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# Share Repurchases: How Important Is Market Timing?

by

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## Abstract

Although market-timing and leverage-rebalancing motives are empirically important, free cash flow (FCF) and employee stock options (ESOs) considerations have considerably stronger effects on share repurchase decisions. Managers either do not systematically time the market or have poor timing abilities as many firms do not exploit good timing opportunities through repurchases. Moreover, firms' decisions to buy back shares often tend to be poor in a market-timing sense as they are more likely to experience negative than positive abnormal stock returns after repurchases. On the other hand, high levels of FCF greatly increase the probability of conducting a repurchase, and this effect dominates the market-timing consideration. A large increase in ESOs also leads to a higher probability of conducting a repurchase, regardless of whether market timing opportunities are favorable or unfavorable. While lower debt ratios below the estimated target levels are associated with higher probability of undertaking a tender-offer repurchase, this finding is sensitive to the model for estimating leverage targets.

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## 1. Introduction

The market-timing explanation for share repurchases holds that managers exploit stock market undervaluation by buying back stock on the cheap. The literature views market timing as the primary explanation for share repurchases (see, e.g., Vermaelen, 2005; Baker and Wurgler, 2002). This argument is grounded in evidence that includes: (1) positive average abnormal announcement returns for all types of repurchases except greenmail transactions (Dann, 1981; Vermaelen, 1981; Masulis, 1980; Peyer and Vermaelen, 2005); (2) a negative correlation between prior stock returns and open-market repurchase (Comment and Jarrell, 1991; Stephens and Weisbach, 1998); (3) positive post-buyback long-term excess returns of average firms in open-market, tender-offer and private repurchases (Lakonishok and Vermaelen, 1990; Ikenberry, Lakonishok and Vermaelen, 1995; Ikenberry, Lakonishok and Vermaelen, 2000; Peyer and Vermaelen, 2005 and 2009); and (4) a negative correlation between market-to-book ratio (M/B) and open-market repurchases (Dittmar, 2000).

However, some researchers have found that aggregate stock repurchase volume is positively related to aggregate stock market valuation (Dittmar and Dittmar, 2008). For example, the aggregate dollar amount of stock repurchases (net of equity issuance) peaked at $414 billion in 2007 when stock markets were skyrocketing and not long before they plummeted with the arrival of the financial crisis. It is therefore unlikely that market timing fully explains aggregate repurchase activities as the market-timing hypothesis predicts that firms tend to repurchase less when stock market valuation is high. An alternative possibility is that some firms may be undervalued while the aggregate stock market valuation is high. In rejecting this possibility, Dittmar and Dittmar (2008) show that the time-series pattern of aggregate repurchases is not explained by the relative valuation of repurchasing firms. Their results suggest that, on the aggregate level, firms are more likely to repurchase when their stock prices are high.

Moreover, in recent years, practitioners have criticized managers for buying back shares at prices that seemed too high. The *Wall Street Journal* made this point bluntly in an article titled "Corporate buybacks test concept of value":

> "Warren Buffett knows a value stock when he sees it. Other executives can struggle with the concept -- particularly when it comes to their own company's shares.
>
> Take General Electric Co. From the start of 2005 until the end of this June, GE bought back $29 billion dollars of stock, paying an average of $36 and change for each share, according to regulatory filings. This week, it sold $12.2 billion worth for $22.25 each (before fees) and put $3 billion worth of warrants, with the same strike price, in Mr. Buffett's pocket." (*The Wall Street Journal*, October 6, 2008*)*.

The "CFO Journal" column raised a similar point in a story titled "Buying shares often brings troubles," which criticizes 30 companies in the Dow Jones Industrial Average for wasting cash on poorly timed buybacks:

> "The 30 companies in the Dow Jones Industrial Average have spent a combined total of about $70.6 billion this year to buy back their stock. Through Friday they had lost 7.5% on their investment, far outstripping the industrial average's 3.9% decline over the same period." (*The Wall Street Journal*, October 12, 2011).

Bonaime, Hankins, and Jordan (2012) raise a similar criticism in an academic study of share repurchases and market timing. They examine a sample of 5,517 firms that bought back shares during at least one quarter between 1984 and 2010. They compare stock price and other valuation variables for the same firm during the buyback quarters and non-buyback quarters, and find that managers tend to repurchase in quarters in which stock prices are high and other valuation variables are unfavorable. Moreover, they show that the average annualized rate of return on each firm's investment in its own stock (as of the end of 2010 or until the firm delists) would have been almost 2% higher had the managers just evenly spaced their repurchases through all quarters during the life in the sample rather than repurchasing in some quarters but not in others. In other words, their findings suggest that, conditional on the decision to repurchase shares, managers generally do not pick the best time to do so. These findings, together with the practitioners' criticisms, cast doubt on the market-timing explanation for repurchases.

