An analysis of operating performance and firm characteristics around open market share repurchases

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Abstract

This study finds new evidence that managers announce open market share repurchases for different reasons that vary according to the firm's investment opportunity set. Low q firm managers announce repurchases because they perceive an increase in free cash flow and they desire to disgorge cash, whereas high q firm managers announce repurchases because their firms' shares are undervalued. Around the time of repurchase announcements, low q firms experience decreases in financial leverage, but increases in sales growth, cash balances, and free cash flow (when compared to matched control firms). After repurchase announcements, only market-to-book ratios increase for high q firms.

Keywords: Share repurchases, corporate finance, free cash flow, valuation
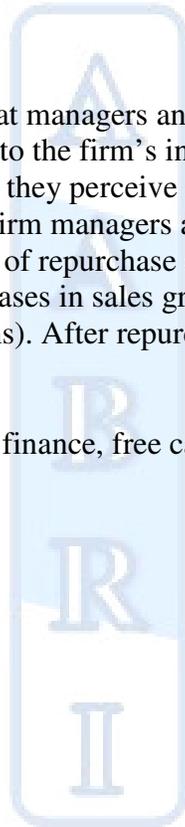
Introduction

The finance literature suggests that managers announce share repurchase plans for multiple reasons that are not mutually exclusive. Among the more commonly accepted explanations are that managers announce repurchases to buy back shares that are undervalued in the market (the undervaluation hypothesis), to signal improved future operating performance (the earnings signaling hypothesis), or to pay out free cash flow (the free cash flow hypothesis). Prior financial research focuses on uncovering the dominant managerial motives for share repurchases and on documenting the performance of firms using share repurchase plans.[1]

Nohel and Tarhan (1998) argue that different firms may have different reasons for repurchasing shares, depending on their investment opportunity set. In particular, low q firms are less likely to have valuable investment opportunities and more likely to have free cash flow. To distinguish among possible motives for share repurchases, Nohel and Tarhan gather evidence on the long-term operating performance of firms making tender offer share repurchases. They find evidence that managers of low q firms make tender offer repurchases as part of a larger restructuring package designed to sell off unproductive assets, shrink the size of the firm, improve operating performance, and pay out free cash flow. In contrast, Nohel and Tarhan find that high q firms do not experience an improvement in operating performance following tender offer plans.

A small number of studies investigate the long-term operating performance of firms announcing open market repurchase plans, which are much more common than tender offer plans.[2] Lie (2006) finds evidence that firms experience an improvement in operating performance when they actually repurchase shares during the same fiscal quarter in which they make open market plan announcements. His evidence suggests that actual open market repurchases, rather than simply open market plan announcements, foreshadow performance improvements. Grullon and Michaely (2004) find no evidence that firms announcing open market plans subsequently experience an improvement in operating performance.[3] Grullon and Michaely (2004) find evidence that managers announce open market plans because their firms are maturing and managers seek to pay out free cash flow. Consistent with firms losing growth opportunities, Grullon and Michaely (2004) find that repurchase announcing firms subsequently experience a decrease in capital expenditures, R&D expenditures, systematic risk, and cost of capital. Consistent with firms paying out free cash flow, they find that the cash holdings of firms decrease following repurchase announcements. However, Grullon and Michaely (2004) do not allow for high-growth firms and low-growth firms to have different motives underlying their repurchases. Grullon and Michaely (2004) do not divide their sample on the basis of growth

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[1] These studies include Bartov (1991), Comment and Jarrell (1991), Dittmar (2000), Grullon and Michaely (2004) , Ikenberry, Lakonishok, and Vermaelen (1995, 2000), Jagannathan and Stephens (2003), Kahle (2002), Lie (2005), Nohel and Tarhan (1998), and Stephens and Weisbach (1998).

[2] Of the three major types of share repurchase plans, fixed-price tender offers, Dutch auction tender offers, and open market share repurchases, the most commonly used plan is the open market share repurchase. Open market repurchases account for approximately 90 percent of the value of all announced repurchase programs (Ikenberry, Lakonishok, and Vermaelen, 1995, and Stephens and Weisbach, 1998).

[3] Jagannathan and Stephens (2003) find similar evidence for firms announcing open market repurchase plans.

opportunities to determine whether operating performance or changes in firm characteristics differ for firms with different investment opportunities.

This study provides new evidence on long-term operating performance and changes in other characteristics for firms announcing open market repurchase plans. Sample firms that announce open market plans are matched to control firms that do not announce repurchase plans (of any kind) during the six year window centered on the sample firm's repurchase announcement. The sample of repurchase announcements is drawn from the years 1985-1994. Repurchase announcing firms are matched to control firms on the basis of pre-announcement cash flow return on assets (ROA), SIC code, total market value of equity, and q. Because the motives underlying open market plans likely differ for firms with different investment opportunity sets, operating performance and changes in firm characteristics are examined for subsamples of high q firms and low q firms. To determine whether changes in operating performance or firm characteristics are abnormal, the changes for repurchase announcing firms are measured relative to changes for control firms.

In general, the evidence from this study supports the free cash flow hypothesis for low q firms and the undervaluation hypothesis for high q firms. The earnings signaling hypothesis is not supported. For low q firms, the evidence suggests that sales growth increases, financial leverage decreases, free cash flow increases, and cash holdings increase around the time of repurchase announcements. None of these changes are observed for high q firms. For high q firms, the evidence suggests that market-to-book ratios increase after repurchase announcements.

The evidence that low q firms experience increases in sales growth, cash balances, and free cash flow indicates that managers correctly perceive increasing levels of free cash flow when they announce open market share repurchases. Furthermore, the decrease in financial leverage for these firms suggests that managers use some of the increased cash flow to pay down debt or that managers are retaining more earnings. Shareholders of sampled low q firms react favorably to repurchase announcements.

Neither asset sales nor capital expenditures change significantly around the repurchase announcement period for low q firms. These findings suggest low q firms that announce open market plans are not dramatically restructuring their real assets and that the increase in free cash flow that they experience is generated by their assets in place. No significant changes are observed in market-to-book ratios and operating performance for low q firms around repurchase announcements. These findings fail to support the undervaluation hypothesis and earnings signaling hypothesis, respectively. In short, the best interpretation of this study's evidence is that low q firm managers announce open market repurchase plans because they correctly perceive an increase in free cash flow and they wish to pay out cash to shareholders.

The finding that market-to-book ratios increase in the post-announcement period for high q firms suggest that managers with valuable investment opportunities correctly anticipate an increase in market valuation levels when they make open market plan announcements. High q firms are unlikely to have substantial free cash flow and no evidence is found that free cash flow increases for these firms in the post-announcement period. Given the evidence that operating performance does not change for these firms, the best explanation is that high q firm managers announce open market plans because they perceive their firms' shares as undervalued. Also supporting this conclusion, the pre-announcement share returns are negative for high q firms and are significantly lower than the pre-announcement share returns for low q firms.

The remainder of the paper is organized as follows. Section 2 provides a brief background and literature review on share repurchases. Section 3 describes the empirical

methods used to detect abnormal operating performance and changes in firm characteristics. Section 4 presents the results in detail. Section 5 summarizes the results and concludes.

Background and related literature

Share repurchase plans have become an important method by which US corporations distribute cash to shareholders. By the end of the 1980s, the dollar amount of announced share repurchases reached about one-half the amount of all dividend payments.[4] Grullon and Michaely (2002) report that industrial firms paid out more cash through share repurchases than through dividends in the years 1999 and 2000. They find evidence that regulations existing before 1983 discouraged firms from repurchasing shares and that the removal of these restrictions helped spur growth in share repurchases. Kahle (2002) argues that the growth in repurchase activity in the 1990s was likely driven by a managerial desire to fund stock option programs, which were also growing in popularity during that time. Of the three major types of share repurchase plans, fixed-price tender offers, Dutch auction tender offers, and open market share repurchases, the most commonly used plan by far is the open market plan (Ikenberry, Lakonishok, and Vermaelen, 1995; and Stephens and Weisbach, 1998).

Although the aggregate dollar value of open market plans exceeds that of tender offer plans, finance researchers initially concentrated more attention on tender offers. This emphasis on tender offer plans, rather than on open market plans, likely can be traced to two factors. First, unlike tender offer announcements, there is considerable uncertainty surrounding open market plan announcements. Firms that announce open market plans often do not repurchase any shares or they repurchase fewer shares than initially announced (Stephens and Weisbach, 1998). Second, open market plans typically target a smaller percentage of firm shares, relative to other plans (Comment and Jarrell, 1991), so the impact of open market plans on firm performance is probably smaller.[5]

Researchers analyzing open market repurchases consistently find that shareholder wealth increases at plan announcements (see, e.g., Vermaelen, 1981; Comment and Jarrell, 1991; Ikenberry, Lakonishok, and Vermaelen, 1995; and Stephens and Weisbach, 1998). Although the evidence suggests that, on average, positive information is revealed at open market plan announcements, the exact nature of the information revealed is less clear. Managers could announce open market plans for several reasons that are not mutually exclusive. Perhaps the most commonly excepted managerial motives are: to repurchase undervalued shares; to signal operating performance (earnings) improvement; and to pay out free cash flow.

