Actual Share Reacquisitions in Open-Market Repurchase Programs

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ABSTRACT

Unlike Dutch auction repurchases and tender offers, open-market repurchase programs do not precommit firms to acquire a specified number of shares. In a sample of 450 programs from 1981 to 1990, firms on average acquire 74 to 82 percent of the shares announced as repurchase targets within three years of the repurchase announcement. We find that share repurchases are negatively related to prior stock price performance, suggesting that firms increase their purchasing depending on its degree of perceived undervaluation. In addition, repurchases are positively related to levels of cash flow, which is consistent with liquidity arguments.

EQUITY REPURCHASES, SPECIFICALLY open-market repurchases, are a commonly used method of distributing corporate cash flows to shareholders. In recent years, the dollar value of announced share repurchases has been approximately one half the value of all dividend payments, or about $65 billion in 1994 alone. Open-market repurchase programs have become increasingly popular relative to Dutch auction or fixed-price tender offer repurchases and represent approximately 90 percent of the dollar value of all announced repurchase programs.[1]

The questions of how many shares are actually acquired subsequent to an open-market repurchase program announcement and to what extent firms exploit the flexibility inherent in these programs are empirical issues that have not been addressed in the academic literature but have raised concerns in the popular press. For example, both *The Wall Street Journal* (March 7, 1995) and *Fortune* (September 4, 1995) have argued that actual reacquisitions are small relative to firms' announced intentions and suggest that announcement of an open-market repurchase program is merely an attempt by management to raise the firm's stock price at little or no cost.

This paper describes the difficulty of measuring actual open-market share repurchases and proposes several alternative measures of actual share re-

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[1] See Power, *The Wall Street Journal*, March 7, 1995, "Most Buybacks Are Stated, Not Completed," pp. c1–c2; also see Ikenberry, Lakonishok, and Vermaelen (1995).

purchases. We then document the magnitude of actual open-market share repurchases. We argue that the popularity of open-market repurchase programs is less likely due to managers attempting to manipulate their firm's stock price than to the inherent flexibility of these programs with respect to the timing and quantity of actual purchases.[2]

Our sample consists of 450 open-market repurchase program announcements from 1981 through 1990. In contrast to speculations in the press, our evidence suggests that 74 to 82 percent of the shares targeted at the time of the original announcement are subsequently repurchased. It also appears that firms generally repurchase either substantially all or almost none of the shares announced at the time of program initiation. Three years after the announcement, more than one half (57 percent) of the firms bought back at least the number of shares targeted in the original repurchase announcement, 10 percent of the firms bought less than 5 percent of the number of shares announced, and a substantial number of firms reacquired no shares at all. After completing the initially announced repurchase program many firms continue to repurchase shares—30 percent of the firms in our sample repurchased twice as many shares as originally announced.[3]

We also examine the factors affecting the timing and magnitude of stock repurchases. We find that repurchases in one quarter are negatively related to the performance of the firm's stock in the prior quarter, as well as to the cumulative return on the firm's stock since the announcement of the program. This finding provides additional support for the hypothesis that managers repurchase shares when they believe their firm is undervalued (Dann (1981), Vermaelen (1981), Comment and Jarrell (1991), Ikenberry et al. (1995)). Our estimates indicate that quarterly repurchases are positively related to both the expected and surprise components of the firm's quarterly cash flows, suggesting that managers adjust their stock repurchases for unexpected changes in the firm's cash position. Such adjustments would not be possible if the manager were required either to precommit to a specific quantity, or dollar value, of share repurchases or to precommit to the timing of these repurchases.

The remainder of this paper is organized as follows. We provide a brief discussion of the related literature in Section I. In Section II, we introduce potential reasons why the flexibility implicit in open-market share repur-

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[2] Although firms are not required to announce share repurchases, the announcement of the firm's intent to repurchase shares on the open market (or through privately negotiated transactions) is one of the "safe harbor" provisions under the stock price manipulation provisions of the Securities and Exchange Act.

[3] These plans are frequently adjusted (expanded) and the announcement of these changes is voluntary and rarely reported by *The Wall Street Journal*. Share repurchases are measured for the three years following the program's announcement; our estimate of share repurchases is constructed to measure only the extent to which firms complete their "original" repurchase program. If the shares repurchased after completing the initially announced program are also included in our repurchase measure, then the average firm repurchases 266 percent of the announced number of shares and the median firm repurchases 125 percent.

chase programs could be valuable and the associated factors that could explain share buyback behavior empirically. In Section III, we describe the sample, discuss the construction of alternative measures of actual open-market share repurchases, and present univariate statistics for the alternative share repurchase measures. We consider the abnormal returns at the announcement of the repurchase plans and their relation to subsequent buyback activity by the firm in Section IV. We test the flexibility arguments directly by estimating equations that predict share repurchases as a function of lagged stock returns and the firm's cash flows; these results are reported in Section V, followed by a brief conclusion in Section VI.

I. Literature Review

There are three primary methods a firm may use to repurchase its own equity: (1) tender-offer repurchases, (2) Dutch auction repurchases, and (3) open-market repurchases. Dann (1981), Vermaelen (1981), Asquith and Mullins (1986), and Comment and Jarrell (1991) have identified significant, positive abnormal returns associated with the announcement of each of the three types of repurchase arrangements. This stock-price increase around the announcement of share repurchases is usually interpreted as support for the asymmetric information, or signalling hypothesis, which states that firms buy back their own equity when their managers have private information that the firm's stock is underpriced. A stock repurchase announcement signals management's information about their company's undervaluation, so the stock price rises when this information is revealed. Similarly, share repurchases may result in the redistribution of wealth among investors. Brennan and Thakor (1990) derive an analytical model suggesting that share repurchases result in a redistribution of wealth from small, uninformed shareholders to large, informed shareholders. Because information gathering is costly, only large shareholders will profit from becoming informed; uninformed shareholders will tend to sell when the market price is too low and remain when the market price is too high.