The purpose of this study is to gauge whether or to what extent market timing is an important explanation for repurchases. Prior studies find that the average post-repurchase excess stock return is positive and thus conclude that repurchasing firms typically have undervalued shares at the time when they buy back stock. This inference is problematic as I discuss later. Even if we accept their conclusions, an observation that repurchasing firms typically have undervalued shares does not necessarily indicate

that market timing is the main motive for repurchases, since many firms may also face favorable market-timing opportunities, yet fail to repurchase. Therefore I examine possible market-timing opportunities for all sample firms and investigate how many of them exploit stock market undervaluation through repurchases. This approach differs from that of Bonaime, Hankins, and Jordan (2012), who analyze firms that have made the decision to repurchase stock and assess whether they pick the optimal time to do so. I seek to understand how often managers take advantage of attractive market-timing opportunities via repurchases, and how often their decisions to repurchase stock turn out to be good or poor.

I do so by first running logit regressions to assess whether the probability that a firm conducts a repurchase is positively related to favorable market-timing conditions. Although I eventually examine all repurchases, I focus on tender-offer repurchases first because this type of repurchases tends to be large in size and is usually completed in a relative short period of time. If managers do repurchase shares to exploit market undervaluation, they are more likely to repurchase a large number of shares when the timing is extremely favorable. Moreover, Comment and Jarrell (1991) argue that tender-offer repurchases are stronger signals of stock undervaluation than open-market repurchases. Therefore market-timing effects are likely to be more prominent and more readily observable in tender-offer repurchases due to their large size and strong signaling effect.

To gauge the importance of market timing in explaining repurchases, I focus on comparing the explanatory power of market timing on the probability of repurchase against a simple theory in which firms conduct repurchases to distribute free cash flow (FCF). Firms could also distribute FCF by paying dividends. However, the focus in this study is not on explaining either total payouts or the mix of dividends and repurchases. Rather, the focus is on why firms repurchase stock and, in particular, to gauge the importance of timing in the repurchase decisions. Therefore, FCF serves as an appropriate alternative hypothesis to the market-timing hypothesis. Other theoretical explanations for repurchases are also compared to market timing. These motives include substituting buybacks for dividends to avoid value reduction in employee stock options (ESOs), reducing the number of shares outstanding to offset the EPS dilution impact of ESOs, and increasing the debt-to-equity ratio to rebalance toward a target leverage ratio.

The logit regressions assess repurchase decisions using the market-to-book ratio (M/B), and pre- and post-repurchase abnormal stock returns - proxies employed by prior studies - to measure timing opportunities. I find that the tender-offer probability in a given year is (1) not statistically significantly related to post-repurchase abnormal stock returns, (2) positively related to pre-repurchase abnormal stock return when measured over the 12 months before the year in which a firm repurchases, and (3) negatively related to M/B. The first two findings are inconsistent with the market-timing hypothesis while the last finding is consistent with that hypothesis. However, M/B plausibly captures factors other than stock market undervaluation. For example, M/B also measures growth opportunities, as is widely understood. Therefore the negative coefficient on M/B is also consistent with the FCF hypothesis, which suggests that low-growth firms tend to have more FCF and are more likely to distribute FCF via repurchases. As a result, it is not conclusive that a negative coefficient on M/B is evidence supporting the market-timing hypothesis.

Although market timing shows some explanatory power for the decision to conduct a tender-offer repurchase, FCF has a stronger impact. I use the ratio of operating income before depreciation (OIBDP in Compustat) to total assets as a proxy for FCF. [1]When I include this FCF proxy in the logit regressions along with timing variables, high levels of FCF greatly increase the probability of conducting a repurchase tender offer regardless of whether timing opportunities are favorable or unfavorable. Moreover, a firm with poor timing opportunities and high FCF is more likely to conduct a tender-offer repurchase than a firm with excellent timing opportunities and low FCF.

