstances or ways in which such companies operate—that have consistently succeeded (or failed) to repurchase their stock at what prove to be bargain prices for their shareholders who choose not to sell.

The Sample

Our sample consisted of all 2,237 publicly traded U.S. companies that repurchased their own stock as part of open market stock repurchase programs between 2004 and 2011. For each company repurchasing stock during this eight-year period, we collected the average prices at which the shares are repurchased as well as the number of shares repurchased each month, as reported in the companies’ 10-K and 10-Q filings with the SEC. Moreover, we were the first researchers to examine the average price paid and number of shares that were *actually* repurchased on a monthly basis for a full sample of repurchasing companies.

Repurchase Activity

Figure 1 shows the number of repurchasing companies for each year in our sample from 2004 through 2011. As shown in the figure, the frequency and volume of repurchase activ-

1. See Dittmar (2000), Grullon and Michaely (2002), Jagannathan, Stephens and Weisbach (2000), Kahle (2002), Bens, Nagar, Skinner and Wong (2003), and Massa, Rehman and Vermaelen (2007). Full citations of all articles are provided at the end of the article.

2. Brav, Graham, Harvey, and Michaely (2005).

The Findings of Previous Studies

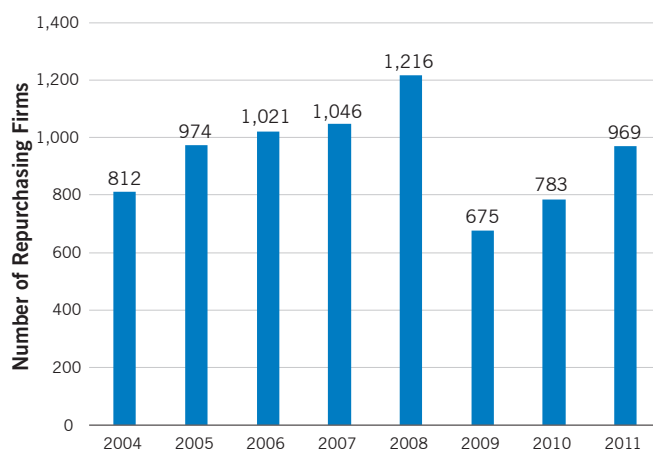
The question of whether managers can time the market by buying back undervalued shares has spurred many academic studies, yet despite numerous investigations the answer remains unclear. Several papers have presented evidence in support of marketing timing, but others dispute the interpretation of the evidence.³ Therefore, whether companies repurchasing their stock have succeeded in identifying when it is undervalued—or when the general market is undervalued generally—has remained an open question. One strand of this literature examines long-run returns after the repurchase announcement,⁴ but this evidence is particularly difficult to link to such “market timing” because many companies announce repurchase programs but never actually repurchase their stock.⁵ Another difficulty for researchers has been that, until recently, companies were not required

to disclose actual repurchases, which meant that researchers could only infer repurchase amounts on a quarterly basis (without any way of determining the exact prices at which the buybacks were carried out).

In 2003, the SEC amended Exchange Act Rule 10b-18, requiring companies to disclose all repurchases in their annual and quarterly reports, starting in March 15, 2004. As a result, at the end of each fiscal quarter, companies are now required to disclose the number of shares repurchased each month, the average price paid for repurchases over the month, and whether the shares were repurchased as part of a public plan. Our study used these data to evaluate both the ability of companies to time the market and the kinds (or practices) of companies that have demonstrated an ability to repurchase at low and possibly undervalued prices.

Figure 1 Number of Repurchases Per Year

Figure 1 depicts annual number of share repurchases done by public firms between 2004-2012.

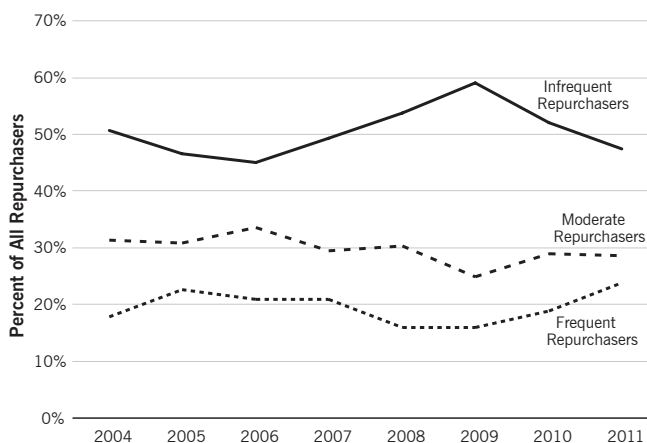


ity has varied considerably over time. The largest number of companies repurchasing was in 2008 (with 1,216 companies), with the smallest number repurchased (675 companies) in the following year.

As shown in Figure 2, we classified repurchasing companies into groups based upon their repurchasing frequency in a given year. Companies that repurchase only a few times a year are likely to have more flexibility in timing their buybacks

Figure 2 Number of Repurchases Per Year, by Repurchase Frequency

Figure 2 depicts percentage of total annual number of share repurchases done by public firms between 2004-2012, categorized by repurchasing frequency (infrequent repurchasers repurchase between 1-4 times per year, moderate repurchasers repurchase between 5-8 times per year, while frequent repurchasers repurchase at least 9 times per year).



than companies that repurchase more frequently. We identified “frequent repurchasers” as those that repurchased at least nine times in a year, “moderate repurchasers” as those that repurchased between five and eight times a year, and “infre-

3. Baker and Wurgler (2000, 2002), Ikenberry, Lakonishok, and Vermaelen (1995, 2000a, 2000b), and Peyer and Vermaelen (2009) present evidence consistent with market timing. Eckbo, Masulis, and Norli (2000), Schultz (2003), Butler, Grullon, and Weston (2005), and Dittmar and Dittmar (2008) dispute the interpretation of these