Comment and Jarrell (1991) compare the three most common ways of repurchasing securities: tender offers, Dutch auction repurchases, and open-market repurchases. They find that tender offers tend to be for the largest number of shares and to have the largest stock-price reaction, and open-market repurchase plans tend to be the smallest, in terms of both the number of shares targeted and the stock-price reaction. Comment and Jarrell interpret their results as suggesting that fixed-price tender offers generally signal the most information to investors and open-market repurchases the least.

There also appears to be evidence that firms time their repurchase announcements to take advantage of periods when their equity is more undervalued by the market. Comment and Jarrell (1991) find that firms tend to announce open-market repurchase plans following a decline in their share price, when their stock is more likely to be undervalued. Ikenberry et al.

(1995) find that subsequent performance, especially for "value" firms, is sufficiently high that even investors who purchase after the announcement day, including the firm itself, can earn abnormal returns. This abnormal performance strongly suggests that these firms were in fact undervalued at the time of the announcement of the repurchase program.

Ikenberry and Vermaelen (1995) propose an alternative interpretation, treating open-market repurchases as exchange options that give the firm the ability to exchange the market value of the firm for its "true" value at management's discretion. The stock-price increase around the announcement comes in part from the option to buy back shares which is "created" when an open-market repurchase plan is announced.

II. Factors Affecting the Timing of Share Repurchases

A. *The Asymmetric Information or "Undervalued" Equity Hypothesis*

The asymmetric information or "undervalued" equity hypothesis suggests that the increase in share price results from the information revealed by the announcement; Asquith and Mullins (1986) call the announcement of a repurchase program a "news bulletin" that management is convinced the firm is undervalued. This explanation of share repurchases suggests that managers time their share repurchases for when they believe their firm's stock is most undervalued. There is substantial evidence that asymmetric information is an important determinant of the initiation of repurchase programs for initiations are: preceded by poor performance (Comment and Jarrell (1991)), greeted by the market positively (Dann (1981), Vermaelen (1981)), and followed by good earnings and stock price performance (Bartov (1991), Ikenberry et al. (1995)). An open-market repurchase program allows managers the flexibility to purchase less stock than planned if the stock becomes more expensive or more stock if it remains less expensive. Thus, the asymmetric information hypothesis predicts that repurchases will increase following poor stock price performance and decrease following good stock price performance.

B. *Cash Flow Considerations*

A clear prediction of any theory of payout policy is that the quantity of payouts will vary positively with the firm's cash flow. Although managers of firms announcing share repurchase programs are likely to expect cash flows high enough to cover some future payouts, there is uncertainty regarding the future cash flow streams and cross-sectional variation among the repurchasing firms' cash flow positions. There are large reputational penalties for reducing dividends (Bajaj and Vijh (1990), Kaplan and Reishus (1990), Denis, Denis, and Sarin (1994)), but this same phenomenon has not been documented for failure to complete a previously announced open-market repurchase program. Thus, we might expect firms to utilize their ability to vary actual repurchases as a way of adjusting payouts without attracting atten-

tion, which would imply a positive relation between a firm's share repurchases and its cash flows.

III. Sample Construction and Univariate Analysis of Repurchases

A. Sample Selection

To examine actual reacquisition of shares in open-market repurchase programs, we construct a sample of open-market repurchase program announcements designed to facilitate measurement of stock purchases by the firm subsequent to the announcement of the repurchase program. The initial sample consists of all 944 open-market repurchase programs announced from 1981 to 1990 in *The Wall Street Journal Index*, excluding the 995 announcements made during the fourth quarter of 1987. We exclude repurchase announcements made during the fourth quarter of 1987 for two reasons. First, most of the existing literature (see Bartov (1991) or Ikenberry et al. (1995), for example) excludes them and we would like our results to be comparable (a detailed examination of repurchase activity after the 1987 market crash is provided by Netter and Mitchell (1989)). Second, the sheer number of repurchase programs announced during this period suggests that they are different in some important respect from more typical programs and including them would lead to time-clustering problems because market-wide shocks affect all these observations in the same way. We do not consider repurchase announcements subsequent to 1990 because we wish to calculate the number of shares repurchased by these firms for three years following the open-market repurchase program announcement.

We eliminate a number of observations from the sample because of data constraints. Forty-eight repurchase programs are excluded because the number of shares involved in the repurchase program is unavailable.[4] Ninety announcements are excluded for either lack of event period returns, estimation period returns necessary to calculate the event period abnormal returns, or returns subsequent to the announcement. One hundred twenty-three firms delist in the three years subsequent to the announcement and 92 announcements are excluded due to a prior repurchase program within three years of the current program, precluding our ability to measure repurchases in these programs.[5]

For the sections of our analysis requiring only information in the original announcement and from the Center for Research in Securities Prices (CRSP) database, these selection criteria leave us with a sample of 591 open-market

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[4] Announcements typically include the number of shares to be repurchased, the percentage of shares to be repurchased, and/or the total dollar amount of the repurchase plan. When only the dollar amount of the repurchase program is given, the share price on the announcement date is used to calculate the actual number of shares intended to be repurchased.

[5] Ninety-two of our programs announce secondary open-market repurchase programs in the three years subsequent to the original repurchase announcement, but none repurchase stock through tender offers or Dutch auctions during this period.

repurchase program announcements. Of these 591 cases, 141 firms do not have all of the required data available on Compustat for 12 quarters subsequent to the announcement, yielding a primary sample of 450 observations. Additionally, one of our measures of share repurchases relies on the "Purchases of Common and Preferred Stock" from Compustat quarterly cash flow data. Because this data item is not available prior to 1984, our sample is further reduced to 370 observations when this variable is required.