In interpreting the logit results, I attribute the full impact on the repurchase decision of M/B to market timing. Although this interpretation favors the market-timing hypothesis, FCF nonetheless has a stronger influence on the probability that a firm conducts a tender-offer repurchase. Caution is needed in interpreting this result. Regardless of whether market timing conditions are favorable or unfavorable, a large difference in the level of FCF implies a large *relative* percentage change in the probability of a

[1] I also use the ratio of operating income before depreciation (OIBDP in Compustat) to total assets minus the median capital expenditure to assets ratio in the same industry to proxy for FCF. Results remain qualitatively unchanged.

tender offer, indicating the strength of the FCF effect over the market-timing effect. However, the *absolute* change in the probability of a tender offer is small, and thus casts doubts on the market-timing and FCF hypotheses as a stand-alone theory of tender-offer repurchases.

When I apply the same logit analyses to general repurchase decisions, variation in FCF induces both large *relative* and *absolute* change in repurchase probability. For example, a firm with a high level of FCF and highly unfavorable timing opportunities is more than twice likely to buy back at least 1% of its shares than a firm with a low level of FCF and highly attractive timing opportunities (19.14% versus 7.57%). In this case, the absolute change in repurchase probability is nearly 12%, indicating the strong FCF effect on the repurchase probability.

These estimates also demonstrate that the FCF effect overrides the market-timing effect on the estimated probability of conducting a repurchase. Without a high level of FCF, firms facing excellent market-timing opportunities are reluctant to exploit them through repurchases.

Another difference between the tender-offer and general repurchase logit results is that the general repurchase probability is negatively related to past abnormal stock returns and positively related to future abnormal stock returns. This is consistent with the market-timing hypothesis. However, abnormal stock returns show no significantly economic effect, as a swing of 180% (-90% to 90%) in abnormal stock returns have almost no effect on the estimated repurchase probability. Except for the above two differences, the results from the logit analyses on tender-offer and general repurchase are qualitatively the same.

An important finding stands out from the logit results is that although the market-timing hypothesis can explain some repurchase activities, it cannot provide a stand-alone theory that can explain the majority of repurchase activities. This is because when the FCF effect is not considered, nearly 80% of firms facing extremely attractive timing opportunities choose not to conduct a repurchase.

As with FCF, the change in employee stock options (ESOs) also shows a stronger influence than market timing on the repurchase decisions. I compute the change in ESOs as the difference between the ratios of Compustat options outstanding to common shares outstanding in the current and prior year.

When I include this option increase proxy in the logit regressions instead of FCF, the increase in ESOs leads to a higher probability of conducting a repurchase. This effect almost remains the same in all hypothetical timing scenarios. For example, for a firm facing extremely unfavorable (or favorable) timing opportunities, the estimated probability of conducting a repurchase jumps from 28% to 40% (or 41%) when its change in ESOs increases from 0% to 10% of its shares outstanding.

I also find that lower debt ratios below the estimated target levels are associated with higher probability of undertaking a tender-offer repurchase. However this finding does not necessarily support the leverage rebalancing hypothesis for tender-offer repurchases. When I estimate the target leverage ratios as fitted values from a linear regression of debt to assets ratio on variables often hypothesized to affect leverage decisions (see Rajan and Zingales, 1995), firms tend to have debt ratios below their predicted targets before tender offers. However, when industry median debt ratios (2-digit SIC or Fama-French 49 industries) are used as the target ratios, firms on average have debt ratios above their estimated targets before tender offers, inconsistent with the rebalancing hypothesis.

Even when firms decide to repurchase shares, their decisions often tend to be poor in a market-timing sense. I find that the median post-repurchase abnormal returns are -3% during the 12 months following the year in which a firm repurchases shares and -7% during the 36 months following the year in which a firm repurchases shares. The negative median post-repurchase abnormal stock returns indicate that more than half of the firms experience abnormal stock price declines after repurchases. This is inconsistent with the market-timing hypothesis, because if managers do time the market and buy back shares when their firms' stock is cheap, we should expect to see that firms are more likely to experience abnormal stock price appreciations after repurchases.

In contrast, the mean post-repurchase abnormal returns have the opposite sign to the median values: 7% during 12 months and 18% during 36 months. These positive post-repurchase abnormal returns are consistent with some degree of semi-strong form market inefficiency. However, this finding of market inefficiency does not necessarily support the market-timing hypothesis as I discuss later. Moreover, these positive average values do not imply that a firm would be more likely to experience abnormal stock price

appreciation than abnormal stock price depreciation after repurchases. This is because the average value is distorted by extreme values, a finding that stands out when I examine the full distributions of post-repurchase abnormal returns.