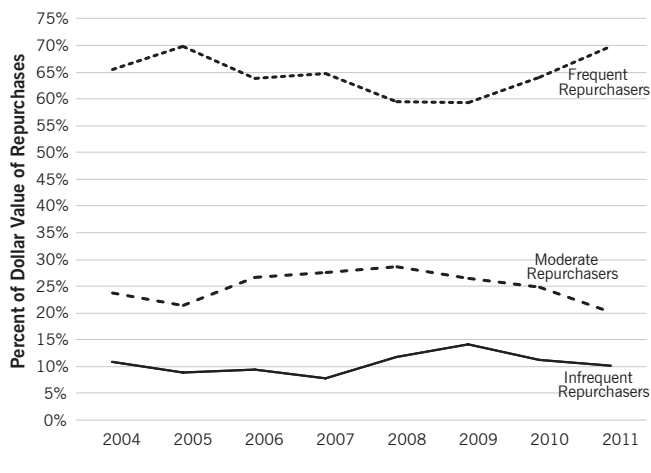
findings as evidence of market timing.

4. For example, Lakonishok and Vermaelen (1990), Ikenberry, Lakonishok, and Vermaelen (1995, 2000a, 2000b), and Peyer and Vermaelen (2009).

5. See Stephens and Weisbach (2000).

Figure 3 **Total Market Value of Repurchases Per Year, by Repurchasing Frequency**

Figure 3 depicts percentage of total market value of repurchases done by public firms between 2004 and 2012, categorized by repurchasing frequency (infrequent repurchasers repurchase between 1-4 times per year, moderate repurchases repurchase between 5-8 times per year, while frequent repurchasers repurchase at least 9 times per year).



quent repurchasers” as those that repurchased one to four times during the year. As shown in Figure 2, about half of all the companies in our sample repurchased infrequently, four or fewer times during the year. Perhaps more surprisingly, almost 20% of repurchasing companies repurchased frequently, at least nine times a year.

Although infrequent repurchasers conducted about 50% of all repurchases in any given year, Figure 3 shows that they accounted for only about 10% of the total market value of repurchases in any given year (where total market value is the number of shares repurchased times the average price at which they were repurchased in any given month). By contrast, frequent repurchasers accounted for about 60-70% of the total market value of all repurchases in any given year. Thus, although many more companies repurchased infrequently, fewer than four times a year, frequent repurchasers—again, those repurchasing at least nine times a year—bought back the largest dollar volume of shares.

Characteristics of Repurchasing Companies

Table 1 presents the means (medians) of a number of relevant company characteristics for the full sample and for subsamples based on repurchase frequency. The frequent repurchasers in

our sample differed significantly from infrequent repurchasers on many dimensions. Frequent repurchasers were significantly larger and more profitable, and had higher market-to-book and dividend payout ratios than infrequent repurchasers. Frequent repurchasers also had a smaller bid-ask spread and lower stock return volatility. As summarized graphically in Figures 2 and 3, the findings reported in Table 1 confirm that, although frequent repurchasers bought back less on a monthly basis than infrequent repurchasers, they tended to repurchase more over the entire year (though the difference is statistically significant only for the medians). Although the median frequent repurchaser’s monthly repurchase was 0.32% of market value (as compared to 0.44% for infrequent repurchasers), the median frequent repurchaser bought back 4.6% of the company’s market value on an annual basis (as compared to 1.2% for infrequent repurchasers). These differences suggest that the motives for repurchasing, and the potential role of market timing, is likely to be quite different for frequent and infrequent repurchasers—a subject we come back to later.

Measuring Undervaluation

To measure market timing, we compared the average price paid for repurchases during the month to the average price at which the firm’s shares traded during the repurchase month as well as various time periods, including the months after the repurchase. We refer to this variable as the “Relative Repurchase Price” (RRP), and it can be thought of as the percentage difference between the average price paid by the firm during the repurchase month (REP) and the average daily market price of the firm’s stock (AP) over various timeframes. We estimated the RRP by comparing the average repurchase price paid by the firm during the repurchase month with the average daily stock market price from the repurchase month through one-, three- and six-month windows after the repurchase month.⁶ To the extent that corporate managers are able to determine when their company’s stock is undervalued, we expected them to buy at prices that would turn out to be lower than future prices.

By contrast, most of the studies of the long-run “performance” of stock buybacks track price changes from the time of the *announcement* of the repurchase. And because such announcements tend to take place months or even years before the actual repurchases, our study provides a more precise measure of managerial timing with repurchases. To the extent that managers were able to recognize when their stock is undervalued, we expected their RRP to be significantly negative.

In Figure 4, we provide a number of examples taken from our sample of companies that show how the RRP was

6. We designate the repurchase as taking place in month 0. We calculate the Relative Repurchase Price (RRP) as the average price paid by the firm in the repurchase month (month 0), REP_0 , divided by the average daily market price of the firm’s stock in the repurchasing month through “t” months later, AP_{+t} , and we subtract one to get a percentage difference. Specifically, the Relative Repurchase Price is calculated as follows:

$$RRP_{+t} = \frac{REP_0}{AP_{+t}} - 1$$

For example, RRP_{+6} measures the percentage difference between the price paid by firm during the repurchase month and the average daily market price of the stock from the repurchase month through six months after the repurchase.

Table 1 **Summary Statistics of Repurchasing Firms**

The table below provides summary statistics on various firm and stock characteristics for the full sample and by repurchasing frequency. The far-right column presents differences between means (medians) for frequent and infrequent repurchasers. ***, **, and * indicate significant differences between the groups presented at the 1%, 5% and 10% level, respectively, using T-tests for means (Wilcoxon non-parametric test for medians).