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[4] See Ikenberry, Lakonishok, and Vermaelen (1995) and Stephens and Weisbach (1998). Jagannathan, Stephens, and Weisbach (2000) estimate that, over the period 1985-1996, the aggregate dollar volume of actual repurchases by industrial firms ranged from 20 to 27% of the aggregate dollar volume of dividends.

[5] Open market share repurchase announcements target on average about 7% of a firm's outstanding shares (Stephens and Weisbach, 1998), whereas Dutch auction and fixed-price tender offers target a larger percentage of total firm shares, about 15.6% and 18.8% respectively (Comment and Jarrell, 1991). Comment and Jarrell find that fixed-price tender offer announcements produce the highest announcement returns (11%), followed by Dutch auction announcements (8%), and open market announcements (2%).

Some existing research supports the undervaluation hypothesis. Ikenberry, Lakonishok, and Vermaelen (1995) find evidence that managers of U.S. firms announce open market plans when shares are undervalued and that outside shareholders are slow to appreciate this positive news. Specifically, Ikenberry et al. find that shareholders of firms announcing open market plans earn positive abnormal buy-and-hold returns during the four years following plan announcements. Their evidence indicates that the long-term abnormal returns are greater for high book-to-market firms, which are more likely to be undervalued. Ikenberry, Lakonishok, and Vermaelen (2000) find similar evidence using a sample of Canadian firms announcing open market plans. Furthermore, their evidence suggests that managers of Canadian firms increase (decrease) actual repurchases after the firm's stock price has decreased (increased). Stephens and Weisbach (1998) focus on the actual repurchase behavior of U.S. firms that announce open market plans. They find that repurchases in one quarter are negatively related to both the firm's stock performance in the prior quarter and the firm's cumulative stock performance following the repurchase announcement. The evidence from these studies suggests that managers use open market plans in an attempt to time the market and repurchase shares that are undervalued. Dittmar (2000) finds evidence that different motives underlie share repurchases during different periods, but undervaluation is an important motive over her entire sample period, 1977-1996.

Bartov (1991), Jagannathan and Stephens (2003), Grullon and Michaely (2004), and Lie (2006) search for abnormal operating performance around open market share repurchase announcements. Bartov (1991) finds weak evidence to support the earnings signaling hypothesis. He finds that, in the year of the repurchase announcement, unexpected earnings per share (actual earnings per share minus median analyst forecasted earnings per share) is significantly greater for firms announcing open market plans than for control firms. Bartov also finds that analysts upwardly revise their earnings forecasts for firms announcing open market plans. Both of these findings suggest that managers might announce open market plans to signal improved operating performance. Jagannathan and Stephens (2003) examine operating performance following open market repurchase announcements. They find little evidence that operating performance improves following open market plan announcements.[6]

Grullon and Michaely (2004) also find no evidence that operating performance improves following open market plan announcements. Consistent with the free cash flow hypothesis, their evidence suggests that managers announce open market repurchases because their firms are experiencing declining growth opportunities and managers wish to pay out free cash flow. Grullon and Michaely find that cash balances decrease around open market plan announcements. Grullon and Michaely do not analyze operating performance or changes in firm characteristics separately for firms with valuable investment opportunities (high q firms) and firms with poor investment opportunities (low q firms). Evidence later presented in the current study suggests that the primary motives underlying repurchase announcements differ for high and low q firms.

Lie (2005) finds evidence that firms experience operating performance improvements following initiation of actual open market repurchases. Of firms that announce open market repurchase plans, he finds the only firms that exhibit subsequent operating performance

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[6] Neither Bartov (1991), nor Jagannathan and Stephens (2003), match control firms to repurchase announcing firms on the basis of pre-announcement operating performance. Barber and Lyon (1996) analyze methods of detecting abnormal operating performance. They conclude that a failure to match firms on the basis of pre-event operating performance leads to test statistics that are misspecified.

improvements are those firms that actually repurchase shares during the same fiscal quarter that the announcement was made. Lie concludes that open market plan announcements do not necessarily portend operating performance improvements, but actual repurchases do portend such improvements.[7]

Although they do not search for abnormal operating performance, Stephens and Weisbach (1998) find evidence that supports the free cash flow hypothesis of open market plans. They estimate actual repurchases following open market plan announcements and find that repurchases in one quarter are positively related to both the expected and unexpected components of the firm's cash flows in the prior quarter. Their evidence suggests that managers adjust their repurchase activity to coincide with the firm's recent cash flows and that managers announce open market plans in anticipation of increased free cash flow.

Finally, Kahle (2002) finds evidence to support an alternative explanation of open market plans. She argues that managers are motivated to repurchase shares to maximize the value of their option and share holdings, and to decrease the dilution effects of executive and employee stock options. She finds that managers are more likely to announce open market plans when their personal stock option holdings are high and when employees hold large numbers of exercisable stock options. After open market plans are announced, the number of shares actually repurchased increases with the total exercisable options held by all employees. Kahle's evidence suggests that managers are, in part, motivated to announce and execute open market plans by the firm's compensation policy.[8]

Methodology and data

To gather evidence on the underlying motives and consequences of open market repurchase plans, changes in operating performance and changes in several key firm characteristics are measured around open market share repurchase announcements. The methods of detecting abnormal changes used in this study are similar, but not identical, to those used by Nohel and Tarhan (1998), who analyze tender offer share repurchases. As explained later, the

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[7] The three types of share repurchases discussed in this section have important differences. In a fixed-price tender offer, the firm specifies a definite date by which a specific number of shares will be purchased at a fixed price. For fixed-price tender offers, the purchase price is at a premium to the market price. In a Dutch auction tender offer, the firm announces a price range and the number of shares it will purchase by a certain date. In a Dutch auction tender offer, firms generally repurchase shares at a premium (Comment and Jarrell, 1991). In an open market share repurchase plan, managers announce their intention to repurchase a certain number of shares at the market price, but there is no deadline imposed and managers are under no legal obligation to conduct the repurchase. Stephens and Weisbach (1998) find that only 74% to 82% of shares targeted in open market repurchase announcements are actually repurchased. They find that a significant number of firms announcing open market plans repurchase no shares.

[8] Kahle (2002) also finds evidence to support the undervaluation hypothesis and the free cash flow hypothesis. Consistent with the undervaluation hypothesis, she finds that firms that have announced open market plans subsequently repurchase more shares when they have low market-to-book ratios. Consistent with the free cash flow hypothesis, she finds that firms that have announced open market plans subsequently repurchase more shares when they have high free cash flow and low capital expenditures.

techniques used in this study are based in part on suggestions made by Barber and Lyon (1996), who analyze methods of detecting abnormal operating performance.

The initial sample of announcements is drawn from wire reports and major newspapers (including the *Wall Street Journal*). Lexis-Nexis is used to search for plan announcements made during the years 1985 through 1994. Specifically, a search is conducted for stories containing any derivation of the word "announce" and, within 20 words, the words "share repurchase" or "share buyback" or "stock repurchase" or "stock buyback." Some announcements include statements that the firm's board of directors has authorized an open market repurchase plan for the first time. Some announcements include statements that a prior repurchase plan had been completed and that the firm's board has authorized a new open market repurchase plan to repurchase additional shares. Some repurchase announcing firms appear more than once in the final sample, because they announce multiple open market plans during the sample period.

To test whether firms announcing repurchases experience abnormal operating performance, a sample of control firms is gathered using a method very similar to that suggested by Barber and Lyon (1996), who find that test statistics used to identify abnormal operating performance are only well specified when control firms are matched to repurchase announcing firms on the basis of pre-event operating performance.

An attempt is made to match repurchase announcing firms to control firms in five steps. In the first step, repurchase announcing firms are matched to potential control firms on the basis of 2-digit SIC code. In the second step, repurchase announcing firms are matched to potential control firms on the basis of year -1 operating performance. Year 0 is the fiscal year that the firm announces the open market plan. To develop a control sample, the measure of operating performance used is operating income divided by cash-adjusted assets. This measure is evaluated in Barber and Lyon (1996).[9] To test for abnormal operating performance, the slightly different measure of cash flow return on assets (ROA) from Nohel and Tarhan (1998) is used, so that the current study's results are more comparable to theirs.[10] The definition of ROA and the definitions of other key firm variables used appear in Table 1. All remaining potential control firms on Compustat are selected that have an ROA within 10% of the sample firm's ROA.

In the third step, repurchase announcing firms are matched to remaining potential control firms on the basis of year -1 firm size (market value of equity). All remaining potential control firms are selected such that they have a market value of equity in year -1 that is within 30% of the sample firm's market value of equity. In the fourth step, a remaining control firm is matched (if possible) to the repurchase announcing firm on the basis of year -1 q value.[11] Specifically, the

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[9] Operating income (Compustat item 13) is defined as sales less cost of goods sold, and selling, general, and administrative expenses. Cash-adjusted assets is the book value of total assets minus cash and marketable securities. For the motivation underlying this measure, see Barber and Lyon (1996).

[10] The decision to use Nohel and Tarhan's (1998) measure of ROA for test purposes results in the loss of some sample firms. This happens because some firms originally matched using Barber and Lyon's (1996) measure of ROA do not have the full Compustat data necessary to calculate Nohel and Tarhan's (1998) measure of ROA.