Table I partitions the sample by year. The average announced size of an open-market repurchase program is approximately 7 percent of the firm's total shares outstanding on the date of announcement; the median is approximately 5 percent of the firm's shares outstanding. The number of open-market repurchase programs per year is roughly constant over the sample period; however, there is a large spike in repurchase announcements in 1984 when 68 announcements are included in the sample. Additionally, the programs are generally increasing in size during the sample period.

B. Measuring Reacquired Shares

Our analysis relies on accurate measurement of the number of shares actually acquired by the firms. However, share repurchases can be neither observed at the time the transaction occurs nor directly measured afterward. We examine four alternative proxies for the number of shares repurchased to mitigate the effect of potential measurement error.

The measures we use as possible proxies for the actual number of shares repurchased by firms subsequent to the announcement of an open-market repurchase program are: (1) monthly decreases in the firm's shares outstanding from CRSP cumulated quarterly, (2) quarterly decreases in the firm's shares outstanding from Compustat, (3) dollars spent (a) reacquiring firm securities, assuming firms are able to purchase at the minimum price for the security in a given quarter, and (b) reacquiring securities, assuming firms purchase the securities at the average of the three monthly closing prices for the quarter, (4) quarterly increases in the dollar value of the firm's treasury stock divided by (a) the average of the three monthly closing prices for the quarter, and (b) the minimum price for the security in a given quarter. We scale each measure by either the total number of shares outstanding at the time of announcement or the number of shares announced in the repurchase program; the results are similar using either scaling factor. Each of these measures, as well as the differences in their construction and biases, is discussed below.

B.1. CRSP Shares Outstanding

The primary measure we use to proxy for share repurchases is the monthly *decrease* in shares outstanding reported by CRSP, adjusted for nonrepurchase activity affecting shares outstanding, such as stock splits. We do not offset monthly decreases with increases in the other months in the same quarter, because it is possible, even when a firm is actively repurchasing

Table I

Share Repurchases and Open-Market Repurchase Announcements by Year

Our sample selection begins in 1981 and ends in 1990, thus there are no third-year repurchases for 1982 and no second- and third-year repurchases for 1981. Nor are there first-year repurchases in 1991 or first- and second-year repurchases in 1992. Meaningful comparisons can only be made for the years 1983 to 1990 inclusive. The mean and median numbers of shares targeted for repurchase at the time of the program's announcement are expressed as a percentage of shares outstanding; and the actual repurchases are expressed as a percentage of the number of shares targeted at the time of the announcement. Actual share repurchases are measured as the cumulative monthly decreases in shares outstanding per CRSP. The share repurchases variables are truncated at both 0 and 1 by construction. Increases in shares outstanding or share distributions are not used to offset share buybacks truncating the variable at 0. Repurchases above 100 percent of the target level of repurchases are defined to be zero to mitigate the effects of secondary announcements or repurchase program expansions.

| | | Target Shares | | Actual Shares Repurchased | | | | | |
| | | | | Annual Share Repurchases | | | Cumulative Annual Repurchases | | |
Year	#	Mean Announced	Median Announced	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
1981	23	6.02%	2.81%	66.20%			66.20%		
1982	43	4.62	3.60	47.24	13.04%		47.24	79.24%	
1983	15	4.48	3.07	47.03	15.14	1.70%	47.03	62.17	80.94%
1984	68	5.34	4.48	53.02	21.95	6.69	53.02	68.98	68.86
1985	46	6.48	4.68	44.73	12.91	4.53	44.73	65.93	73.51
1986	48	6.07	4.59	51.34	19.63	5.44	51.34	64.36	71.37
1987	43	9.11	7.02	70.06	21.97	11.30	70.06	73.31	75.61
1988	55	8.74	6.18	55.00	11.17	3.54	55.00	81.17	76.85
1989	53	8.98	7.71	53.78	19.64	4.73	53.78	74.64	85.90
1990	56	7.40	5.46	54.82	8.84	3.85	54.82	62.62	78.49
1991					7.99	3.79		62.81	66.41
1992						3.60			66.41
All	450	7.0%	5.00%	54.10%	14.6%	5.10%	54.10%	68.70%	73.80%

shares, for monthly shares outstanding to increase through distribution of shares to benefit plans, the exercise of executive stock options, or even through contemporaneous stock sales. To the extent that the firm both repurchases shares and distributes shares within the same month, this proxy for repurchased shares understates the true quantity of repurchases.

B.2. Compustat Shares Outstanding

A similar measure can be constructed using the number of shares outstanding reported on Compustat. Quarterly decreases in the number of Compustat shares outstanding produces a measure of shares repurchased that should be nearly identical to the CRSP measure. However, use of the longer quarterly time period versus the monthly time period available on CRSP increases the probability of share repurchases and distributions crossing within the same time period, thereby understating actual share repurchases more severely than the CRSP-based measure.

B.3. Purchases of Common and Preferred Stock
from Compustat Cash Flow Data

The net dollars spent on repurchases or retirements of the firm's own securities is reported on the Statement of Cash Flows or Flow of Funds Statement and is provided on the quarterly Compustat tapes. There are, however, two issues that must be addressed when using this variable to construct a measure of the number of repurchased shares. First, we do not know the price of the shares repurchased. We compute the number of shares repurchased under one of two alternative assumptions: (1) the shares were purchased at the lowest price during the quarter, or (2) they were purchased at the average monthly closing price during the quarter. The lowest price assumption is based on the notion that managers use their informational advantages over other investors; however, the assumption overstates the number of shares repurchased as it is unlikely that managers were able to execute all their purchases at the minimum price.[6] Additionally, if many of the repurchases are conducted through privately negotiated block transactions that may contain premiums associated with take-over defenses or "green-mail" type payments, the number of shares repurchased through these privately negotiated block trades is even more likely to be overstated.