Firm characteristic	Repurchase frequency				Difference: Frequent – Infrequent
	Full sample	Infrequent	Moderate	Frequent	
Total Assets (millions)	6.993 (1.044)	3.380 (0.684)	5.321 (1.249)	18.718 (2.999)	15.339*** (2.315***)
Market-to-Book Ratio	1.823 (1.455)	1.747 (1.378)	1.876 (1.508)	1.936 (1.626)	0.189*** (0.248***)
Return on Assets	6.05% (6.36%)	4.76% (5.50%)	7.00% (6.82%)	7.90% (7.61%)	0.031*** (0.021***)
Leverage	17.18% (13.63%)	17.45% (13.24%)	16.34% (12.40%)	17.77% (16.17%)	0.003 (0.029***)
Cash-to-Assets	19.50% (12.53%)	20.53% (13.44%)	19.65% (13.10%)	16.65% (10.56%)	-0.039*** (-0.029***)
Dividend Payout	3.56% (0.00%)	3.01% (0.00%)	3.75% (0.00%)	4.66% (2.24%)	0.017*** (0.022***)
Bid-Ask Spread	0.44% (0.15%)	0.55% (0.18%)	0.36% (0.13%)	0.28% (0.10%)	-0.003*** (-0.001***)
Stock Return Volatility	0.94% (0.76%)	0.99% (0.78%)	0.94% (0.77%)	0.83% (0.69%)	-0.002*** (-0.001***)
Repurchase Size/Market Value of Equity	1.12% (0.37%)	2.49% (0.44%)	0.87% (0.42%)	0.56% (0.32%)	-0.019* (-0.001***)
Annual Repurchases/ Market Value of Equity	5.69% (2.38%)	5.73% (1.19%)	5.44% (3.64%)	5.98% (4.57%)	0.003 (0.034***)
Number of observations	7,496	3,765	2,250	1,481	

calculated. Panel A demonstrates how we calculate the RRP looking forward three months after the repurchase (RRP_{+3}), while Panel B demonstrates the calculation for the RRP looking forward six months after the repurchase (RRP_{+6}).

As shown in Panel A of Figure 4, Firm 1 repurchased shares during December 2011 at an average price of \$7.82. As shown in the figure, between the repurchase month and three months after the repurchase, Firm 1's shares sold for an average of \$8.62. Thus, we calculated the RRP_{+3} for Firm 1 as the repurchase price paid divided by the average price from the repurchase month through three months later and subtract one: $RPP_{+3} = \$7.82/\$8.62 - 1 = -9\%$.

As also reported in Panel A, Firm 2 repurchased shares in July 2010 at an average price of \$14.68. Between the repurchase month and three months after the repurchase, Firm 2's shares sold for an average of \$16.61. Thus, we calculated RRP_{+3} for Firm 2 as $\$14.68/\$16.61 - 1$, which equals -12% . In sum, both Firm 1 and Firm 2 ended up repurchasing their

shares at significant discounts (of 9% and 12%, respectively) from the average share price between the repurchase month and three months later.

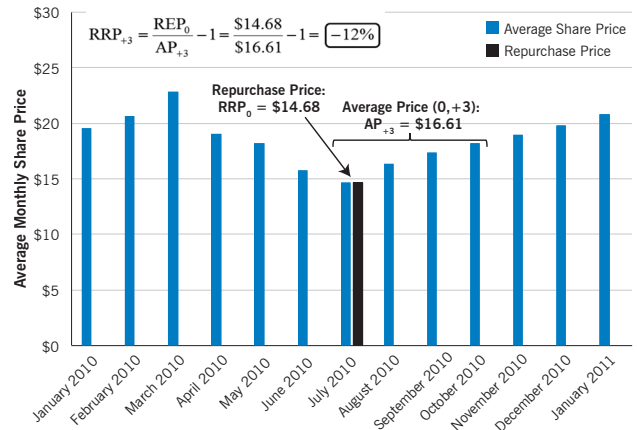
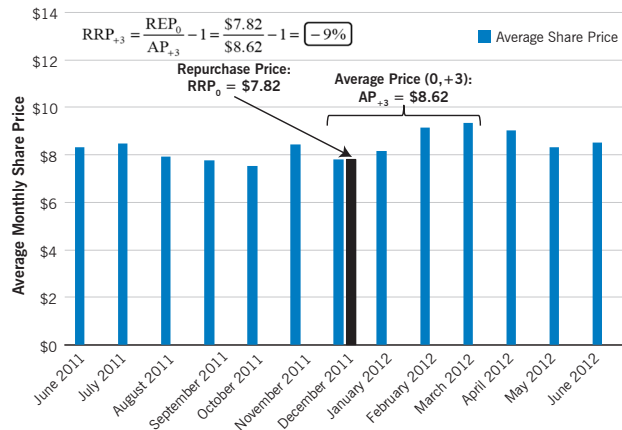
In Panel B of Figure 4 we demonstrate similar calculations for two other firms, examining a window from the purchase month through six months later. Firm 3 repurchased shares in May of 2004 at an average price of \$5.07. The average stock price from the repurchase month through six months later was \$6.70. Thus, Firm 3 repurchased its shares at a 24% discount from its average share price during the next six months ($RRP_{+6} = \$5.07/\$6.70 - 1 = -24\%$).

Finally, in the far right figure in Panel A, we can see that Firm 4 repurchased shares in August of 2007 at a 35% discount from its average share price during the next six months. Specifically, Firm 4 repurchased at an average price of \$19.01, while the average share price from the repurchase month through six months later was \$29.25, giving us an RRP_{+6} of -35% ($\$19.01/\$29.25 - 1$).