[11] Tobin's Q is approximated using the method tested in Chung and Pruitt (1994). Chung and Pruitt's approximation is q = (MVE + PS + Debt)/TA, where MVE is the total market value of common stock, PS is the liquidating value of preferred stock, Debt is the book value of long-term debt plus the current liabilities minus current assets, and TA is the book value of total assets.

potential control firm is selected that is in the same q category as the repurchase announcing firm (q greater than one is the high q category, whereas q less than one is the low q category) and that has the q value closest to the repurchase announcing firm's q value. If the process described above fails to produce a control firm for a repurchase announcing firm, Steps 1-4 are repeated, except that firms are matched on the basis of 1-digit SIC codes in Step 1. If this procedure fails to produce a control firm, Steps 2-4 are repeated without regard to SIC code. All repurchase announcing firms that cannot be matched after ignoring the SIC code requirement are dropped from the final sample.

In the fifth step, wire reports and major newspapers are searched for evidence that each of the surviving potential control firms announced a share repurchase program. If the potential control firm did announce a repurchase program of any type within three years before or after the year of its matched firm's repurchase announcement, that potential control firm and its matched firm are dropped from the final sample.

The final sample has a maximum of 351 firms that announced an open market repurchase program during the years 1985-1994. Each of these 351 firms is successfully matched to a control firm. The sample size decreases for particular tests of different variables, because necessary Compustat data are not available for repurchase announcing firms or their matched control firms. Share performance is also analyzed for the successfully matched repurchase announcing firms. Center for Research in Securities Prices (CRSP) data are used to calculate share returns. The sample size for analyzing share returns decreases when CRSP data are not available for repurchase announcing firms or for control firms.

Using the process describe above, matched control firms are sampled with replacement. However, the vast majority of control firms are used only once. Out of 351 matched firms, 28 control firms (under 8% of total matches) were used twice and 1 control firm (0.28% of total matches) was used three times. Of the 351 matched firms, 166 (47.29%) are matched on 2 digits or greater, 117 (33.33%) are matched on one digit, and the remaining 68 (19.37%) are not matched on the basis of industry. The majority, but not all, of the firms observed in this study operate on a December year-end fiscal year. A control for fiscal year is maintained throughout the gathering and reporting of descriptive statistics, as well as when analyzing changes in operating performance or other variables following repurchase announcements.

Table 2 shows the descriptive statistics for the repurchase announcing firms and control firms. These statistics suggest that the control firms are free of meaningful systematic bias on the basis of firm size, cash flow return on assets (ROA), and q category. Repurchase announcing firm size and control firm size are not significantly different (at standard levels of significance) in tests of means and medians for the full sample, the high q sample, and the low q sample. Repurchase announcing firm ROA and control firm ROA are not significantly different at standard levels. This is true in tests of means and medians. It is also true for the full sample, the high q sample, and the low q sample. The Wilcoxon signed-rank test does indicate that repurchase announcing firm q is higher than control firm q in the high q sample and in the full sample. This is not especially surprising because in the data gathering it is only required that matched pairs are in the same q category (above one or below one). Because the q values in the high q sample are unbounded, this obviously allows for the possibility that sample firms have higher q values. Within the high q sample, the median q value for sample firms is 1.80, which is about 15% higher than the median q value of 1.56 for control firms. In contrast, mean q values are not significantly different in any sample.

To analyze operating performance and other key characteristics of firms announcing open market plans, Compustat data are used for the following measures: cash flow return on assets (ROA), capital expenditures, asset sales, asset growth, sales growth, asset turnover, cash flow margin, free cash flow, leverage, and market-to-book ratio. Analyzing ROA reveals whether operating performance changes around plan announcements. Analyzing asset turnover, cash flow margin, and leverage reveals why changes (if any) in operating performance are occurring. Analyzing market-to-book ratios suggests whether valuation levels change after plan announcements. Analyzing the remaining variables indicates whether the firm is altering its investment in real assets, experiencing a change in investment opportunities, or experiencing a change in the agency costs of free cash flow. The median differences (repurchase announcing firm values minus control firm values) are tested to determine whether they're different than zero in the post-announcement period. A test is also conducted to determine whether significant changes in these variables occur from the pre-announcement period to the post announcement period.

The undervaluation hypothesis states that managers announce open market plans so that they can repurchase shares that are undervalued in the market. Consequently, the undervaluation hypothesis would be supported by an increase in the market-to-book ratio following the repurchase announcement. The earnings signaling hypothesis is that managers announce open market plans to signal improvements in operating performance. Accordingly, the earnings signaling hypothesis would be supported by an increase in ROA in the post-announcement period.

In their study of tender offer repurchases, Nohel and Tarhan (1998) emphasize that earnings improvements could occur after repurchases because managers exploit valuable investment opportunities or because firms sell unproductive assets and pay out free cash flow to shareholders through stock repurchases. Nohel and Tarhan argue that the latter explanation supports paying out free cash flow rather than signaling growth opportunities as the primary motive underlying tender offer repurchases. Capital expenditures, asset sales, asset growth, sales growth, asset turnover, and cash flow margin are analyzed to determine whether firms announcing open market repurchases are exploiting growth opportunities or restructuring and selling off the firm's real assets. Nohel and Tarhan find that operating performance improves after tender offer repurchases for low q firms only. Using a sample of firms announcing open market repurchases, operating performance and changes in firm characteristics for high q and low q firms are also examined.

The free cash flow hypothesis states that managers announce open market plans to pay out free cash flow. Lehn and Polsen's (1989) measure of undistributed cash flow is used as a proxy variable for free cash flow. Cash holdings (cash and short-term investments divided by book value of assets) and financial leverage is also measured as indicators of free cash flow. If the free cash flow proxy variable increases, cash holdings increase, or financial leverage decreases following repurchase plan announcements, these changes would suggest that managers anticipate an increase in free cash flow and are using open market repurchases to at least partially offset the increasing agency costs of free cash flow.

Results

Operating performance and firm characteristics: repurchase announcing firms versus control firms

Table 3 shows nonparametric test results for repurchase announcing firms. Shown are the median differences (repurchase announcing firm values minus control firm values) for ROA and other key variables during the years –1 through +3, where year 0 is the fiscal year in which the repurchase announcement occurred. Year –1 is referred to as the "pre-announcement" period and later years are referred to as the "post-announcement" period. Panel A shows results for the full sample of firms. Panels B and C show results for high q and low q firms, respectively.

Using the full sample of firms announcing open market plans, no evidence is found to support the assertions that repurchase announcing firms are signaling earnings improvements or selling off unproductive assets. ROA for repurchase announcing firms is not significantly different than ROA for control firms in any year observed. Asset sales are significantly lower, asset growth is significantly higher, and sales growth is significantly higher for repurchase announcing firms in years 0, +1, and +2, respectively. These results sharply contrast those of Nohel and Tarhan (1998), who analyze the same variables for firms announcing tender offer repurchase plans. Using their full sample of firms, Nohel and Tarhan (1998) find evidence that ROA is significantly higher, asset sales are significantly lower, asset growth is significantly lower, and sales growth is significantly lower for repurchasing firms than for control firms in the years after the tender offer repurchase announcements.

Evidence from the full sample does support the undervaluation hypothesis. Although there is no significant difference in market-to-book ratios before the open market plan announcement, market-to-book ratios for repurchase announcing firms are significantly greater than those for control firms in year +1 (p = 0.0149), year +2 (p = 0.0067), and year +3 (p = 0.0109). Furthermore, the median differences in market-to-book ratios increase monotonically from year 0 to year +3. The full sample evidence regarding market-to-book ratios contrasts that of Nohel and Tarhan (1998), who find no significant difference in market-to-book ratios in the years following tender offer announcements.

Using the full sample of firms, median differences are statistically significant for leverage, cash holdings, and free cash flow. Leverage is significantly lower for repurchase announcing firms in each year observed. Cash holdings are significantly higher for repurchase announcing firms in each year observed. Free cash flow is significantly greater for repurchase announcing firms in years -1, 0, and +1. As noted, firms are matched on the basis of pre-announcement ROA, size, q, and SIC code. After controlling for these factors, managers appear much more likely to announce open market repurchase plans when their firms have lower debt levels, greater cash holdings, and greater free cash flow. Furthermore, these differences between repurchase announcing firms and control firms generally remain significant in the post-announcement period.

Nohel and Tarhan (1998) find evidence that firms with fewer profitable investment opportunities (low q firms) announce tender offer repurchases to reduce firm size, pay out free cash flow, and improve operating performance. They also find that improvements in ROA are driven by asset sales and more efficient asset use. Because managerial motivations underlying open market plans could be different for high q versus low q firms, the full sample is divided on the basis of q. Panels B and C of Table 3 show test results for these subsamples. Managers of low q firms are less likely to have growth opportunities, more likely to have free cash flow, and may be more likely to use open market repurchases to pay out free cash flow. Managers of high q firms are more likely to have growth opportunities, less likely to have free cash flow, and may be more likely to use open market repurchases to repurchase undervalued shares or signal earnings improvement.