A second problem with this measure of share repurchases is that the repurchase figure from Compustat is an aggregate of all security repurchases and retirements during the quarter. This aggregation may result in serious

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[6] The low price assumption implicitly requires that managers are able to recognize contemporaneously the lowest price of the firm's stock during the quarter and are able to execute all trades at this price. The trade restrictions imposed by the antimanipulation "safe harbor" provisions essentially preclude the execution of all trades at this price, even if management is able to recognize this as the lowest price of the quarter. Additionally, the low price is likely to be a bid price, which further reduces the likelihood that all trades take place at precisely this price.

overstatement of share repurchases and may, in some instances, double-count repurchases.[7] To the extent that the firm has engaged in any of these other types of transactions, this measure will overstate the actual repurchases. Thus, the combination of these two effects implies that the flow of funds measure, especially with the lowest price assumption, overestimates actual repurchases of common stock.

B.4. Compustat Changes in Treasury Stock

The final measure is computed from the quarterly change in the dollar value of Treasury stock reported by Compustat. This measure suffers from both of the previously discussed problems of not knowing the repurchase price, as well as repurchases and distributions overlapping in the same period. We again compute two estimates of shares repurchased based on changes in the dollar value of Treasury stock divided by either the average monthly closing price or the low price during the quarter. The measure based on changes in the dollar value of Treasury stock has the most potential sources of bias and is likely to have the lowest correlation with the firm's actual share repurchases of any of the repurchase measures.

C. Comparison of the Alternative Repurchase Proxies

Table II presents statistics on the timing and quantity of repurchases by quarter subsequent to the announcement of the programs. Panel A presents estimates of the extent to which firms complete their repurchase programs as originally announced; Panel B documents total repurchases, including repurchases in excess of the quantity specified in the initial announcement.

Several results are apparent from Table II. First, the observed differences in the repurchase levels are consistent with our expectations about the problems with inferring the number of shares repurchased from a dollar figure that potentially includes repurchases of preferred stock and that assumes a low price for common stock repurchases. The measures based on the dollar value of share repurchases are likely overstated and imply noticeably larger repurchase levels than do the measures based on changes in shares outstanding. The truncation imposed in the construction of the repurchase measures presented in Panel A results in the dissipation of these differences over

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[7] This aggregation includes: (1) conversions of classes A, B, and special stock into common stock, (2) conversion of preferred into common, (3) purchase of Treasury stock, (4) retirement of common stock, (5) retirement of preferred stock, and (6) redemption of redeemable preferred stock. Treasury stock is reported by the firm as a contra account or debit to owner's equity for financial reporting purposes. The increase in Treasury stock value associated with an equity repurchase is included by Compustat in the aggregate figure, Purchases of Common and Preferred Stock (Compustat quarterly data item 93). If the firm holds the shares as Treasury stock or retires the shares, the value included in this aggregation is an accurate reflection of the cost of acquiring the shares. However, if the shares are subsequently distributed or reissued, this aggregation will also capture any change in the market value of the shares since the time they were repurchased. We thank Doug Malcom at Compustat for his invaluable assistance with this problem.

Table II

Alternative Measures of Average Quarterly Share Repurchases Through Time Relative to Announcement

Share repurchases are expressed as the average percentage of the number of shares announced at the time of the repurchase plan initiation and are given for 12 quarters, beginning with the quarter of the announcement and ending after the eleventh quarter subsequent to the plan announcement. Panel A presents cumulative repurchases truncated at both 0 and 100 percent. Quarterly repurchases are defined to be zero once cumulative repurchases reach 100 percent of the target shares announced at the time of initiation of the open-market repurchase program. Panel B provides the mean cumulative quarterly share repurchases, where repurchases are only truncated at 0; this repurchase measure allows for firms to repurchase more than announced at the plan's initiation. These data are not truncated at 100 percent of the target and likely overstate repurchases attributable to this announcement because no adjustment is made to mitigate for program expansions or subsequent repurchase programs. Quarterly and cumulative repurchases are expressed as a percentage of shares announced at the time of program initiation. Panel C provides the percentage of firms in the sample that have repurchased at least the specified percentage of shares announced; Panel D provides the percentage of firms in the sample that have not repurchased the specified percentage of shares. In Panels C and D, the measure of repurchased shares is the cumulative month-to-month decreases in shares outstanding from CRSP.