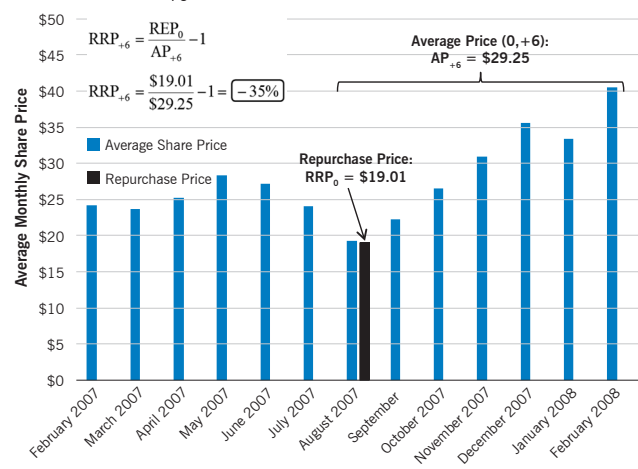
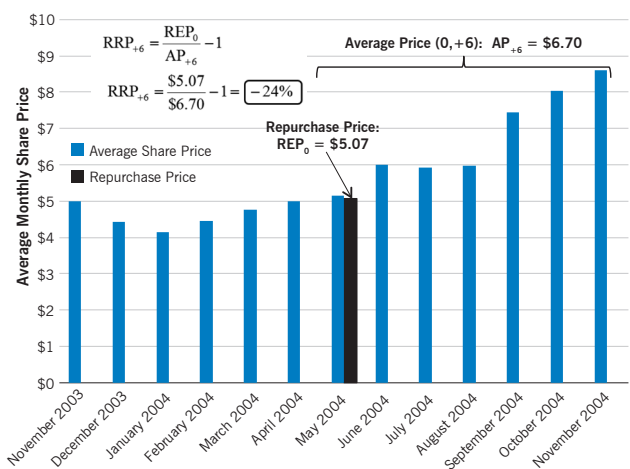
Figure 4 Examples of Relative Repurchase Prices (RRPs) for Selective Companies in Sample

Figure 4 depicts the calculation of Relative Repurchase Prices for four repurchasing firms in our sample. Panel A provides the RRP from the repurchase month through three months later for two repurchasers, while Panel B provides the RRP from the repurchase month through six months later for two other repurchasers.

Panel A: Calculating the Relative Repurchase Price for (0,+3) months: RRP_{+3}



Panel B: Calculating the Relative Repurchase Price for (0,+6) months: RRP_{+6}



As these examples are meant to suggest, some companies have succeeded in repurchasing undervalued shares. In the next section, we investigate the extent to which companies in general have been able to repurchase shares at a discount relative to the future stock price.

Evidence on Whether Companies Are Able to Recognize When Their Stock Is Undervalued

Figure 5 shows the median RRP for all repurchasers in our sample on an annual basis from 2004-2011. For example, RRP's are presented for the repurchase month, for the repurchase month through one month later, three months later, and six months later.

As shown by the black bars in the figure, the median RRP for the repurchase month was negative in every single

year. What this tells us is that more than half of all companies repurchased their shares at small discounts relative to their average stock price in the repurchase month. For the entire sample, companies repurchased their shares at a median 0.88% discount to the average share price for the repurchase month.

When measuring the RRP using longer post-repurchase windows, we found that the median RRP was negative for most repurchase years, but not for 2007 and 2008. In fact, the median company that repurchased shares in 2008 ended up paying an 8.4% premium for those shares, when measured from the repurchase month through six months later. By contrast, companies that repurchased shares in 2009 and 2010 repurchased them at the largest discounts, with median discounts of 9.5% for 2009 and 6.6% for

Figure 5 **Median Relative Repurchase Prices (RRPs) for Full Sample at Various Windows**

Figure 5 depicts median RRP for our full sample of 38,900 monthly repurchases conducted by 2,237 firms from 2004 to 2011. The figure presents a measure of the percentage difference between the median repurchase price paid by a firm during the repurchase month (as reported in the 10-K) and the average closing stock prices (as reported by the Center for Research in Security Prices, CRSP) during the repurchase month and from the repurchase month through one, three or six months later. This percentage is termed the Relative Repurchase Price.

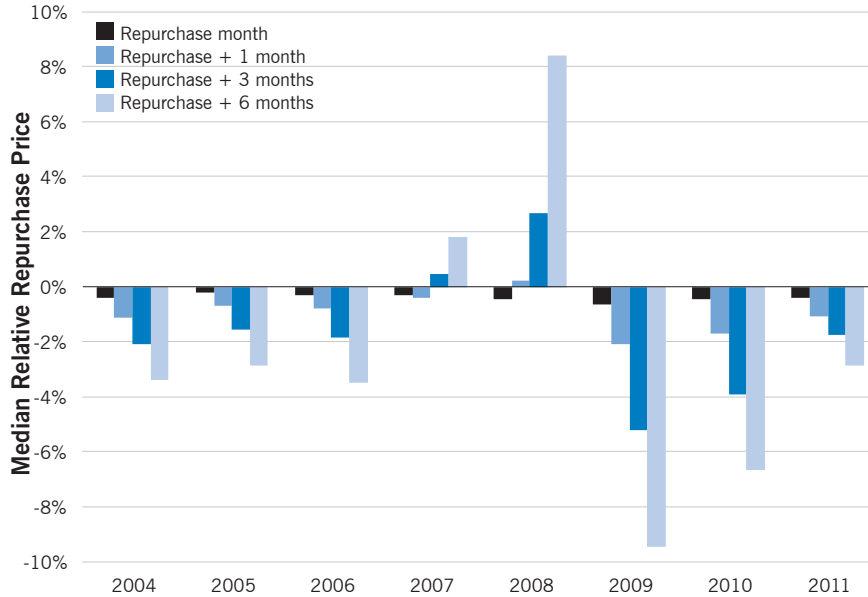


Figure 6 **RRPs by Repurchasing Frequency**

Figure 6 depicts median RRP for our full sample of 38,900 monthly repurchases conducted by 2,237 firms from 2004 to 2011 by repurchasing frequency. The figure presents a measure of the percentage difference between the median repurchase price paid by a firm during the repurchase month (as reported in the 10-K) and the average closing stock prices (as reported by the Center for Research in Security Prices, CRSP) during the repurchase month and from the repurchase month through one, three or six months later. This percentage is termed the Relative Repurchase Price.