This investigation shows that the positive average post-repurchase abnormal stock returns are mostly driven by extreme abnormal stock returns following small repurchases that account for 6% of the aggregate dollar value repurchased. Among all repurchases in the sample from 1985 to 2010, the largest post-repurchase abnormal returns are 3,891% during the 12 months following the year in which a firm repurchases shares and 4,457% during the 36 months following the year in which a firm repurchases shares. However, the lowest post-repurchase abnormal returns are limited to -100% by the nature of rate of return calculation. In a semi-strong efficient market, the expected average abnormal return should be zero. Nevertheless, if the market is inefficient as indicated by the positive average abnormal returns, this asymmetry could easily generate a positive average value even if more observations are negative than positive.

To test whether extreme values are responsible for the positive average post-repurchase abnormal returns, I examine the abnormal returns in the middle of the full distribution. When I focus on the middle 80% of the distribution, I find that both 12-month and 36-month post-repurchase average abnormal returns become -1%. Moreover, these 80% of repurchases represent more than 94% of the aggregate dollar value repurchased, indicating that positive average post-repurchase abnormal returns are mostly driven by firms that repurchase trivial amounts and experience extremely positive or negative abnormal returns after that. If I focus on the middle 90% of distribution, the average 12-month future abnormal return becomes zero while the average 36-month future abnormal return becomes 3.2%. This suggests that the inclusion of extreme values does push the average future abnormal returns toward positive.

Since the market-timing hypothesis concerns the behavior of managers, we should focus on what most managers do. As a result, the relevant research question is "what is more likely to happen to the share prices if managers conduct a repurchase." The mean post-repurchase abnormal returns are distorted by extreme abnormal stock returns, and thus cannot tell us what is more likely to happen after repurchases,

abnormal stock price depreciation or appreciation. It is therefore not appropriate to emphasize the positive mean post-repurchase abnormal stock returns as strong evidence supporting the market-timing hypothesis. In contrast, the negative median post-repurchase abnormal returns imply that the majority of repurchasing firms experience negative abnormal stock returns after buybacks. This suggests that managers' decisions to conduct a repurchase are generally poor in a market-timing sense, inconsistent with the market-timing hypothesis.

To summarize, the results from the logit analyses and distribution analyses indicate that market-timing effects are at most weak, as they show either managers do not systematically time the market or their ability to time the market is poor. First, the majority of firms that face excellent timing opportunities fail to exploit them by conducting a repurchase. Second, firms that conduct repurchases are more likely to experience abnormal stock return decreases than increases. Moreover, both FCF and ESOs show greater influence on the estimated probability of conducting a repurchase than market timing.

The remainder of this paper proceeds as follows. Section 2 discusses three different versions of the market-timing theory of repurchases. Section 3 explains sample procedure and presents the aggregate repurchase activities in the US. Section 4 presents the logit analyses that yield the main inference regarding the impact of market timing and other motives on the probability of conducting a tender-offer repurchase. Section 5 presents the logit analyses that yield the inference regarding the impact of market timing and other motives on the general repurchase decisions. Section 6 reports the full distributions of post-repurchase abnormal stock returns that show the effect of extreme returns on the mean post-repurchase abnormal stock returns. Section 7 provides a short summary and discussion.

## 2. The Market-timing theory of share repurchases

Share repurchase emerged as an economically significant corporate behavior in the early 1980s (Bagwell and Shoven, 1989). Since then, the literature has viewed the market-timing hypothesis as the primary motivation for stock repurchases. Table 1 summarizes the main assumptions and implications of three distinct market-timing theories that have been advanced in the literature and that potentially explain

stock repurchase decisions. These are the mispricing theory, the rational asymmetric information theory, and the managerial perceptions theory.

The mispricing theory is the most popular market-timing theory in the repurchase literature. Unless otherwise specified, the market-timing theory in this study refers to the mispricing theory. In this theory, investors are assumed to be irrational and sometimes make mistakes in assessing firms' fundamental values. Managers are assumed to be rational. Therefore when they see their firms' common stock is undervalued by irrational investors, they exploit investors' pricing mistakes and buy back shares. Managers gain personally from buying undervalued shares if they own shares and do not sell them. So the mispricing itself provides a motive for repurchase. In this theory a repurchasing firm need not have a motive for distributing capital. When repurchases are announced, stock prices are predicted to increase immediately as investors know managers have incentives to buy back underpriced shares. However, irrational investors on average underreact to the news of repurchase. Share prices are expected to continue to increase in the long run, consistent with managers' rational expectations of firms' true values. This mispricing version of market timing implies that firms will repurchase shares when investors irrationally underprice their shares and managers expect stock prices to increase in the long-run.