Repurchase Measures:	Quarter Relative to Announcement											
	0	1	2	3	4	5	6	7	8	9	10	11
Panel A: Cumulative Quarterly Repurchases—Cumulative Repurchases Truncated at 100 Percent												
CRSP decreases in shares outstanding	6.3	23.2	37.8	46.2	54.4	59.0	62.6	66.9	68.8	70.6	72.4	73.9
Compustat decreases in shares outstanding	12.9	25.7	34.1	39.7	45.7	49.6	52.9	56.1	58.5	60.7	62.6	65.3
Dollars spent on repurchases / average price	34.2	54.5	64.6	70.4	74.3	76.7	77.8	78.7	79.5	80.0	81.0	81.9
Dollars spent on repurchases / low price	34.3	54.7	65.7	71.6	75.5	77.5	78.7	79.6	80.0	80.3	81.2	82.0
Increases in the dollar value of Treasury stock / average price	9.8	17.5	22.2	26.7	31.3	34.1	35.8	37.9	40.3	42.2	43.3	44.9
Increases in the dollar value of Treasury stock / low price	10.3	17.7	22.3	26.7	31.7	34.5	36.1	38.0	40.3	42.3	43.4	45.2
Panel B: Cumulative Quarterly Repurchases—Not Truncated												
CRSP decreases in shares outstanding	25.4	45.8	61.4	78.2	139.0	155.3	174.1	192.5	210.1	225.2	237.5	266.2
Compustat decreases in shares outstanding	17.6	32.0	80.3	88.8	111.7	162.9	174.1	195.0	204.3	216.5	224.0	234.9
Dollars spent on repurchases / average price	70.1	163.2	246.9	322.8	421.7	546.9	605.9	672.9	746.4	830.8	897.1	961.4
Dollars spent on repurchases / low price	77.2	178.6	267.1	347.8	465.0	614.0	679.6	753.2	833.9	925.8	998.6	1064.0
Increases in the dollar value of Treasury stock / average price	10.4	24.2	33.1	42.4	73.7	89.9	98.3	108.5	125.4	145.3	156.2	167.4
Increases in the dollar value of Treasury stock / low price	11.7	26.1	36.2	45.6	92.5	110.9	119.9	131.0	150.1	171.8	183.6	197.0
Panel C: Percentage of Firms Repurchasing More than												
200 percent of announced shares	1.77	2.67	4.22	6.67	8.66	12.66	17.11	19.33	22.44	25.55	27.33	30.44
100 percent of announced shares	5.33	10.44	16.0	23.77	30.66	36.44	41.33	45.56	48.22	52.0	54.44	57.11
50 percent of announced shares	14.89	30.88	41.33	50.88	56.44	60.0	64.22	67.11	69.55	70.67	71.78	73.55
Panel D: Percentage of Firms Repurchasing Less than												
20 percent of announced shares	71.33	49.55	40.88	33.11	27.77	25.11	23.11	20.67	19.55	18.88	18.44	16.88
5 percent of announced shares	60.88	37.33	27.55	20.88	17.11	15.33	14.44	13.55	11.78	11.33	11.11	10.0
1 percent of announced shares	57.11	32.66	22.66	16.22	13.11	11.11	10.67	9.55	7.78	7.50	7.33	6.67

time, as more firms reach completion under each of the alternative repurchase measures. However, these differences persist or even grow through time when the measures are not truncated (Panel B). The differences observed between the cumulative repurchases as measured by the truncated data (Panel A) versus repurchases as measured by the data without truncation (Panel B) suggest either that repurchases are often not a one-time event and represent an ongoing payout strategy or that initial limits from one-time programs could simply be exceeded. In either case, firms do so rather quickly—many firms exceed initial limits within the first two quarters of the program.

The truncated values from Panel A provide estimates of what fraction of the shares targeted in a given plan are subsequently repurchased. The measures based on the dollars spent repurchasing the firm's securities, which are likely to be *overestimates*, show that approximately 82 percent of the original target shares are repurchased in the three years following the announcement of the program. The CRSP-based measure, which *underestimates* repurchases, shows that about 74 percent of the original target shares are repurchased. We therefore can bound expected actual repurchases during the three years following the announcement of the program at between 74 percent and 82 percent of the shares originally announced as the repurchase target.

We also suspect that the Compustat measure based on decreases in shares underestimates repurchases by more than the CRSP-based measure because increases in shares outstanding tend to offset decreases within a quarter more than when cumulated monthly. The data are consistent with this view. The Compustat shares-outstanding measure is generally lower than the analogous CRSP measure.[8] The measures based on changes in the dollar value of Treasury stock are generally quite different from the other measures, which is not surprising given that they have more potential sources of bias.

The distribution of cumulative share repurchases, including those shares repurchased after completion of the initial program, is described in Panels C and D. Although a large portion of the firms purchase at least their announced repurchase targets, there are still a significant number of firms that repurchase very little. More than one-half of the firms complete their announced programs and nearly one-third repurchase twice as many shares as they originally announced, but one-tenth of the firms repurchase less than 5 percent of their announced intentions.

IV. Abnormal Returns and the Announcement of Repurchase Programs

We obtain confirmation that our repurchase measures are, in fact, related to actual repurchases by modifying an equation originally estimated by Com-

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[8] One exception is the announcement quarter. In this quarter, the CRSP measure uses the change in shares outstanding from the date of the announcement, whereas the Compustat measure uses the change in shares outstanding over the entire quarter and is thus likely to overstate repurchases during this one quarter.

ment and Jarrell (1991). Comment and Jarrell and Ikenberry and Vermaelen (1995) find that announcement period returns are positively related to the fraction of shares stated in the original announcement of the repurchase program, presumably because a larger target signals better information about the company. If investors have information about what fraction of the announced target they anticipate will actually be repurchased, we would expect them to incorporate this information into their behavior. Thus, to the extent that investors can forecast the firm's future share repurchases, the announcement period abnormal returns should be related to actual share repurchases.

A. Calculating Abnormal Returns

We rely on standard event-study procedures to calculate the abnormal returns on the announcement of an open-market repurchase program.[9] The mean announcement period abnormal returns are 2.69 percent over a three-day event window starting the day prior to announcement, which is statistically significant ($t = 11.38$) and similar to results reported elsewhere in the literature (Dann (1981), Vermaelen (1981), Asquith and Mullins (1986), Comment and Jarrell (1991), Ikenberry et al. (1995)).