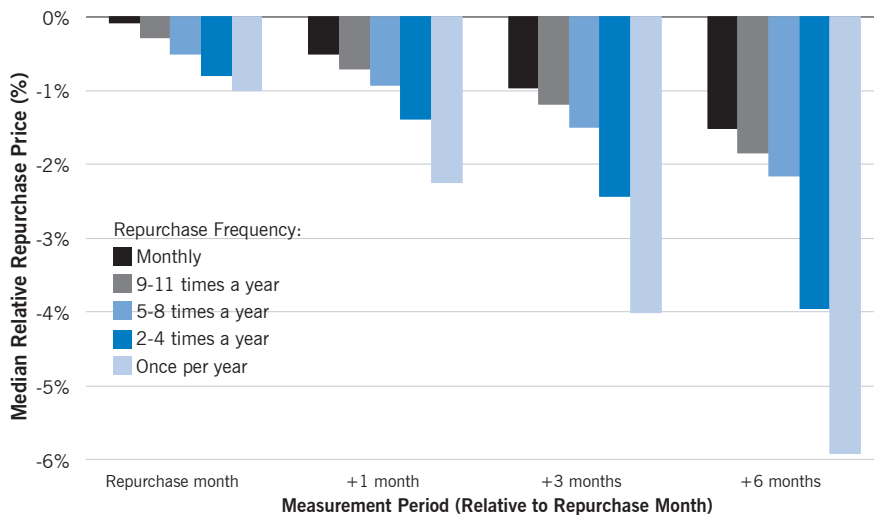


Table 2 **Announcement Returns for Repurchase Announcements**

The table examines the stated motivation for repurchases for 2,921 repurchase program announcements made from 1999 to 2011 (announcing subsequent repurchases in our sample, which covers the period 2004 to 2011). Repurchase announcements are categorized into several categories of motivation for the share repurchase, and we select firms that mention “undervaluation” and “best use of money” as those with a stated motivation of mispricing. We present the mean (median) three-day cumulative abnormal returns (CARs) for these repurchase program announcements, categorized by whether the firm made a repurchase announcement that suggests the stock could be mispriced.

Stated repurchase motivation	Mean (Median) CAR	Number of announcements
Stated motivation of mispricing	2.09%*** (1.65%)***	1,397
No stated motivation of mispricing	1.67%*** (1.22%)***	1,524
Difference	0.42% (0.43%)**	

2010. Over the entire sample period, and for all windows we examined, the median company in our sample repurchased its stock at a statistically significant discount—which, again, means that more than half of repurchasing companies bought back their shares at what turned out to be discounts to their future values.

Repurchase Frequency and Success in Buying Back Undervalued Stock

As suggested earlier, the frequency with which a company buys back its own stock is likely to be negatively correlated with a manager’s ability to time the market and buy back undervalued shares. For example, companies that repurchase shares only once a year have more flexibility in terms of timing than firms that repurchase monthly.

When we examined how the frequency of repurchases relates to the Relative Repurchase Price, we found that the Relative Repurchase Price, as shown in Figure 6, decreased in a roughly linear way with the frequency of repurchase, regardless of comparison window. And in fact, the difference in the Relative Repurchase Prices among infrequent versus moderate or frequent repurchasers was strikingly large—and, indeed, perhaps the most important finding of our study. Using the window from the repurchase month through six months later, we found that companies that repurchased just once during the year had a median Relative Repurchase Price of -5.9% , as compared to only -1.5% for monthly repurchasers. And when we compared infrequent repurchasers (those that repurchase four or fewer times a year) with frequent repurchasers (those repurchasing at least nine times a year), we found a significant median difference of -2.4% .

Companies’ Stated Motivation for Repurchasing

The evidence presented thus far shows that some companies seem able to recognize when their shares are undervalued

and are able to repurchase shares at a discount relative to the future stock price. A natural question is whether companies try to signal their perceived undervaluation through their repurchase announcement, since one motive commonly stated in companies’ repurchase announcements is to correct what they perceive as undervaluation of their own stock.

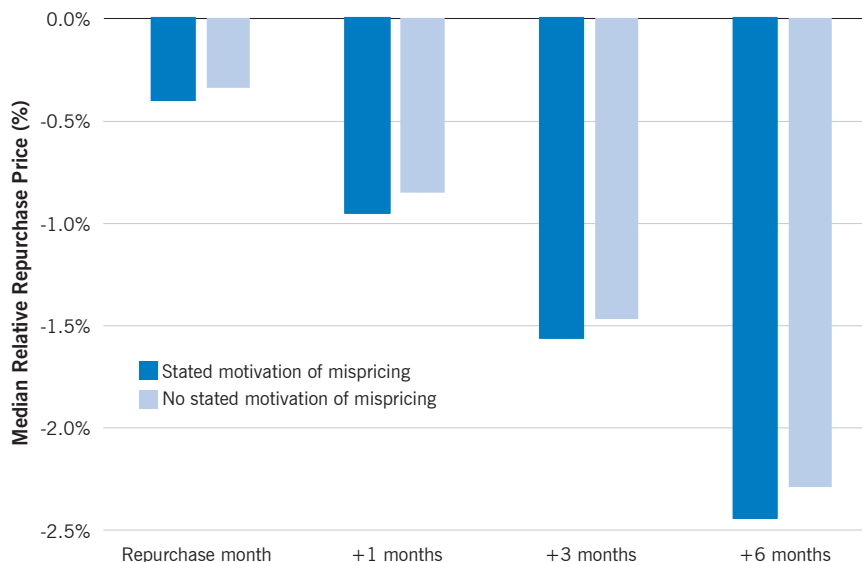
To examine whether companies’ stated motivation to repurchase was related to the Relative Repurchase Price, we divided our sample based on motives stated in the announcements of corporate repurchase programs. (Note that announcements of repurchasing programs are made before firms actually start repurchasing.) After finding a total of 2,921 repurchase announcements, we grouped together all companies whose stated motivation for the repurchase cited undervaluation. All other repurchase announcements, including those in which no motive was provided, were assigned to a second group.