As shown in Panel B, high q repurchase announcing firms have asset sales that are significantly lower in year 0 (p = 0.0836) and in year +1 (p = 0.0244), relative to control firms. These repurchase announcing firms hold significantly more cash in every year observed except year 3. Although there is no significant difference in market-to-book ratios for high q repurchase announcing firms relative to their high q control firms in year –1, the market-to-book ratios are significantly greater for high q repurchase announcing firms in year +1 (p = 0.0135), year +2 (p = 0.0026), and year +3 (p = 0.0008).

As shown in Panel C, low q repurchase announcing firm ROA is significantly greater than control firm ROA in year 0 (p = 0.0901), but not in any other year observed. This finding provides some support for the view that managers of low q firms announce open market repurchases when their firms are experiencing strong earnings. Sales growth is significantly greater for low q repurchase announcing firms in year +2 (p = 0.0375). Asset sales are significantly greater for low q repurchase announcing firms in year +1 (p = 0.0247). This finding regarding asset sales provides some support for the notion that managers announce open market plans as part of a restructuring package designed to sell off unproductive assets. However, asset growth is significantly greater for low q repurchase announcing firms in year +1 (p = 0.0004). Thus, no evidence is found that managers of repurchase announcing firms are reducing their firms' investments in real assets.

The magnitude of actual share repurchases is insufficient to eliminate the high cash balances observed in low q repurchase announcing firms. Cash balances for these firms are significantly greater (at the 1% level) in each year observed. Free cash flow (which is not affected by repurchases) is significantly higher for these firms in year –1 (p = 0.0030), year 0 (p = 0.0009), and year +1 (p = 0.0023).

Abnormal changes in operating performance and firm characteristics

Although the test results reported in Table 3 are informative, they do not directly test whether abnormal *changes* occur in ROA or in other key variables from the pre-announcement period to the post-announcement period. This issue is addressed in the next series of tests. For each of the variables described in Table 1, the post-announcement differences (repurchase announcing firm values minus control firm values) are regressed on the pre-announcement differences. If an intercept coefficient is significantly different than zero, then there is an abnormal change in the value of that variable. The difference in year –1 is used as the pre-announcement difference. The median of differences from years 0 through +3 is used as the post-announcement difference.

To test for abnormal changes in firm performance and in other firm characteristics, this study relied heavily on the approach described in Nohel and Tarhan (1998), who examine similar changes for firms conducting tender offer share repurchases. They describe the motivation underlying the regression of post-announcement differences on pre-announcement differences on pages 197-198 of their article. Nohel and Tarhan cite Healy, Palepu, and Ruback (1992) to support this approach. The regression approach is viewed as superior to a simple paired difference test because the regression approach controls for any existing trend in the behavior of the variable while better isolating any "abnormal" change. Following earlier researchers, such as Lie (2006) and Nohel and Tarhan (1998), trimmed data are used to analyze changes in operating performance

or other firm characteristics following share repurchases.[12] All regressions are conducted after trimming approximately 1% of the extreme observations (i.e., extreme values for the post-announcement difference minus the pre-announcement difference) from the sample.

The regression results for tests of abnormal variable changes are shown in Table 4. Test results are reported separately for the full sample in Panel A, for high q firms in Panel B, and for low q firms in Panel C. In no case do any tests of ROA, using the full sample or the high and low q subsamples, indicate an abnormal increase in ROA for repurchase announcing firms in the post-announcement period. Thus, operating performance does not increase abnormally for firms announcing open market plans, regardless of their investment opportunity set. The earnings signaling hypothesis is not supported by these tests.

As shown in Panel A, the evidence from the full sample of firms supports the undervaluation hypothesis and the free cash flow hypothesis. Consistent with managers announcing open market plans because their firms' shares are undervalued, the market-to-book ratios for repurchase announcing firms increase abnormally in the post-announcement period (p = 0.012). This evidence supports Grullon and Michaely's (2004) findings that stock values increase following open market plan announcements. Consistent with managers announcing open market plans because they anticipate an increase in free cash flow, the free cash flow variable shows a significant increase in the post-announcement period (p = 0.039). Using the full sample of firms, leverage decreases significantly in the post-announcement period (p = 0.011). Overall, the evidence from the full sample suggests that managers announce open market plans to purchase undervalued shares and to pay out free cash flow.

As noted, managers of low q firms are more likely than managers of high q firms to have free cash flow. Consequently, low q firm managers and high q firm managers likely have different dominant motives for announcing share repurchases. Panels B and C of Table 4 show the regression results after dividing the full sample on the basis of q. As shown in these panels, the results are strikingly different for low q and high q firms.

For high q repurchase announcing firms, market-to-book ratios increase significantly in the post-announcement period (p = 0.001). None of the other variables change significantly in the case of high q firms. In sharp contrast, for low q repurchase announcing firms there is no significant change in market-to-book ratios in the post-announcement period. Instead, the low q repurchase announcing firms experience a significant increase in sales growth (p = 0.094), a significant decrease in leverage (p = 0.004), a significant increase in free cash flow (p = 0.046), and a significant increase in cash holdings (p = 0.001).

These results suggest that the dominant motive underlying open market repurchases differs for firms according to their investment opportunity set. Managers of high q firms, which are likely have valuable investment opportunities, are more likely to repurchase shares because the shares are undervalued. Managers of low q firms, which are unlikely to have valuable investment opportunities, are more likely to repurchase shares because they anticipate an increase in free cash flow. Furthermore, given the abnormal decrease in leverage, as well as the abnormal increase in cash holdings, the evidence presented here suggests that the magnitude of actual share repurchases is insufficient to prevent an increase in the agency costs of free cash flow. To summarize, the test results concerning abnormal changes presented in Table 4 support the

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[12] Nohel and Tarhan (1998) describe using trimmed data as a control for outliers on page 202. Lie (2005) defends the use of trimmed data as a control for outliers in footnote 10 of his article.

undervaluation hypothesis for high q firms and the free cash flow hypotheses for low q firms. The earnings signaling hypothesis is not supported.

The results found in this study using a sample of open market repurchase announcements are substantially different than those found by Nohel and Tarhan (1998) for tender offer share repurchases. For firms announcing open market plans, the current study finds that ROA does not increase, leverage decreases (for low q firms), asset sales do not increase, and market-to-book ratios increase (for high q firms). Nohel and Tarhan (1998) report that ROA increases (for low q firms), leverage increases, asset sales increase, and market-to-book ratios do not change. These contrasting results suggest that different managerial motives underlie tender offer plans and open market plans.

Nohel and Tarhan (1998) find no evidence to support the undervaluation hypothesis. However, they do find evidence of improved operating performance and a strong managerial commitment to pay out free cash flow. Nohel and Tarhan argue that managers use tender offer plans as part of a larger restructuring of the firm designed to sell off unproductive assets and pay out free cash flow. Tender offer plans are typically larger than open market plans. Furthermore, tender offer plans involve a strong commitment by managers to repurchase shares, whereas open market plan announcements do not obligate managers to repurchase any shares. Considering these key differences between plans and the contrasting evidence from this study and Nohel and Tarhan (1998), it appears that tender offer plans are more likely to be used by managers with a stronger desire to decrease the agency costs of free cash flow.

The evidence presented in this section in some cases corroborates and in other cases contrasts evidence found in other studies of open market plans. For example, the current study's evidence that operating performance does not improve following open market plan announcements, but that market-to-book ratios increase following open market plan announcements, is consistent with evidence found by Grullon and Michaely (2004). However, evidence from the current study that capital expenditures do not change and that cash holdings increase significantly (for low q firms) after repurchase announcements contrasts the findings of Grullon and Michaely (2004). They do not partition their sample on the basis of q or consider that high growth firms and low growth firms might have different primary motives for announcing repurchases. For their full sample, they find that capital expenditures and cash holdings decrease following open market plan announcements. They interpret their results to suggest that firms making open market plan announcements are running out of growth opportunities and using repurchase plans to pay out free cash flow. Thus, both studies suggest that paying out free cash flow is an important managerial motive for firms announcing open market plans. But evidence from the current study suggests that paying out free cash flow in an important managerial motive primarily for low q firms.

Robustness Tests

To conduct the tests of changes in operating performance, and other firm characteristics, this study relied on a methodology very similar to that used by Nohel and Tarhan (1998). One benefit of this approach is that it allows the current study's results regarding open market plans to be more comparable to their results regarding tender offer plans. However, this section reports the results of robustness tests in which other methods are used.

As mentioned, year-zero data are defined as those data taken from the fiscal year-end following the announcement of an open market share repurchase. Year zero data are assigned to

the post-announcement period. This technique was used by Nohel and Tarhan (1998). However, for most of the sample firms in the current study, some months included in the fiscal year defined as year zero technically fall before the announcement. An alternative approach would be to define years +1 through +3 as the post-announcement period, while ignoring year zero. However, by using years +1 through +3 as the post-announcement period (and thus removing year zero from the post-announcement period) those months in which changes are likely most directly related to the share repurchase would be removed. The further in time from the repurchase announcement, the more difficult it is to argue that any changes in firm performance or firm characteristics are connected with the repurchase announcement. In summary, some of the most important data very likely would be discarded if year zero were excluded from the post-announcement period.