In the rational asymmetric information theory, investors are assumed to make unbiased forecasts about firms' intrinsic values conditional on all public information. As a result, no undervaluation conditional on public information should be observed before repurchases take place. Managers are also rational about firms' true values and have more information about it than outside investors have. An important assumption in this theory is that firms have a fundamentals-based incentive for capital distribution, such as paying out free cash flow or rebalancing capital structure toward a target ratio. Given the incentive for distributing capital, managers time the market and conduct a repurchase when they believe current stock price is undervalued due to the asymmetric information.

Since investors are rational, the stock price is expected to increase immediately to reflect investors' unbiased estimates of fair value conditional on all public information, including information about the repurchase itself. As a result, share prices are no longer undervalued on average and managers cannot

gain simply from buying undervalued shares. Thus this theory requires a motive for managers to buy back shares in at least some states of the world in which the stock is overvalued. On the other hand, in some states of world, the stock price must increase and exceed the intrinsic value so that investors gain from selling overvalued shares. Otherwise, if managers only buy back undervalued shares, then no rational investors would sell their shares back to the firm.

In the managerial perceptions version of the market-timing theory, regardless of whether investors have biased or unbiased expectation of firms' fundamental values, managers are overconfident and believe that they know the firms' true value better than do investors and can predict future stock returns. Therefore when managers feel that their firms' shares are undervalued they will want to exploit this perceived undervaluation and buy back shares. Similar to the mispricing theory, managers' perceptions of undervaluation provide the motives for repurchase since overconfident managers believe they can exploit investors' mistakes and gain from buying undervalued shares. No other motives for repurchase are needed in the managerial perceptions version of market timing.

One assumption of this theory is that managers on average have no real ability to predict share price performance. This assumption implies that although in some cases, managers do buyback undervalued shares, they are unable to do so systematically. So, on average, they do not buy back shares at times of market undervaluation. And thus in the long run, no positive abnormal stock returns should be observed. However, in short run, stock prices are expected to increase. This is because the repurchase reveals managers' perception that current share price is too low, and thus investors have a temporary opportunity to sell the share to the firm at a price that is higher than the current price but does not exceed managers' expectation.

### 3. Aggregate repurchase activities

I analyze repurchases conducted by US industrial firms defined as those firms from the Compustat and Center for Research in Security Prices (CRSP) merged files that (1) have four-digit SIC codes outside the range 4900-4949 (utilities) and 6000-6999 (financial firms), (2) have CRSP share code 10 or 11

(common shares), (3) are incorporated in the U.S., and (4) have nonmissing values on Compustat for total assets.

Following Fama and French (2001) and Skinner (2008), I measure repurchase as net repurchase defined as the increase in common treasury stock. If the firm does not use the treasury stock method for repurchase (i.e., treasury stock is zero in both the current and prior year, or not available), I follow their approach of using the difference between stock repurchase and stock issuance to proxy for net repurchase. Figure 1 depicts of the aggregate dollar volume of repurchases and common share dividends for 14,958 sample firms from 1971 to 2010. Repurchases were rare before the adoption of SEC rule 10b-18 in November 1982 that provides a "safe harbor" for repurchasing companies from being sued for price manipulation. After that regulation was adopted, net repurchase surged in the 1980s and experienced rapid growth until reaching the peak of $414 billion in 2007 when S&P 500 also reached its historical high. Meanwhile, total dividends also increased but at a much slower speed, and were first surpassed by total repurchases in 1998.

More importantly, Figure 1 shows that the aggregate repurchases increase during a stock market boom and decline when the stock market plunges. This is consistent with the findings in Dittmar and Dittmar (2008). Some argue that individual firms' repurchases need not necessarily follow the same pattern as aggregate repurchases. However, using cross-sectional analyses, Bonaime, Hankins, and Jordan (2012) report that individual firms tend to repurchase more in quarters when their firms' average share price is high. These findings cast doubt on the market-timing hypothesis, as the market-timing explanation suggests that firms should repurchase less when stock prices are high (bad timing opportunities), the opposite to the evidence here.