When we then we examined the market’s response to the announcements of buyback programs by these two groups of companies, we found, as reported in Table 2, that companies making announcements of repurchase programs that included some mention of stock undervaluation had significantly positive announcement returns of 2.1% , on average, for the three days surrounding the announcement. Moreover, the median announcement return was significantly higher for companies mentioning undervaluation in the announcement than for those that did not (there was no significant difference in mean returns).

Next, we examined Relative Repurchase Prices based upon the motives stated by management in the repurchase program announcement. And as summarized in Figure 7, our findings showed little difference in the RRP measure for the two different groups of companies—those that mentioned undervaluation and those that did not.

Figure 7 **RRPs by Stated Repurchase Motivation**

Figure 7 depicts median RRP for our full sample of 38,900 monthly repurchases conducted by 2,237 firms from 2004 to 2011 by the stated motivation given by the firm for the repurchase program. The figure presents a measure of the percentage difference between the median repurchase price paid by a firm during the repurchase month (as reported in the 10-K) and the average closing stock prices (as reported by the Center for Research in Security Prices, CRSP) during the repurchase month and from the repurchase month through one, three or six months later. This percentage is termed the Relative Repurchase Price.



Differences among Kinds of Companies in the Relative Repurchase Prices

As we noted earlier in Figure 6, frequent repurchasers paid significantly higher prices relative to their future stock price than did infrequent repurchasers. However, as shown in Table 1, we found significant differences in company characteristics between frequent and infrequent repurchasers. For example, infrequent repurchasers tended to be smaller, with lower market-to-book and dividend payout ratios, and higher cash-to-asset ratios. Their shares also had higher bid-ask spreads and stock return volatility.

In addition to these differences, we had to control for other factors that may affect the Relative Repurchase Price. For example, studies have shown that managers are able to time the market with their personal trades.⁷ To control for all these factors that could affect the Relative Repurchase Price, we used regression analysis of the Relative Repurchase Price in a multivariate setting.

In Table 3, we summarize the findings of our regressions of the Relative Repurchase Price on the following variables: repurchase frequency; an indicator variable equal to one for whether the firm announced the motivation for the repurchase program as mispricing (equals zero if mispricing

not mentioned); net insider buying (which measures the difference between insider purchases and sales during the repurchase month); and the firm characteristics shown in Table 1 (including year and firm fixed effects). The dependent variable was the Relative Repurchase Price, measured over three comparison periods: through one-, three-, and six-months after the repurchase. We included two variables to capture repurchase frequency: Infrequent Repurchaser is an indicator variable equal to one for firms that repurchase one to four times a year, and Frequent Repurchaser is an indicator variable equal to one for firms that repurchase at least nine times a year (the excluded group is moderate repurchasers, which is captured in the intercept). To determine the impact of aggregate market timing, we included the overall market return for the period six months prior through the repurchase month (we used the pre-repurchase period for the aggregate market return because we assume managers could time the aggregate market by repurchasing following a decline, but are less able to predict future market movements).

Controlling for all these characteristics, we found that, regardless of the event window we employed, infrequent repurchasers obtained a significantly lower Relative

7. See Seyhun (1986).

Table 3 **Regressions of Relative Repurchase Price (RRP)**

The table reports regressions of the Relative Repurchase Price on firm and repurchasing characteristics. Relative Repurchase Price is measured as the percentage difference between the average repurchase price paid by the firm during a repurchase month (as reported in the 10-K) and the average closing stock prices as reported on CRSP, during various windows: repurchase month plus one, three, and six months. Accounting variables are summarized at the firm-year, measured at the fiscal year-end before the repurchase month. See the Appendix for variable definitions. The regressions include year- and firm-fixed effects and clustered standard errors at the firm level. P-values are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	Repurchase month		
	+ 1 month	+3 months	+ 6 months
<i>Infrequent repurchaser</i>	-0.006*** (0.004)	-0.014*** (0.000)	-0.023*** (0.000)
<i>Frequent repurchase</i>	0.001 (0.642)	-0.000 (0.967)	0.000 (0.978)
<i>Stated motivation of mispricing</i>	-0.001 (0.434)	-0.002 (0.612)	-0.002 (0.729)
<i>Net insider buying</i>	0.001 (0.260)	-0.001 (0.171)	-0.005*** (0.000)
<i>Ln(Total assets)</i>	0.011*** (0.005)	0.047*** (0.000)	0.085*** (0.000)
<i>Market-to-book</i>	0.004*** (0.000)	0.016*** (0.000)	0.029*** (0.000)
<i>Return on assets</i>	-0.013 (0.305)	-0.005 (0.842)	0.015 (0.700)
<i>Leverage</i>	0.010 (0.365)	0.009 (0.704)	0.006 (0.880)
<i>Cash-to-assets</i>	-0.004 (0.623)	-0.023 (0.159)	-0.037 (0.163)
<i>Stock return volatility</i>	-0.554*** (0.006)	-0.788*** (0.008)	-1.532*** (0.000)
<i>Prior six-month market return</i>	0.030*** (0.000)	0.084*** (0.000)	0.140*** (0.000)
<i>Ln(Number of analysts)</i>	-0.004* (0.088)	-0.008 (0.112)	-0.006 (0.412)
<i>Percent of analyst downgrades</i>	0.016 (0.165)	0.011 (0.536)	0.014 (0.530)
<i>EPS forecast dispersion</i>	-0.001 (0.531)	-0.003 (0.195)	-0.003 (0.413)
<i>Change in six-month average EPS forecast</i>	0.003 (0.236)	0.010* (0.085)	0.016* (0.086)
<i>Prior six-month firm abnormal return</i>	0.006* (0.092)	0.027*** (0.000)	0.046*** (0.000)
Intercept	-0.095*** (0.004)	-0.386*** (0.000)	-0.702*** (0.000)
Adjusted R ²	0.154	0.224	0.342
Number of observations	15,206	15,206	15,206

Repurchase Price than moderate repurchasers (the excluded group), which is consistent with the “univariate” results we reported earlier (and were presented in Figure 6). For example, our findings can be interpreted as saying that the Relative Repurchase Price was 2.3% lower for infrequent repurchasers when using the six-month comparison window.