As a robustness check, all regressions were re-estimated after discarding year zero data and using the alternative +1 through +3 post-announcement period. The key result for the high q sample remains. The market-to-book ratio increases significantly in the alternative post-announcement period for high q firms. However, most of the key coefficient estimates for the low q sample are not significant when the alternative post-announcement period is used. In each case the coefficient signs remain the same, but free cash flow no longer increases significantly ($p = 0.420$), financial leverage no longer decreases significantly ($p = 0.305$), and cash balance no longer increases significantly ($p = 0.12$). Sales growth continues to increase significantly using the alternative post-announcement period. A reasonable interpretation of the combined results (using both post-announcement period definitions) is that financial leverage experiences a drop, but free cash flow and cash balance experience a surge *around the time of* the repurchase announcement.

As mentioned, the use of trimmed data is well-established in studies of share repurchases (see Lie, 2006, and Nohel and Tarhan, 1998). This approach is preferred, especially with ROA and other accounting based measures, because extreme outliers do occur in such data. As a robustness check, untrimmed data are used to re-estimated the regression models used in Table 4. Most of the findings are very similar. For high q firms, the market-to-book ratio increases significantly. For low q firms, sales growth, free cash flow, and cash balance increase significantly. The only change in key findings is that, for low q firms, financial leverage no longer decreases significantly ($p = 0.283$).

As a final robustness check of the conclusion that repurchase announcing firm operating performance does not improve following open market plan announcements, abnormal operating performance is recalculated using a method described by Barber and Lyon (1996). Specifically, the current study uses their model of expected operating performance, which appears as Model 8 on page 367.

Using this model, Barber and Lyon calculate the expected operating performance, $E(P_{st})$, for sample firm s in year t as

$$E(P_{st}) = P_{s(t-1)} + (P_{ct} - P_{c(t-1)}) \qquad\qquad\qquad \text{Eq. (1)}$$

where,

$P_{s(t-1)}$ = operating performance for sample firm s in year t-1;
P_{ct} = operating performance for control firm c in year t; and
$P_{c(t-1)}$ = operating performance for control firm c in year t-1.

The abnormal performance for firm s in year t, AP_{st}, is defined as

$$AP_{st} = P_{st} - E(P_{st}) \qquad\qquad\qquad\qquad\qquad \text{Eq. (2)}$$

where,
P_{st} = operating performance for sample firm s in year t.

The current study tests whether median values of abnormal operating performance are significantly different from zero using the Wilcoxon signed-rank test.

Using Barber and Lyon's (1996) approach with the current study's full sample of firms announcing open market plans, the median abnormal ROA is -0.21% (p = 0.31) in year 0, -0.81% (p = 0.06) in year 1, -0.01% (p = 0.95) in year 2, and 0.91% (p = 0.08) in year 3. To determine whether repurchase announcing firm operating performance is abnormal over the entire post-announcement period (years 0 through 3), the median abnormal ROA for all firm years (n = 1145) in this period is calculated. The median abnormal return over the post-announcement period is –0.08% and insignificantly different from zero (p = 0.48). The results are similar when the full sample of firms is divided into low q and high q firms. The median abnormal ROA for low q repurchase announcing firms over the entire post-announcement period is -0.04% and insignificantly different from zero (p = 0.75). The median abnormal ROA for high q repurchase announcing firms is -0.18% and insignificantly different from zero (p = 0.17). Overall, the results obtained using the alternative test for the entire post-announcement period indicate that operating performance does not improve following open market repurchase plan announcements.

Shareholder returns around open market plan announcements

Prior research (see, e.g., Vermaelen, 1981; Comment and Jarrell, 1991; and Ikenberry, Lakonishok, and Vermaelen, 1995) documents negative abnormal share returns in the days preceding open market plan announcements. This finding is generally interpreted as supporting the undervaluation hypothesis of open market repurchases. That is, if share prices are declining just prior to repurchase announcements, managers may well perceive the shares as undervalued at the time of the announcement. Consistent with positive information released when managers make the repurchase announcements, these earlier studies also find favorable share price reactions to the announcements.

Our evidence regarding shareholder returns around open market plan announcements is broadly consistent with that found in earlier studies, but is particularly supportive of the undervaluation hypothesis for high q firms. Table 5 shows cumulative abnormal returns (CARs) for various intervals in which day 0 is the day that managers of repurchase announcing firms made their initial public announcements of open market plans. Panel A shows CARs for the full sample of repurchase announcing firms and control firms. Panels B and C show CARs for the high q and low q subsamples, respectively.

Using the full sample of repurchase announcing firms, the mean pre-announcement CAR, calculated from day -30 to day -2, is –6.07% (significant at the 0.001 level). Panel B shows that the mean pre-announcement CAR is -7.90% (significant at the 0.001 level) for high q repurchase announcing firms. Panel C shows that the mean pre-announcement CAR is -4.55% (significant at the 0.001 level) for low q repurchase announcing firms. Using a difference in means t-test, the mean pre-announcement CAR for high q repurchase announcing firms is significantly lower than the mean pre-announcement CAR for low q repurchase announcing firms (p = 0.051). The evidence that share returns are even lower for high q firms than for low q firms in the days preceding open market repurchase announcements suggests that high q firm managers are more

likely than low q firm managers to announce these plans due to managers' perceived undervaluation of their companies' shares.[13]

Additional tests

This section reports (but does not show in table form) the results of supplemental tests. Grullon and Michaely (2004) find that firms experience a decrease in systematic risk following announcements of open market share repurchases. This issue is examined by testing whether beta changes after the repurchase announcement for repurchase announcing firms and their control firms. Using a 504 trading day estimation period, repurchase announcing firms and their control firms experience a significant decrease in beta after the repurchase announcement. The mean and median decrease in beta is about 13% for the full sample of repurchase announcing firms, significant at the 0.01 level. Using a 255 trading day estimation period, the evidence supporting a decrease in beta for repurchase announcing firms and their control firms is somewhat weaker. For example, the mean and median decreases in beta are 8.89% and 14.52%, respectively, for the full sample of repurchase announcing firms. However, the mean and median decreases are significant only at the 0.10 level and 0.05 level, respectively.

In an attempt to learn what influences shareholder reactions to open market plan announcements, announcement returns are regressed on several variables. These variables include ROA (the median cash flow return on assets in the post-announcement period), the Announced Repurchase % (the percent of shares managers state they will repurchase at the initial plan announcement), the Actual Repurchase % (the percentage of shares managers actually repurchase in the two years following the announcement), and the Change in Beta (where the systematic risk changes are calculated using one year of daily data before and after the announcement). Using cumulative abnormal returns (CARs) calculated over the two day period (-1, 0) and the full sample of repurchase announcing firms, none of the model variables are significant. However, using CARs calculated over the three day period (-1, +1) ROA in the post-announcement period is positively related to shareholder reactions (p = 0.029). The results using three day CARs suggests that shareholders have some ability at the announcement to forecast which repurchase announcing firms will experience higher future ROA.

Kahle (2002) finds evidence that managers are motivated to announce open market plans when their own stock option ownership is substantial and when the level of exercisable stock options held by other employees is high. The current study does not directly test whether funding stock options is a main motivation underlying open market share repurchases. Rather, sources on Lexis-Nexis are searched to document managers stated reasons for the open market repurchase plan and these stated reasons are used to further analyze operating performance and announcement returns. In order of frequency, where (1) is the most common, the most frequent reasons given by managers for repurchasing shares are: (1) to buy undervalued shares; (2) no

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[13] In Table 5 CARs are shown calculated using the CRSP equally weighted index and the Scholes-Williams adjustment for nonsynchronous trading. As a robustness check, CARs are re-estimated using three alternative approaches: (1) the CRSP equally weighted index and no Scholes-Williams adjustment; (2) the CRSP value weighted index and no Scholes-Williams adjustment; and (3) the CRSP value weighted index and the Scholes-Williams adjustment. Using these alternative approaches qualitatively similar evidence is found and this study's main conclusions regarding CARs, especially pre-announcement CARs for repurchase announcing firms, remain unchanged.

reason provided; (3) to fund stock option plans; (4) to buy undervalued shares and fund stock option plans; (5) to change capital structure; and (6) other reasons.

This study tests whether ROA changes significantly from the pre-announcement period to the post-announcement period for the "buy undervalued shares" subsample and the "fund stock option plans" subsample. The test results indicate that there is no significant change in ROA for either of these subsamples. Next, regression models of announcement returns (described earlier and using three day CARs) are specified, except that indicator variables corresponding to managers' stated motives are included. The motive "fund stock option plans" has a negative effect on announcement returns, but the motive "buy undervalued shares" has a positive effect on announcement returns.[14] No other motives are significantly related to announcement returns. The results from this study are broadly consistent with Kahle's (2002) finding that announcement returns are lower when firms have high levels of employee (nonexecutive) options outstanding. That is, both studies find evidence that shareholders react less favorably when the apparent managerial motive for repurchasing shares is to fund stock options programs.

Conclusion

Prior researchers have suggested that managers conduct share repurchases mainly to signal earnings improvement, to pay out free cash flow, or to repurchase undervalued shares. Nohel and Tarhan (1998) argue that firms undertake tender offer repurchase programs for different reasons, depending on their investment opportunities. In particular, firms without valuable growth options are more likely to repurchase shares to pay out free cash flow. Nohel and Tarhan analyze changes in operating performance and key firm characteristics for firms making tender offer share repurchases. Consistent with their argument, they find that only low q firms experience improvements in operating performance following share repurchases and these improvements are generated by selling off unproductive assets and paying out free cash flow.