Figure 2 depicts the percent of firms that repurchase and the percent of firms that pay dividends in a given year. The percent of firms that buy back shares also increased after 1982, exceeded the percent of firms that pay dividends in 1997, and reached its historical high in 2008, the year after the aggregate dollar volume repurchased peaked. Nearly 43% of sample firms in 2008 spent some cash in repurchases. It is worth noting that the stock market continued to increase in the first half of 2008 and my repurchase

measures use the annual data. Therefore it is not surprising to see large portion of firms participating in share repurchases in 2008 even though few firms bought back shares after the onset of financial crisis. On the other hand, the percent of dividend payers steadily decreased from early 1980s to early 2000s, while the total dollar amount of dividends increased during the same time, a finding that has been documented by prior studies.

During the period between 1985 and 2010, there are 600 tender-offer repurchases in my sample. These tender offers account for 2% of total number of repurchases. However, they account for about 5% of aggregate dollar value repurchased (see the Internet Appendix). This type of repurchases tends to be large in size and is usually completed in a relative short period of time. The average repurchased value in a tender-offer repurchase is $270 million compared to $98 million for all repurchases during the same period. If managers buy back shares to take advantages of market undervaluation, they would repurchase more when the market-timing opportunities are highly attractive.

In addition to their large size, Comment and Jarrell (1991) report that tender-offer repurchases are stronger signals of stock market undervaluation than are open-market repurchases because tender offers are associated with higher announcement returns than are open-market repurchases. Therefore market-timing effects likely become more prominent for tender-offer repurchases due to their large size and strong signaling effect. Hence I first focus on the importance of the market-timing effect on the decision of conducting tender-offer repurchases, and then extend the sample to include general repurchases. The role of tender offers in repurchase is similar to the role of SEOs in equity issuing. SEOs are significant equity issuing events as a SEO on average raises over $115 million. Even though SEOs only represent a small portion of total equity issues (7% of total issuers and 10% of aggregate dollar amount issued) as detailed in the Internet Appendix, they have attracted wide attention and a large body of literature has been devoted to explain why firms conduct SEOs.

Table 2 further documents the significant magnitude of tender-offer repurchases when they are compared to all repurchases. Most repurchases only buy back a small portion of common shares outstanding. For example, 44% of repurchases buy back no more than 1% of total shares outstanding. The

majority of repurchases (81.2%) buy back no more than 5% of total shares. In contrast, the majority of tender-offer repurchases (75.1%) buy back more than 5% of total shares. Moreover, more than half of tender-offer repurchases (55.2%) buy back at least 10% of total shares, and account for more than 70.5% of aggregate dollar value repurchased by tender offers.

## 4. Logit analysis of the decisions to conduct a tender-offer repurchase

In this section, I present my findings on the determinants of the decision to conduct tender-offer repurchases. Besides market timing, researchers have identified three major motives for conducting repurchase, including free cash flow (FCF) distribution, the offset of employee stock options (ESOs) dilution, and rebalancing the leverage ratio. I compare the economic effects of market-timing variables on the decision of conducting tender offers against these benchmarks and gauge their relative importance in explaining tender-offer repurchases. The focus in this section is the comparison between market timing and free cash flow distribution hypotheses. Since SDC started reporting tender-offer repurchases after 1985, the sample period in this section begins in 1985 and ends in 2010. The approach used in this section is similar to that in DeAngelo, DeAngelo, and Stulz (2010), in which they examine the importance of the market-timing hypothesis in explaining the decision to conduct a SEO.

### 4.1 Free cash flow and market timing

Jensen (1986), Stulz (1990), and many others recognize that managers have incentives to retain excess cash because doing so enables them to derive perks from investing in projects that benefit themselves at the expense of outside investors. Therefore outside investors constantly pressure managers to pay out excess cash in order to reduce the agency costs associated with FCF. Firms that are in the late stage of their lifecycles and have fewer growth opportunities are more likely to pay out FCF as they would otherwise hold too much FCF (DeAngelo, DeAngelo and Stulz, 2006; Fama and French, 2001). Investors interpret the announcements of repurchase as good news for firms that are likely to have high agency costs. Consistent with this, Nohel and Tarhan (1998) for tender-offer repurchases, and Grullon

and Michaely (2004) for open-market repurchases, find that repurchase announcement returns are higher among those firms that have more excess cash or few growth opportunities.