Although we found no relation between the stated motive for the repurchase program and the RRP, we did find that companies paid a lower repurchase price when there was more insider buying (significant only for the six month after comparison window). Focusing on company characteristics, we found that smaller companies, compa-

Table 4 **Fama-French Regressions by Repurchasing Frequency**

The table presents Fama and French regressions of market returns for various return windows following 38,900 repurchase months from 2004 to 2011. For each calendar month of the sample period, we construct a portfolio consisting of all firms making a repurchase within the three, six, 12, 24, or 36 months. To do this, we add firms to the portfolio in the month that they repurchase stock and the stock is retained in the portfolio for three, six, 12, 24, or 36 months. Portfolios are rebalanced each month and an equal-weighted portfolio excess return is calculated. The resulting time series of monthly excess returns is regressed on the three Fama and French (1993) factors: the market return minus the risk-free rate (RMRF), returns on a portfolio of small firms minus returns on a portfolio of big firms (SMB), and returns on a high book-to-market portfolio minus returns on a low book-to-market portfolio (HML). The estimated intercept from the regression of portfolio returns is used as a measure of abnormal performance. ***, **, and * indicate significance of coefficients at the 1%, 5%, and 10% level, respectively.

	Intercept	RMRF	SMB	HML	Adj R^2
Three-month returns					
Infrequent 1–4 times/year	0.008***	1.099***	0.706***	-0.058	0.92
Frequent ≥ 9 times/year	0.002***	0.917***	0.355***	-0.015	0.97
Frequent – Infrequent	0.006***	0.182***	0.350***	-0.043	0.40
Six-month returns					
Infrequent 1–4 times/year	0.007***	1.093***	0.664***	-0.026	0.93
Frequent ≥ 9 times/year	0.002**	0.923***	0.373***	-0.000	0.96
Frequent – Infrequent	0.005***	0.169***	0.291***	-0.026	0.42
One-Year Returns					
Infrequent 1–4 times/year	0.006***	1.068***	0.711***	0.046	0.94
Frequent ≥ 9 times/year	0.002*	0.934***	0.382***	0.028	0.96
Infrequent – Frequent	0.005***	0.134***	0.329***	0.018	0.49
Two-Year Returns					
Infrequent 1–4 times/year	0.005***	1.077***	0.717***	0.099	0.94
Frequent ≥ 9 times/year	0.002**	0.944***	0.393***	0.060	0.96
Infrequent – Frequent	0.003***	0.133***	0.324***	0.040	0.49
Three-Year Returns					
Infrequent = 1–4 times/year	0.005***	-1.078***	-0.719***	-0.111*	0.94
Frequent ≥ 9 times/year	0.002**	-0.958***	-0.411***	-0.083**	0.96
Infrequent – Frequent	0.003***	0.120***	0.308***	0.028	0.46

nies with lower market-to-book ratios, and companies with more volatile stock returns obtained higher RRP, which suggests that these kinds of companies were more likely to be seeking (and finding) opportunities to buy back undervalued stock. We also found that the coefficient on the six-month prior market return was negative and significant, suggesting that companies pay lower Relative Repurchase Prices following market declines. This evidence suggests that corporate managers, besides recognizing when their own stock is undervalued, have also been able to time the aggregate market, repurchasing at lower prices when prior aggregate market returns have been lower.

Overall, the results summarized in Table 3 suggest that infrequent repurchasers have been able to buy back their stock at what turn out to be bargain prices—whether

because their own company or the general market is undervalued—while more frequent repurchasers appear to have other motives to repurchase than correcting—or profiting from—undervaluation of the company’s stock. Like dividends, stock repurchases provide companies with a means of returning excess capital, which can in turn improve corporate operating efficiency and returns on capital. But since infrequent repurchasers tend to be smaller and have more volatile stock, as well as higher cash holdings—which are also confirmed in Table 3—such companies are likely to be much less troubled by the concern about having too much capital that, by contrast, is likely to be an important consideration for companies that repurchase stock on a regular basis, with apparently much less attention to the prices paid.

Long-Run Risk-Adjusted Returns

Thus far, we have demonstrated that some companies have been able to use their repurchases to buy back undervalued stock by measuring relative prices over periods up to six months after the repurchase. In the final part of our study, we examined the post-repurchase returns of repurchasing companies over longer windows using risk-adjusted returns.⁸ Specifically, we examined calendar-time portfolios over several time periods: three, six, 12, 24, and 36 months following the repurchase.⁹ To the extent that corporate managers have better information about the prospects for their own company (for which there is persuasive evidence) or for the market in general (for which there is almost no evidence), we would expect positive long-run returns following repurchases.

For our full sample of 2,237 companies, we found that, on average, repurchasing companies had a positive and significant alpha of 0.3% per month over various windows from the repurchase month ranging from three to 36 months after the repurchase.

To examine the market-adjusted returns by repurchase frequency, we formed a portfolio of infrequent repurchasers (those that repurchase one to four times per year) and a portfolio for frequent repurchasers (those that repurchase at least nine times a year). As reported in Table 4, both portfolios exhibited significantly positive alphas over all horizons (from three months to three years). At the same time, the portfolio of infrequent repurchasers significantly outperformed that of frequent repurchasers over all horizons, with differences in “alpha” that ranged from a low of 0.3% to as much as 0.6% per month. These results are consistent with our earlier reported finding that companies that repurchase infrequently significantly outperform frequent repurchasers.

Overall, this long-run return evidence demonstrates that, on average, companies have been able to recognize when their stock is undervalued, and that companies’ ability to time the market in this way has depended significantly on the frequency of the repurchasing. These results suggest that some managers do time the market with repurchases and that the long-run performance can persist for three years or longer.