Grullon and Michaely (2004) argue that firms generally undertake open market share repurchases to pay out free cash flow. They reason that firms announcing open market plans do so because they are maturing and running out of valuable growth opportunities. Consistent with the free cash flow hypothesis, they find that firms announcing open market share repurchases do not subsequently experience an improvement in operating performance. Furthermore, they report that firms announcing open market plans experience a decrease in capital expenditures, R&D expenditures, cash reserves, and systematic risk. Grullon and Michaely do not analyze whether changes in operating performance or firm characteristics differ for firms that are perceived, *ex ante*, to have different investment opportunities.

In this study, operating performance and changes in firm characteristics around open market repurchase announcements are analyzed. Methods similar to those employed by Nohel and Tarhan (1998) are used. In particular, separate evidence is gathered for high q firms and low q firms. The results concerning operating performance support the evidence from Grullon and Michaely (2004). Neither high q firms nor low q firms experience an increase in operating performance following open market repurchase announcements.

In contrast to Grullon and Michaely (2004), the current study finds that changes in other firm characteristics differ dramatically according to the firm's perceived investment opportunity

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[14] These results are not obtained when definition of announcement returns is modified to two day CARs calculated over days -1 to 0.

set. Around the time of the open market repurchase announcement, low q firms experience a decrease in leverage, but an increase in sales growth, cash holdings, and free cash flow. These findings are consistent with the free cash flow hypothesis. Low q firm managers appear to correctly perceive an increase in free cash flow at announcements of open market plans. Thus, paying out free cash flow seems to be a likely motive for these managers.

Notably, none of the characteristics observed changing for low q firms also changes for high q firms. The only characteristic that changes for high q firms is the market-to-book ratio. This study finds that high q firms experience an abnormal increase in market-to-book ratios following open market repurchase announcements. This evidence suggests that high q firm managers announce open market plans because they perceive their firms' shares as undervalued. Also supporting the notion that high q firm managers are more likely to repurchase shares because they are undervalued, the pre-announcement share returns are negative for high q firms and are significantly lower than the pre-announcement share returns for low q firms. Other researchers, such as Ikenberry, Lakonishok, and Vermaelen (1995), also find evidence that managers announce open market repurchases because shares are undervalued.

In summary, evidence from the current study supports the free cash flow hypothesis and the undervaluation hypothesis of open market repurchases. Low q firm managers announce repurchase plans because they perceive an increase in free cash flow, whereas high q firm managers announce repurchase plans because their shares are undervalued.

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Table 1

Definitions of variables used to measure operating performance and firm characteristics

With the exception of free cash flow and cash holdings, the variables below are defined as in Nohel and Tarhan (1998). Free cash flow is defined as in Lehn and Polsen (1989).

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Variable	Definition
Cash flow return on assets of	Earnings before depreciation, interest, and taxes (EBITDA), as a percentage of beginning of year market value of assets (market value of equity, plus book value debt and preferred stock, minus cash).
Cash flow margin	EBITDA divided by sales.
Asset turnover	Sales divided by beginning-of-year market value of assets.
Asset sales	Change in book value of assets, less capital expenditures, plus depreciation, as a percentage of beginning-of-year book value of assets.
Asset growth value	Change in market value of assets, as a percentage of beginning-of-year market of assets.
Capital Expenditures	Capital expenditures, as a percentage of beginning-of-year market value of assets.
Leverage	End-of-year market value of assets, divided by end-of-year market value of equity.
Market-to-book ratio of	End-of-year market value of common equity, divided by end-of-year book value common equity.
Sales growth	Change in sales, as a percentage of previous year's sales
Free cash flow	Net income, plus depreciation, less capital expenditures, less preferred dividends, less common dividends, as a percentage of beginning of year market value of assets.
Cash Holdings	Cash and short-term investments as a percentage of book value of assets.

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Table 2

Descriptive Statistics for repurchase announcing firms and control firms for the full sample, for high q firms, and for low q firms.

Shown for each variable are the mean and median values for repurchase announcing firms and control firms. Values for each repurchase announcing firm and its matched control firm are measured at Year -1, the year before the repurchase announcement. Cash flow return on assets is defined in Table 1. The t-value is shown for the difference in means. The Z-value is shown for the difference in medians (using the Wilcoxon signed-rank test). For all tests, the number in the parentheses is the p-value.

Variable	Repurchase Announcing	Matched Control	Test of Difference
Total Market Value of Equity (n = 351)			
Mean	672.91	660.22	0.7852 (p = 0.4329)
Median	137.42	134.07	1.335 (z = 0.1818)
Cash flow return on assets (n = 300)			
Mean	0.2145	0.1752	0.9377 (p = 0.3491)
Median	0.1593	0.1585	-0.321 (z = 0.7486)
Q (n = 351)			
Mean	1.32	1.28	0.6264 (p = 0.5315)
Median	0.91	0.87	2.707 (z = 0.0068)

High Q Sample

Variable	Repurchase Announcing	Matched Control	Test of Difference
Total Market Value of Equity (n = 158)			
Mean	966.24	923.26	1.3787 (p = 0.1699)
Median	245.25	252.67	1.591 (z = 0.1116)
Cash flow return on assets (n = 123)			
Mean	0.1478	0.1376	0.7997 (p = 0.4255)
Median	0.1306	0.1345	0.220 (z = 0.8262)
Q (n = 158)			
Mean	2.27	2.16	0.6217 (p = 0.5351)
Median	1.80	1.56	2.633 (z = 0.0085)

Continuation of Table 2

Low Q Sample

Variable	Repurchase Announcing	Matched Control	Test of Difference
Total Market Value of Equity (n = 193)			
Mean	432.77	444.89	-0.8415 (p = 0.4011)
Median	91.30	96.43	0.380 (z = 0.7037)
Cash flow return on assets (n = 177)			
Mean	0.2608	0.2014	0.8438 (p = 0.3999)
Median	0.1877	0.1785	-0.326 (z = 0.7445)
Q (n = 193)			
Mean	0.55	0.55	0.0758 (p = 0.9397)
Median	0.58	0.57	0.920 (z = 0.3578)

Table 3

Median differences in operating performance and valuation variables between repurchase announcing firms and control firms for the full sample, for high q firms, and for low q firms

Shown for each variable are the median difference (repurchase announcing firm values minus control firm values), the t-value, the p-value, and the number of matched pairs of firms in the sample. Operating performance variables are defined in Table 1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, using a 2-tail test. The top number shown for each variable is the median difference. The z-value is indicated in the upper parentheses, whereas the number in the lower parentheses is the p-value. Directly below each p-value is the number of matched pairs of firms in the sample. Median differences are checked using the Wilcoxon signed-rank test. Year 0 is defined as the fiscal year in which the open market share repurchase was announced.

Panel A: Results for the full sample of firms

Year	Return On Assets	Capital Expenditures	Asset Sales	Asset Growth	Sales Growth	Free Cash Flow	Leverage	Market-to-Book	Asset Turnover	Cash flow margin	Cash to BV Assets
-1	0.000	-0.026%	0.059%	-0.075	-0.001	1.568%	-0.100	0.016	-0.128	0.010	0.0370
	(-0.322)	(-0.747)	(0.370)	(-1.700)	(0.636)	(3.011)	(-6.415)	(1.000)	(-2.125)	(1.898)	(5.394)
	(0.7476)	(0.4550)	(0.7112)	(0.0891)*	(0.5245)	(0.0026)***	(0.0000)***	(0.3174)	(0.0336)**	(0.0577)*	(0.0000)***
	300	294	315	300	342	294	351	351	300	351	351
0	0.000	0.127%	-2.088%	-0.072	-0.004	1.167%	-0.129	0.001	-0.101	0.006	0.0395
	(0.930)	(0.005)	(-1.759)	(-1.249)	(-0.302)	(2.526)	(-6.631)	(0.025)	(-1.099)	(1.169)	(5.739)
	(0.3526)	(0.9959)	(0.0786)*	(0.2117)	(0.7625)	(0.0115)**	(0.0000)***	(0.9799)	(0.2716)	(0.2423)	(0.0000)***
	336	331	298	331	336	331	330	331	336	335	336
+1	0.009	0.543%	-0.897%	0.056	-0.013	0.926%	-0.101	0.087	0.003	0.003	0.0212
	(1.436)	(0.643)	(-0.046)	(2.745)	(0.063)	(2.538)	(-5.297)	(2.435)	(-0.070)	(-0.047)	(4.850)
	(0.1510)	(0.5203)	(0.9630)	(0.0060)***	(0.9498)	(0.0112)**	(0.0000)***	(0.0149)**	(0.9443)	(0.9623)	(0.0000)***
	298	294	265	293	303	293	293	294	299	300	304
+2	0.005	-0.139%	0.106%	0.001	0.023	0.158%	-0.105	0.170	-0.026	0.005	0.0188
	(0.701)	(0.031)	(-0.527)	(-0.023)	(1.807)	(0.272)	(-3.945)	(2.710)	(-0.794)	(0.419)	(3.821)
	(0.4835)	(0.9749)	(0.5982)	(0.9820)	(0.0707)*	(0.7860)	(0.0001)***	(0.0067)***	(0.4272)	(0.6753)	(0.0001)***
	266	264	242	267	273	261	267	267	268	271	277
+3	0.001	-0.099%	-0.351%	0.007	0.007	0.946%	-0.082	0.261	0.016	0.003	0.0141
	(0.719)	(-0.270)	(-0.041)	(0.818)	(0.976)	(1.242)	(-4.091)	(2.547)	(-0.063)	(0.253)	(2.906)
	(0.4724)	(0.7872)	(0.9675)	(0.4135)	(0.3293)	(0.2143)	(0.0000)***	(0.0109)**	(0.9494)	(0.8003)	(0.0037)***