B. The Relation between Abnormal Returns and Subsequent Repurchases

The signalling explanation of repurchases predicts that the event-day returns on announcement of a program should be related to the information contained in the announcement. Comment and Jarrell (1991) find that larger announced repurchase targets are associated with higher abnormal event-day returns, suggesting that the size of the target proxies for the quality of management's information. We find some corroboration of this result in Model 1 of Table III, which contains a regression of the three-day abnormal returns on the fraction of shares the firm originally announces as a repurchase target, as well as the excess return for days -40 to -6 prior to the announcement. The coefficient on the repurchase target (0.0256) is positive and marginally significantly different from zero (t-statistic $= 1.57$).

One might expect that there are factors related to the market's evaluation of the information content of the repurchase announcement that affect ac-

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[9] We use a three-day event window starting the day prior to the announcement and ending on the day subsequent. Both abnormal returns and cumulative abnormal returns are calculated for each day in the event window. The abnormal return on any given day is the market model residual, which is the difference between the stock's actual return and the predicted return based on the market model parameter estimates and the market return for that day. The cumulative abnormal returns are the geometric cumulation of the abnormal returns. The parameters of the market model are estimated over a 100-day period beginning 165 days prior to the announcement and ending 65 days prior to the announcement, the CRSP equally weighted index is used as the proxy for market returns. Because many firms in the sample are relatively small, Scholes–Williams betas are utilized to adjust for any bias that may result from nonsynchronous trading. Event studies using standard market model OLS betas and abnormal returns defined as the excess firm returns over the CRSP equally weighted index produce both qualitatively and quantitatively similar results.

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Table III
Relation between Announcement Period Returns and Actual Share Repurchases

This table provides estimates of equations describing the relationship between abnormal returns at announcement of the repurchase programs and announced target levels of repurchases, actual share repurchases, and excess returns prior to announcement of the repurchase program. The dependent variable is the cumulative excess returns from the day prior to announcement through the day after announcement. The announcement period abnormal returns are the three-day geometric cumulation of the event study market model residuals. We use a three-day event window starting the day prior to the announcement and ending on the day subsequent. Both abnormal returns and cumulative abnormal returns are calculated for each day in the event window. The abnormal return on any given day is the market model residual, which is the difference between the stock's actual return and the predicted return based on the market model parameter estimates and the market return for that day. The cumulative abnormal returns are the geometric cumulation of the abnormal returns. The parameters of the market model are estimated over a 100-day period beginning 165 days prior to the announcement and ending 65 days prior to the announcement; the CRSP equally weighted index is used as the proxy for market returns. Because many firms in the sample are relatively small, Scholes–Williams betas are utilized to adjust for any bias that may result from nonsynchronous trading. An event study using standard market model OLS betas produces both qualitatively and quantitatively similar results. Actual share repurchases are quarterly share repurchases cumulated over the two years following the repurchase plan announcement (results are quantitatively and qualitatively similar for cumulative repurchases over the first year and over the entire three years). The cumulative excess returns are the individual firm's returns from day -40 through day -6 relative to the announcement date less the return on the CRSP equally weighted market index over the same period. The coefficients are estimated using ordinary least squares. t-statistics are given in parentheses below the estimated coefficients.

	Model 1	Model 2	Model 3	Model 4
Constant	0.0278	0.0176	0.01615	0.01613
	(10.01)	(4.784)	(4.284)	(4.279)
Announced share repurchases as a percentage of shares outstanding	0.0256	0.0005	−0.00114	−0.00323
	(1.57)	(0.0267)	(−0.0655)	(−0.0186)
Actual share repurchases as measured by CRSP expressed as a percentage of shares outstanding		0.14395		
		(3.018)		
Actual share repurchases as measured by repurchase dollars divided by the low price, expressed as a percentage of shares outstanding			0.1467	
			(3.471)	
Actual share repurchases as measured by repurchase dollars divided by the average closing price, exressed as a percentage of shares outstanding				0.1462
				(3.475)
Cumulative excess returns for 35 days (from day −40 through day −6 relative to announcement)	−0.0875	−0.0691	−0.0707	−0.07058
	(−4.63)	(−2.939)	(−3.019)	(−3.014)
Adjusted R^2	0.037	0.0564	0.0560	0.0561
Number of observations	591	591	370	370

tual repurchases but are unrelated to announced targets. For example, some firms might announce repurchase plans, but have expected cash flows too low to complete the programs; in this case we would observe a cross-sectional relation between announcement abnormal returns and subsequent repurchases. We include our measures of actual repurchases for the two years subsequent to the announcement of the program in Models 2, 3, and 4 of Table III to examine this hypothesis.[10] In each of these equations, actual repurchases are positively related to the event-day abnormal return. The coefficients on each of the measures are positive and significantly different from zero at conventional levels. In addition, the coefficient on the repurchase target becomes small and insignificantly different from zero, indicating that its relation with the event-day abnormal returns is due only to the correlation between announced size and the market's expectations of the firm's actual share repurchases.[11]

This result has three implications that should be emphasized. First, it suggests that our measures of repurchased shares are at least somewhat accurate, since noise in our measure of repurchased shares will lower the coefficient on actual share repurchases. Secondly, it suggests that the market has some ability to forecast actual repurchases because inaccurate market forecasts should decrease the informativeness of actual share repurchases.[12] Finally, it suggests that payoffs to firms that announce repurchase programs without actually having plans to repurchase any shares are minimal. Apparently the market can (at least partially) see through attempts at such manipulation.

V. Multivariate Analysis of the Factors that Affect the Repurchase Decision

A. Econometric Specification

We next estimate a model that predicts the factors affecting a firm's decision to repurchase shares. Our measures of actual purchases are available on a quarterly basis; we therefore use quarterly repurchases by a given firm as our dependent variable. In particular, our dependent variable in each of the cross-sectional models is the firm's quarterly share repurchases, scaled by either the number of shares targeted for repurchase or the number of shares outstanding at the time of the repurchase announcement. We per-

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[10] We have also estimated these equations using cumulative repurchases for one and three years subsequent to the announcement with similar results.