Conclusion

Using a new dataset of the average monthly price paid and shares repurchased for a complete sample of U.S. companies that bought back their stock on the open market between 2004 and 2011, our recent study examined the ability of companies to identify and profit from buying back undervalued stock. We compared the actual price paid in the repurchase with the average market price of the stock over several windows. We showed that many companies, and in particular those that buy back infrequently, have been able to time the market with repurchases.

To determine if the mispricing is evident at the announcement or revealed through information in the market prior to the repurchase, our study examined how the price paid in the repurchase relates to announcement returns, the stated motivation for the repurchase, and prior stock returns. Although we found little or no significant relation between the announcement return or stated motivation and the Relative Repurchase Price, we did find that companies paid a lower price after general market declines. This evidence is consistent with corporate managers responding to the market’s overreaction to negative information about the firm through repurchases. We also find that companies pay a lower price after an aggregate market downturn, suggesting that managers time the aggregate market as well as the market for their own stock.

Did these lower prices paid in a repurchase result in long-run abnormal performance? Controlling for the Fama and French factors, our study found that infrequent repurchasers earn a significantly greater return than frequent repurchasers, with an alpha on the difference between the groups of 0.6% per month over three months and 0.3% per month over 36 months.

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8. These risk-adjusted returns are captured by the intercept (or “alpha”) utilizing Fama and French (1993) regressions. The regressions control for the three Fama and French factors: the market return minus the risk-free rate (RMRF), returns on a portfolio of small firms minus returns on a portfolio of big firms (SMB), and returns on a high book-to-market portfolio minus returns on a low book-to-market portfolio (HML).

9. For the month of the repurchase, we estimate the return by comparing the repurchase price with the month-end closing price to capture the return relative to the repurchase price. All other monthly returns are calculated using monthly returns from CRSP. Portfolios are rebalanced monthly, calculating an equal-weighted excess return. The monthly returns are regressed on the three Fama and French factors as detailed in Fama

and French (1993). These portfolios are described in Kothari and Warner (2006) and utilized in Ikenberry, Lakonishok, and Vermaelen (2000a). For each calendar month of the sample period, we construct a portfolio containing all firms making a repurchase within the prior three, six, 12, 24, or 36 months. To do this, we add firms to the portfolio in the month that they repurchase stock, and the stock is retained in the portfolio for three, six, 12, 24, or 36 months. Portfolios are rebalanced each month and an equal-weighted portfolio excess return is calculated. The resulting time series of monthly excess returns is regressed on the three Fama and French (1993) factors: RMRF, SMB, and HML. The estimated intercept from the regression of portfolio returns is used as a measure of abnormal performance.

Appendix **Variable Definitions**

The table reports regressions of the relative repurchase price on firm and repurchasing characteristics. Relative repurchase price is measured as the percentage difference between the average repurchase price paid by the firm during a repurchase month (as reported in the 10 K) and the average closing stock prices as reported on CRSP, during various windows: repurchase month plus one, three, and six months. Accounting variables are summarized at the firm-year, measured at the fiscal year-end before the repurchase month. See the Appendix for variable definitions. The regressions include year- and firm-fixed effects and clustered standard errors at the firm level. P-values are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

A.1. Data from 10-Ks on EDGAR

Frequent repurchaser — Indicator equal to one if the firm repurchases nine or more months in a given year.

Infrequent repurchaser — Indicator equal to one if the firm repurchases four or fewer months in a given year.

Annual repurch/MV — Sum annually of the monthly amounts spent on repurchases divided by the prior period's market value of equity.

Repurch size/MV — Average price paid for the shares repurchased times the number of shares repurchased (as given the 10-K) divided by the market value of equity from the previous quarter (from Compustat).

A.2. Data from Compustat, measured at fiscal year-end prior to repurchase

Total assets — Given in millions, adjusted for inflation, in 2011 dollars.

Market-to-book — Market-to-book ratio, measured as market value of equity plus the long term debt and the current portion of long-term debt divided by total assets.

Return on assets — Measured as income before extraordinary items for the four quarters prior to the repurchase divided by total assets.

Leverage — Long-term debt and the current portion of long-term debt divided by total assets.

Cash-to-assets — Measured as cash and equivalents divided by total assets.

Dividend payout — Measured as cash dividends divided by total assets.

A.3. Data from CRSP

Announcement return — Three-day abnormal return, measured net of the value-weighted CRSP market, surrounding the announcement of the stock repurchase program.

Prior six-month market return — The CRSP value-weighted index return for the six-month period prior to the actual repurchase.

Prior six-month firm abnormal return — Compounded daily excess returns for the repurchasing firm (over the CRSP value-weighted index), measured over the six-month period prior to repurchase month.

Stock return volatility — Stock return volatility measured over prior six months.

Bid-ask spread — Average bid-ask spread measured over prior six months.

A.4. Data from IBES

Number of analysts — Natural log of the number of analysts following the stock from I/B/E/S prior to the repurchasing month.

Percent of analyst downgrades — Number of analyst downgrades divided by total number of analyst recommendations for repurchasing firm. Includes all analyst recommendation events covered by I/B/E/S in the six months prior to the repurchase month.

Change in six-month average EPS forecast — Change in average EPS forecasts of all analysts for the repurchasing firm, measured from six months prior to the repurchase through the repurchase month.

EPS forecast dispersion — Standard deviation of EPS forecasts divided by the average forecast using the forecast closest but prior to the repurchase month.

A.5. Data from the Insider Filing Data Feed, from Thomson Reuters

Net insider buying — Net insider purchases minus insider sales in the month of the repurchase, divided by the shares outstanding in the quarter prior to the repurchase.

A.6. Data from Factiva

Stated motivation of mispricing — Indicator equal to one if repurchase program announcement includes mention of “undervaluation” or “best use of money,” as in Peyer and Vermaelen (2009).

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