236	233	235	236	242	232	238	239	237	241	244
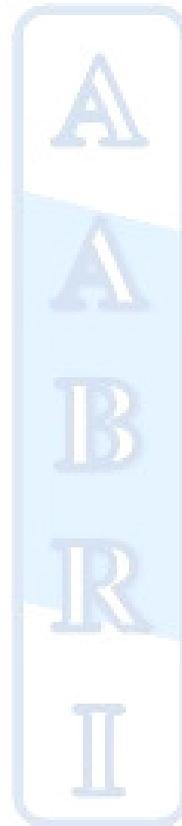
Continuation of Table 3

Median differences in operating performance and valuation variables between repurchase announcing firms and control firms for high q and low q firms

Shown for each variable are the median difference (repurchase announcing firm values minus control firm values), the t-value, the p-value, and the number of matched pairs of firms in the sample. Operating performance variables are defined in Table 1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, using a 2-tail test. The top number shown for each variable is the median difference. The z-value is indicated in the upper parentheses, whereas the number in the lower parentheses is the p-value. Directly below each p-value is the number of matched pairs of firms in the sample. Median differences are checked using the Wilcoxon signed-rank test. Year 0 is defined as the fiscal year in which the open market share repurchase was announced.

Panel B shows results for the 158 repurchase announcing firms with q > 1 and their control firms. The median q value for repurchase announcing firms in Panel B is 1.796. Panel C shows results for the 193 repurchase announcing firms with q < 1 and their control firms. The median q value for repurchase announcing firms in Panel C is 0.584.

Panel B: Results for firms with q > 1

Year	Return On Assets	Capital Expenditure	Asset Sales	Asset Growth	Sales Growth	Free Cash Flow	Leverage	Market-to-Book	Asset Turnover	Cash flow margin	Cash to BV Assets
-1	0.001	0.115%	-1.920%	-0.053	-0.001	0.726%	-0.067	0.109	0.040	0.011	0.0620
	(-0.222)	(-0.171)	(-0.168)	(-1.167)	(0.290)	(1.020)	(-4.348)	(1.122)	(-0.909)	(0.867)	(3.624)
	(0.8242)	(0.8644)	(0.8669)	(0.2431)	(0.7720)	(0.3075)	(0.0000)***	(0.2617)	(0.3635)	(0.3859)	(0.0003)***
	123	121	137	123	152	121	158	158	123	158	158
0	-0.006	0.306%	-4.973%	-0.083	-0.036	-0.955%	-0.040	0.031	-0.063	0.000	0.0366
	(-1.005)	(0.824)	(-1.730)	(-1.138)	(-1.144)	(-0.410)	(-2.178)	(0.480)	(-1.271)	(-0.114)	(2.891)
	(0.3149)	(0.4101)	(0.0836)*	(0.2551)	(0.2525)	(0.6818)	(0.0294)**	(0.6316)	(0.2038)	(0.9090)	(0.0038)***
	151	150	133	148	151	150	148	158	151	151	151
+1	0.004	0.504%	-4.637%	-0.022	-0.026	-0.100%	-0.045	0.252	0.003	-0.003	0.0199
	(0.589)	(0.639)	(-2.250)	(0.280)	(-0.507)	(0.110)	(-2.108)	(2.471)	(-0.220)	(-0.935)	(2.190)
	(0.5561)	(0.5231)	(0.0244)**	(0.7798)	(0.6122)	(0.9125)	(0.0351)**	(0.0135)**	(0.8262)	(0.3497)	(0.0285)**
	135	134	121	133	138	134	133	134	135	136	137
+2	0.009	-0.340%	-0.466%	-0.030	0.010	0.158%	-0.043	0.593	-0.052	0.000	0.0188
	(0.881)	(-0.997)	(-0.931)	(-0.638)	(0.476)	(0.501)	(-2.192)	(3.006)	(-1.121)	(0.001)	(1.881)
	(0.3782)	(0.3190)	(0.3518)	(0.5237)	(0.6342)	(0.6162)	(0.0284)**	(0.0026)***	(0.2622)	(0.9990)	(0.0599)*
	120	120	109	120	123	119	120	120	121	121	125

+3	0.008	-0.451%	-0.288%	0.032	-0.006	0.470%	-0.037	0.946	-0.026	0.003	0.0047
	(1.051)	(-1.083)	(0.292)	(1.255)	(0.125)	(0.749)	(-2.024)	(3.346)	(-0.284)	(0.440)	(0.726)
	(0.2934)	(0.2787)	(0.7704)	(0.2094)	(0.9009)	(0.4536)	(0.0430)**	(0.0008)***	(0.7766)	(0.6601)	(0.4676)
	104	102	104	103	106	102	105	106	104	106	108

Panel C: Results for firms with q < 1

Year	Return On Assets	Capital Expenditure	Asset Sales	Asset Growth	Sales Growth	Free Cash Flow	Leverage	Market-to-Book	Asset Turnover	Cash flow margin	Cash to BV Assets
-1	-0.001	-0.070%	0.329%	-0.079	0.001	1.980%	-0.199	-0.017	-0.240	0.010	0.0242
	(-0.323)	(-0.897)	(0.785)	(-1.310)	(0.592)	(2.967)	(-5.017)	(0.268)	(-1.757)	(1.909)	(4.026)
	(0.7467)	(0.3695)	(0.4324)	(0.1903)	(0.5541)	(0.0030)***	(0.0000)***	(0.7884)	(0.0789)*	(0.0563)*	(0.0001)***
	177	173	178	177	190	173	193	193	177	193	193
0	0.018	-0.134%	-0.793%	-0.061	0.009	3.288%	-0.288	-0.027	-0.173	0.007	0.0414
	(1.695)	(-0.561)	(-0.667)	(-0.602)	(0.782)	(3.334)	(-6.507)	(-0.356)	(-0.484)	(1.709)	(5.177)
	(0.0901)*	(0.5748)	(0.5047)	(0.5471)	(0.4341)	(0.0009)***	(0.0000)***	(0.7218)	(0.6284)	(0.0875)*	(0.0000)***
	185	181	165	183	185	181	182	183	185	184	185
+1	0.017	0.829%	1.609%	0.101	0.002	2.314%	-0.249	0.037	-0.011	0.015	0.0213
	(1.350)	(0.322)	(2.247)	(3.562)	(0.618)	(3.051)	(-5.029)	(1.072)	(0.200)	(0.904)	(4.631)
	(0.1769)	(0.7475)	(0.0247)**	(0.0004)***	(0.5364)	(0.0023)***	(0.0000)***	(0.2839)	(0.8412)	(0.3661)	(0.0000)***
	163	160	144	160	165	159	160	160	164	164	167
+2	-0.002	0.329%	0.988%	0.016	0.030	0.182%	-0.178	0.057	0.016	0.010	0.0191
	(0.280)	(0.821)	(0.205)	(0.505)	(2.081)	(-0.003)	(-3.180)	(0.671)	(-0.242)	(0.643)	(3.524)
	(0.7792)	(0.4118)	(0.8372)	(0.6138)	(0.0375)**	(0.9976)	(0.0015)***	(0.5022)	(0.8090)	(0.5205)	(0.0004)***
	146	144	133	147	150	142	147	147	147	150	152
+3	-0.006	0.048%	-0.483%	0.006	0.011	1.527%	-0.169	0.076	0.038	0.003	0.0218
	(0.196)	(0.505)	(-0.215)	(0.027)	(1.270)	(0.914)	(-3.575)	(0.125)	(0.098)	(-0.061)	(3.538)
	(0.8442)	(0.6133)	(0.8299)	(0.9785)	(0.2042)	(0.3605)	(0.0003)***	(0.9008)	(0.9222)	(0.9510)	(0.0004)***
	132	131	131	133	136	130	133	133	133	135	136

Table 4

Tests of abnormal changes in operating performance and firm characteristics following announcements of open market share repurchase plans

Shown for each variable are regression results where post-announcement differences (repurchase announcing firm values minus control firm values) are regressed on pre-announcement differences. The pre-announcement difference is the difference in year –1. The post-announcement difference is the median of differences from years 0 through +3. Abnormal changes in variables are indicated by significant intercepts (alphas). The upper .5% and the lower .5% of all observations (post-announcement differences minus pre-announcement differences) have been trimmed as outliers. All variables are defined in Table 1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, using a 2-tail test. The t-values are indicated in the upper parentheses, immediately below intercept and beta coefficient estimates. The p-values are indicated in lower parentheses, immediately below the t-values. The number of matched pairs in the sample regression is indicated by n=. Panel A reports regression results for the full sample of repurchase announcing firms. Panels B and C report results for the repurchase announcing firms with q < 1 and q > 1, respectively.