[11] The coefficients on the actual repurchases variable in this equation are biased downward because of reverse causality. If, for example, there is a strongly positive reaction to the announcement, underpricing will be reduced, lowering the firm's demand for reacquiring securities.

[12] It should be emphasized that the market's forecast of future repurchases, although reasonably accurate, still contains substantial noise, as can be observed from the R^2 estimates from these regressions of about 5 percent. A source of the residual uncertainty in the market's expectation of future repurchases is the fact that a number of factors determining subsequent repurchases such as future underpricing and future shocks to the firm's cash flow are not known at the time of the repurchase announcement.

form the analysis using repurchase measures that are truncated at the targeted level, as well as measures that allow share repurchases to exceed the initially targeted levels. In each case, we do not allow share repurchases to be negative even if the firm issued shares during the quarter.

Our choice of explanatory variables is guided by the prior discussion. Because of the asymmetric information arguments, we include lagged returns, both during the quarter prior to the quarter in question and cumulated since the repurchase announcement. Asymmetric information arguments suggest a negative coefficient on this variable, because positive returns are likely to bring an undervalued security closer to its fundamental value, but negative returns are likely to increase any undervaluation. We include a cash flow measure because of the arguments suggesting that firms will vary their repurchases depending on their cash flow situation. We break cash flows into expected and unexpected components, assuming a seasonal random walk model of earnings. Using this specification, we set expected cash flow equal to cash flow lagged four quarters, and we set unexpected cash flow equal to the change in cash flow over these four quarters.[13] In addition, we include in our equation controls for accumulated repurchases over the previous quarters subsequent to the repurchase announcement.

The resulting equation we estimate is:

$$\text{Repurchases in a quarter} = \alpha + \beta_1 \text{ Prior returns} + \beta_2 \text{ Expected cash flows}$$
$$+ \beta_3 \text{ Unexpected cash flows}$$
$$+ \beta_4 \text{ Previous repurchases} + \epsilon. \tag{1}$$

We estimate this equation using a Tobit model that explicitly accounts for the censorship of negative share repurchases, as well as truncation at 100 percent of targeted levels in the equations using the truncated dependent variable.[14] The "Repurchases in a quarter" variable is the actual repurchases for that quarter scaled by either the target number of shares in the program or the total number of shares outstanding, depending on the specification. The "Prior returns" variable is either the return for the quarter preceding the one in question or the cumulative return from the announcement of the repurchase program until the beginning of the quarter (or both in some specifications). The "Previous repurchases" variable is the percentage of announced target shares repurchased in the prior quarter, supplemented in some specifications by the cumulative percentage of announced shares repurchased since the announcement of the repurchase program. Where

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[13] Cash flow is measured as income before extraordinary items (Compustat quarterly data item 25) plus depreciation expense (Compustat quarterly data item 5) standardized by the firm's total assets (Compustat quarterly data item 44). We also estimate cash flow expectations from the more sophisticated models of Foster (1977) and Brown and Rozeff (1978), with very similar results.

[14] See Maddala (1983, p. 160) for a discussion of the estimation and properties of Tobit models with both upper and lower bounds on the dependent variable.

indicated, the estimated equations contain dummy variables for calendar years and for the quarter or year relative to the announcement of the repurchase. Because repurchase activity is known to decrease with time elapsed since the repurchase program was initiated (Table II), we control for this effect explicitly. We also control for calendar years to account for potential macroeconomic effects on repurchase activity. All equations exclude the quarter of the initial announcement because we require returns subsequent to the announcement but prior to the quarter in question.

B. Multivariate Results

We present estimates of equation (1) in Table IV. The firm's current quarter share repurchases appear to be negatively related to the firm's previous (unadjusted) stock returns. In each of the models the coefficient on previous quarter stock returns is negative and significantly different from zero at standard inference levels. Current quarter repurchases also appear to be negatively related to both the cumulative returns on the firm's stock from the time of announcement through the quarter in question and the current quarter stock return; the coefficients on these variables are generally negative and often significant, although the relation is not nearly as strong as that observed with prior quarter returns. The negative relation between current share repurchases and prior stock returns is consistent with the predictions of the asymmetric information hypothesis, since undervaluation is likely to be greater following poor performance.

In addition, the coefficients are large enough to be economically meaningful. Model 1 in Table IV implies that predicted repurchases in the third quarter subsequent to the announcement of a program changes from 7.46 percent of the announced target when the company's stock return in the previous quarter is −16.7 (the median of the bottom quintile of returns) to 5.74 percent when the company's return is 24.5 percent (the median of the top quintile of returns). This drop of 1.72 percentage points is 26.3 percent of the median repurchases for quarter 3, suggesting that the estimated effects are economically important.[15]

A company's decision to repurchase shares in the open market is also related to its cash flows. The coefficients on both expected and unexpected cash flows are positive and significantly different from zero. This result suggests that a firm's ability to pay affects the firm's decision to repurchase stock. It also suggests that firms exploit the flexibility of open-market repurchase programs to adapt to potential surprises in their cash positions. Model 1 in Table IV predicts that when lagged cash flows are equal to the median of the bottom quintile and other variables are at their means, the firm will repurchase 5.77 percent of the target shares in the third quarter subsequent to the repurchase announcement, compared with 7.54 percent if cash flows are equal to the median of the top quintile. This change is a

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[15] We choose quarter 3 for 1986 merely for illustrative purposes. The results for any other quarter or year would be similar.