When firms decide to pay out cash, they can do so by paying dividends or buying back shares. Unlike regular dividends, repurchases are not commitments by firms to regularly pay out cash. Therefore, outsider investors do not expect a firm to continue its repurchase activities in the future. As a result, some researchers suggest that repurchases can be used to distribute cash flows that are unlikely to reoccur (transitory cash flows). Empirical studies have found that transitory cash flows are important determinants of stock buybacks. Jagannathan, Stephens and Weisbach (2000) find that repurchasing firms have higher temporary non-operating cash flows than do non-repurchasing firms, while Guay and Harford (2000) report that firms tend to use open-market repurchases to distribute transient cash flows.

In this section, I focus on comparing the explanatory power of market timing on the tender-offer repurchase decisions against a simple theory in which firms conduct repurchases to distribute free cash flow (FCF). I run logit regressions to assess whether the probability that a firm conducts a tender-offer repurchase is negatively related to its market-to-book ratio (M/B) and recent abnormal stock return, and positively related to its future abnormal stock return and the level of FCF. For each firm, I compute the standardized M/B as the raw M/B divided by median M/B for all firms in the year in question. Prior (future) 12/36-month stock returns are defined as the market-adjusted abnormal stock returns over the 12/36-month period ending (beginning) immediately before (after) the year in question. Abnormal stock returns are calculated as the firm's actual stock return minus the contemporaneous return on the value-weighted market index. I use the ratio of operating income before depreciation (OIBDP in Compustat) to total assets as a proxy of FCF. The logit regressions use the lagged value of this FCF proxy, i.e., the value at the end of the fiscal year prior to the year in question. I also use the ratio of operating income before depreciation (OIBDP in Compustat) to total assets minus the median capital expenditure to assets ratio in the same industry to proxy for FCF. The results remain qualitatively unchanged.

4.1.1 *Basic logit tests*

The logit regressions use data on industrial firms' decisions to make or not make tender-offer repurchases. I pool observations for 1985-2010 and compute standard errors clustered by both firm and time (per Petersen, 2009). The dependent variable equals one if the firm conducts a tender offer in a given year, and zero otherwise. The explanatory variables include the firm's most recent standardized M/B, its most recent and future 12-month (or 36-month in some tests) abnormal stock returns, and its level of FCF.

M/B and pre- and post-repurchase abnormal stock returns, the proxies employed by prior studies, are used to measure market-timing opportunities. Low M/B, low pre-repurchase excess stock return and high post-repurchase excess returns are treated as indicative of favorable market-timing opportunities. The market-timing hypothesis predicts that M/B and pre-repurchase abnormal stock returns are negatively related to the probability of conducting a tender-offer repurchase, while post-repurchase abnormal stock returns are positively related to the tender-offer repurchase decision.

In interpreting the logit results, I attribute the full impact on the tender-offer repurchase decision of M/B to market timing. This interpretation favors the market-timing hypothesis because M/B and stock returns also capture the growth opportunities and thus the level of FCF. As a result, this interpretation overestimates the market-timing effects. Despite this, the logit results nonetheless suggest that FCF is economically more important than the market-timing opportunity in explaining firms' decisions to conduct or not conduct a tender-offer repurchase.

Table 3 reports basic logit results, with the rows of the table differing in (1) the measure of market-timing variables, and (2) the FCF effect as proxied by the operating cash flow. Rows A through C show that M/B is significantly and negatively (t-statistics = -7.49, -6.90 and -6.74) related to the estimated probability of a tender-offer repurchase. However, future abnormal stock returns are not significantly related to tender-offer decision in all rows (e.g., t-statistics -0.27 in Row A). Moreover, the coefficients of past abnormal stock returns are marginally significant and positive in Rows A and B (t-statistics = 1.86 and 1.68), indicating firms are more likely to conduct a tender-offer repurchase when the recent 12-month stock return is high than low. Although the statistically significant negative M/B coefficient is consistent

with the market-timing explanation for repurchases, the statistically insignificant future stock return coefficients and the positive past stock return coefficients are all inconsistent with the market-timing hypothesis. Moreover, M/B may also capture investment opportunities. Managers may pay out cash by repurchasing shares when they have poor investment opportunities as indicated by low M/B. Thus the negative coefficient of M/B itself cannot be conclusive evidence supporting the market-timing hypothesis.