Panel A: Results for the full sample of firms

Variable	Intercept	Beta	R^2	F-Statistics
Cash flow return on assets n=291	-0.0033 (-0.407) (0.684)	0.2864 (6.288) (0.000)***	0.1204	F = 39.54 Prob>F = 0.0000
Market-to-book ratio n=327	0.3537 (2.539) (0.012)**	0.4833 (9.676) (0.000)***	0.2237	F = 93.63 Prob>F = 0.0000
Leverage N=326	-0.1208 (-2.556) (0.011)**	0.7713 (10.446) (0.000)***	0.2519	F = 109.11 Prob>F = 0.0000
Asset turnover N=282	-0.0827 (-0.763) (0.446)	0.3607 (7.442) (0.000)***	0.1651	F = 55.38 Prob>F = 0.0000
Cash flow margin N=330	-0.0081 (-1.144) (0.253)	0.6897 (12.489) (0.000)***	0.3223	F = 155.96 Prob>F = 0.0000
Capital expenditures n=276	0.0060 (1.027) (0.305)	0.3369 (6.950) (0.000)***	0.1499	F = 48.30 Prob>F = 0.0000
Asset sales N=286	-0.0089 (-0.648) (0.518)	0.0956 (3.528) (0.000)***	0.0420	F = 12.45 Prob>F = 0.0005
Asset growth N=277	0.0546 (1.096) (0.274)	0.0165 (0.300) (0.764)	0.0003	F = 0.09 Prob>F = 0.7644
Sales growth n=320	0.0145 (0.946) (0.345)	0.1249 (4.530) (0.000)***	0.0606	F = 20.52 Prob>F = 0.0000
Free cash flow n=276	0.0274 (2.069) (0.039)**	0.1749 (2.467) (0.014)**	0.0217	F = 6.09 Prob>F = 0.0142
Cash to BV assets n=330	0.0057 (0.930) (0.353)	0.6951 (23.664) (0.000)***	0.6306	F = 560.00 Prob>F = 0.0000

Panel B: Results for firms with q > 1

Variable	Intercept	Beta	R^2	F-Statistics
Cash flow return on assets n=122	-0.0057 (-1.036) (0.302)	0.2548 (6.584) (0.000)***	0.2654	F = 43.35 Prob>F = 0.0000
Market-to-book ratio n=144	0.9036 (3.516) (0.001)***	0.4279 (6.660) (0.000)***	0.2380	F = 44.35 Prob>F = 0.0000
Leverage n=148	0.0150 (0.319) (0.750)	1.1886 (7.113) (0.000)***	0.2573	F = 50.59 Prob>F = 0.0000
Asset turnover n=118	-0.0360 (-0.592) (0.555)	0.3991 (7.712) (0.000)***	0.3389	F = 59.48 Prob>F = 0.0000
Cash flow margin n=145	-0.0165 (-1.253) (0.212)	0.7487 (9.303) (0.000)***	0.3771	F = 86.55 Prob>F = 0.0000
Capital Expenditures n=115	0.0012 (0.216) (0.829)	0.2394 (5.619) (0.000)***	0.2184	F = 31.58 Prob>F = 0.0000
Asset sales n=122	-0.0329 (-1.257) (0.211)	0.0990 (2.427) (0.017)**	0.0468	F = 5.89 Prob>F = 0.0167
Asset growth n=114	0.0073 (0.152) (0.880)	0.0559 (1.200) (0.233)	0.0127	F = 1.44 Prob>F = 0.2327
Sales growth n=141	0.0104 (0.372) (0.711)	0.2046 (4.921) (0.000)***	0.1484	F = 24.22 Prob>F = 0.0000
Free cash flow n=116	0.0155 (0.841) (0.402)	0.5556 (4.220) (0.000)***	0.1351	F = 17.81 Prob>F = 0.0000
Cash to BV assets n=148	-0.0164 (-1.558) (0.121)	0.7208 (16.089) (0.000)***	0.6394	F = 258.87 Prob>F = 0.0000

Panel C: Results for firms with q < 1

Variable	Intercept	Beta	R^2	F-Statistics
Cash flow return on assets n=169	-0.0012 (-0.088) (0.930)	0.2989 (4.453) (0.000)***	0.1061	F = 19.83 Prob>F = 0.0000
Market-to-book ratio n=183	-0.0400 (-0.293) (0.770)	0.8386 (7.039) (0.000)***	0.2149	F = 49.55 Prob>F = 0.0000
Leverage n=178	-0.2243 (-2.904) (0.004)***	0.7044 (7.545) (0.000)***	0.2444	F = 56.93 Prob>F = 0.0000
Asset turnover n=164	-0.1164 (-0.640) (0.523)	0.3547 (5.379) (0.000)***	0.1515	F = 28.94 Prob>F = 0.0000
Cash flow margin n=185	-0.0019 (-0.265) (0.791)	0.5598 (6.997) (0.000)***	0.2111	F = 48.96 Prob>F = 0.0000
Capital expenditures n=161	0.0103 (1.112) (0.268)	0.4209 (5.317) (0.000)***	0.1510	F = 28.27 Prob>F = 0.0000
Asset sales n=164	0.0090 (0.645) (0.520)	0.0889 (2.395) (0.018)**	0.0342	F = 5.74 Prob>F = 0.0178
Asset growth n=163	0.0871 (1.118) (0.265)	-0.0274 (-0.287) (0.775)	0.0005	F = 0.08 Prob>F = 0.7747
Sales growth n=179	0.0260 (1.686) (0.094)*	-0.0215 (-0.620) (0.536)	0.0022	F = 0.38 Prob>F = 0.5358
Free cash flow n=160	0.0365 (2.013) (0.046)**	0.0520 (0.614) (0.540)	0.0024	F = 0.38 Prob>F = 0.5401
Cash to BV assets n=183	0.0231 (3.359) (0.001)***	0.6748 (18.030) (0.000)***	0.6436	F = 325.07 Prob>F = 0.0000

Table 5

Abnormal returns at announcements of open market share repurchases

Shown are abnormal stock returns around initial announcements of open market share repurchase plans. Day 0 is the day of the announcement. The market model with the CRSP equally weighted index and the Scholes-Williams correction is used. The estimation period covers the 255 consecutive trading days ending 46 days before the announcement. Abnormal returns are calculated for each firm, provided the necessary CRSP data are available. Panel A shows returns for the full sample of repurchase announcing firms and control firms. Panels B and C show returns after the full sample is divided into high q and low q firms, respectively. The symbols *, **, ***, and **** denote statistical significance at the 10%, 5%, 1%, and 0.1% levels, respectively, using a 2-tail test. Generalized Z statistics are shown for tests of Mean CARs. Sign Z statistics are shown for nonparametric tests.

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Panel A: Returns for full sample

Returns for the full sample of repurchase announcing firms

Days	N	Mean CAR	Pos\Neg	Z	Sign Z
(-30,-2)	349	-6.07%	132:217	-7.010****	-3.493****
(-1,0)	349	2.92%	241:108	11.388****	8.195****
(+1,+30)	349	4.04%	220:129	4.945****	5.944****

Returns for the full sample of control firms

Days	N	Mean CAR	Pos\Neg	Z	Sign Z
(-30,-2)	325	-1.80%	141:184	-2.484**	-1.281
(-1,0)	325	0.14%	158:167	0.447 0.608	
(+1,+30)	325	-0.93%	156:169	-1.151	0.386

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Panel B: Returns for firms with q >= 1

Returns for the q >=1 sample of repurchase announcing firms

Days	N	Mean CAR	Pos\Neg	Z	Sign Z
(-30,-2)	159	-7.90%	50:109	-6.371****	-4.094****
(-1,0)	159	1.81%	104:55	4.484****	4.481****
(+1,+30)	159	3.59%	102:57	2.764***	4.163****

Returns for the q >= 1 sample of control firms

Days	N	Mean CAR	Pos\Neg	Z	Sign Z
(-30,-2)	149	-0.67%	70:79	-0.712	-0.293
(-1,0)	149	-0.26%	67:82	-0.406	-0.785
(+1,+30)	149	-1.01%	76:73	-0.928	0.691

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Panel C: Returns for firms with q < 1

Returns for the q < 1 sample of repurchase announcing firms

Days	N	Mean CAR	Pos\Neg	Z	Sign Z
(-30,-2)	190	-4.55%	82:108	-3.673****	-0.987
(-1,0)	190	3.84%	137:53	11.331****	7.010****
(+1,+30)	190	4.42%	118:72	4.174****	4.247****

Returns for the q < 1 sample of control firms

Days	N	Mean CAR	Pos\Neg	Z	Sign Z
(-30,-2)	176	-2.76%	71:105	-2.720***	-1.474
(-1,0)	176	0.49%	91:85	0.981 1.552	
(+1,+30)	176	-0.87%	80:96	-0.709	-0.112

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