Table IV

Tobit Estimates Predicting Actual Share Repurchases

This table provides estimates of the relation between actual repurchases and variables likely to affect the repurchase decision. The dependent variable is the quarterly decrease in shares outstanding per CRSP expressed as a percentage of the announced number of shares. Returns are the monthly firm returns per CRSP cumulated geometrically to obtain quarterly returns. Announcement quarter returns are cumulated from two days after announcement through the end of the quarter. Expected cash flow is measured as the income before extraordinary items (Compustat quarterly data item 25) plus depreciation expense (Compustat data item 5). Unexpected cash flow is the seasonal first differences or the current quarter's cash flow minus the cash flow for the corresponding quarter from the preceding year. Previous quarter share repurchases is the percentage of the shares targeted at announcement repurchased during the prior quarter and the Cumulative share repurchases is the total percentage of targeted shares repurchased from the quarter of announcement through the prior quarter. Calendar year dummy variables are used to control for time period differences and dummy variables for the quarter relative to announcement are used to control for program life-cycle effects. In Models 3 and 5, the actual equation estimated is a one-tailed Tobit model truncated at zero. The actual equation estimated in Models 1, 2, and 4 is a two-tailed Tobit truncated at both zero and one. t-statistics are given in parentheses below the estimated coefficients. The likelihood function estimated for the two-tailed Tobit model is given by:

$$L(\beta,\sigma|y_i,x_i,L_{1i},L_{2i}) = \prod_{y_i=L_{1i}} \Phi\left(\frac{L_{1i} - \beta'x_i}{\sigma}\right) \prod_{y_i=y_i^*} \phi\left(\frac{y_i - \beta'x_i}{\sigma}\right) \prod_{y_i=L_{2i}} \left[1 - \Phi\left(\frac{L_{2i} - \beta'x_i}{\sigma}\right)\right].$$

Independent Variables:	Repurchases as a Percentage of Shares Announced			Repurchases as a Percentage of Shares Outstanding	
	Truncated Data		No Data Truncation	Truncated Data	No Data Truncation
	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	−0.1652	−0.0979	−0.7329	−0.0261	−0.7711
	(−5.658)	(−3.461)	(−10.666)	(−9.585)	(−10.994)
Current quarter return		0.0026	−0.1634	−0.0004	−0.3806
		(0.051)	(−1.304)	(−0.081)	(−3.004)
Previous quarter return	−0.1844	−0.1297	−0.3633	−0.0145	−0.3809
	(−3.153)	(−2.125)	(−2.690)	(−2.458)	(−2.835)
Cumulative return through previous quarter		−0.0568	−0.0771	−0.0048	−0.0449
		(−2.350)	(−1.773)	(−2.028)	(−1.052)
Expected cash flow	1.6386	2.2080	3.6235	0.1296	2.8682
	(3.608)	(4.761)	(3.603)	(3.074)	(2.934)
Unexpected cash flow	0.9102	1.1965	2.6290	0.0899	2.9824
	(2.058)	(2.685)	(2.640)	(2.194)	(3.017)
Previous quarter share repurchases	−0.1760	0.1498	−0.0038	0.0285	−0.1310
	(−3.131)	(2.513)	(−0.289)	(0.522)	(−0.191)
Cumulative share repurchases—previous quarter		−0.4053	−0.0001	−0.0354	0.8589
		(−12.830)	(−0.031)	(−1.644)	(3.459)
Includes calendar year dummies	Yes	Yes	Yes	Yes	Yes
Includes quarterly dummies	Yes	Yes	Yes	Yes	Yes
Sigma	0.4926	0.4284	0.1536	0.0447	9.7349
	(38.265)	(27.303)	(40.888)	(39.161)	(37.603)
Log-likelihood	−2014.4	−1921.8	−3828.32	442.50	−230.25
Number of observations	3546	3546	4618	3546	4618

difference of 27.06 percent of the median quarter three repurchases. For a similar change in unexpected cash flows, predicted repurchases go from 6.14 percent to 6.88 percent, equal to 11.31 percent of mean quarter three repurchases. These calculations suggest that, in addition to being statistically significant, the estimated effect of cash flows on repurchases is large enough to be economically meaningful.

Finally, current repurchases appear to be positively related to repurchases during the prior quarter and negatively related to cumulative repurchases in all prior quarters since the announcement of the repurchase program, although the results are sensitive to truncation of the data. Truncation of share repurchases at the targeted levels results in a negative correlation between prior cumulative share repurchases and current repurchases because current repurchases are limited to a number of shares that will not result in cumulative repurchases exceeding targeted levels.

VI. Conclusions

One sometimes unrecognized feature of open-market repurchase plans is that although they permit firms to repurchase their own shares, they do not obligate them to do so. This characteristic of open-market repurchase programs potentially allows firms to time their share repurchases to take advantage of changes in stock price and provides flexibility to firms that face uncertain cash flows during the repurchase period.

In this paper, we examine the importance of this flexibility using a sample of repurchase programs announced from 1981 through 1990. First, we examine the magnitude of actual share repurchases relative to firms' announced repurchase targets. Our best estimate is that firms in our sample repurchase 74 to 82 percent of their announced target level of share repurchases. Many firms expand their programs and purchase many more shares than originally targeted; in the three years following the announcement of the program, 57 percent purchase more than the originally targeted quantity and 30 percent purchase more than twice the targeted quantity.

We also empirically consider the determinants of actual repurchases. We find that actual share repurchases are negatively related to a firm's stock return prior to the quarter in question, which is consistent with asymmetric information arguments. We also find that both expected and unexpected cash flows are positively related to repurchases, suggesting that firms actively adjust their buyback behavior to their cash position. Overall, the results are consistent with the view that managers exploit the flexibility inherent in open-market repurchase programs, and suggest that this flexibility is one of the reasons for such repurchase programs' current popularity relative to other methods of reacquiring stock.

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