When the FCF effect is included as an explanatory variable in the logit regressions, the level of FCF is significantly and positively related (t-statistic > 5.00 in all rows) to the probability of a tender-offer repurchase, as predicted by the FCF hypotheses. The findings regarding M/B and future abnormal returns are qualitatively unchanged, while the coefficients of past abnormal returns become insignificant. In addition, the median value of FCF induces a larger marginal probability of tender offer than does the median value of M/B. For example, when standardized M/B and 12-month abnormal returns are included in the model, the marginal probability of tender offer is 0.020 when estimated at the median value of FCF. This is more than three times larger than the marginal probability of -0.006 when estimated at the median value of M/B. The marginal probabilities of tender offer here provide a quantitative feel for how small changes in each explanatory variable translate to changes in the probabilities of a tender offer.

4.1.2 *Relative impact on the tender-offer decisions of market timing versus FCF*

To assess the relative impact on the tender-offer repurchase decision of market timing versus FCF, Table 4 reports the estimated probability of a tender-offer repurchase conditional on specific hypothesized values of the independent variables. Except for the estimated probabilities in the far right column, the probabilities in Panel A of Table 4 are calculated using the model in Row D of Table 3. The estimated probabilities in the far right column are based on the model in Row A of Table 3, which does not account for any FCF effect. I begin by discussing this last column to provide an assessment of the effect of market-timing variables.

My full sample contains 600 tender-offer repurchases that were conducted between 1985 and 2010. This is 0.55% of all firm-year observations during the same period. Thus the probability that a randomly selected firm conducts a tender-offer repurchase in a given year is around 0.55%. This is close to the

estimated probability of 0.67% that a firm with neutral market-timing opportunities (all timing variables equal their sample medians) conducts a tender offer (the last number in Row 1 in Panel A of Table 4). I find that the estimated tender-offer probability changes very little when the firm just experienced an extremely positive recent abnormal return instead of an extremely negative recent abnormal return (compare the last numbers in Rows 2 and 3). Moreover, no matter if the future abnormal return equals its 5th percentile or its 95th percentile, the estimated probabilities virtually do not change (Rows 4 and 5).

In contrast, when the standardized M/B decreases from its 95th to 5th percentiles, the estimated probability increases from 0.07% to 0.97% (Rows 6 and 7). Holding M/B and past abnormal stock return constant at very high or very low levels, a huge swing in future abnormal stock returns (from its 5th to its 95th percentiles) almost does not change the probabilities of tender-offer repurchases (Rows 8 through 13). However, the probability that a firm conducts a tender-offer repurchase is higher when a firm faces an extremely favorable timing opportunity (standardized M/B and prior abnormal return equal their 5th percentiles, and future abnormal return equals its 95th percentile) than when it faces an extremely unfavorable timing opportunity (standardized M/B and prior abnormal return equal their 95th percentiles, and future abnormal return equals its 5th percentile). The estimated probability increases from 0.08% to 0.90% (Rows 14 and 15).

The last estimates indicate that few firms with extremely favorable market-timing opportunities conduct tender-offer repurchases. Of every one hundred firms facing extremely excellent timing opportunities, roughly 99 firms fail to exploit market undervaluation by conducting a tender-offer repurchase (tender-offer probability of 0.90%, Row 15 in Panel A of Table 4, far right column). Less than one additional firm decides to conduct a tender-offer repurchase when faced with extremely favorable rather than extremely poor market-timing opportunities (tender-offer probability increase of 0.82%=0.90-0.08%, Rows 14 and 15). These estimates imply that the market-timing opportunities only marginally influence tender-offer decisions, and the market-timing hypothesis is at best, an incomplete theory that requires modification to explain why so few firms conduct tender-offer repurchases when they face excellent market-timing opportunities.

One possible explanation is that when firms face excellent timing opportunities, managers may choose to exploit these opportunities by conducting other forms of repurchases. However, my logit analyses on general repurchase decisions indicate that when the FCF effect is not considered, roughly 80% of firms with highly favorable timing opportunities do not conduct repurchases (see Table 8). As a result, it seems implausible that market timing is the first-order determinant of repurchase decisions. This finding is incompatible with the view that market timing drives the decision to repurchase stock, as posited by Vermaelen (2005) and with the mispricing versions of Baker and Wurgler's (2002) timing theory.

Overall, the logit results suggest that abnormal stock returns have little effect on tender-offer decisions while M/B has a significant effect. As discussed earlier, although other studies (e.g., Dittmar, 2000) include M/B as a proxy for undervaluation, it also measures other factors such as investment opportunities. And thus it is hard to interpret the coefficient of M/B. For example, the negative coefficient of M/B is also consistent with the FCF hypothesis. Low M/B implies less investment opportunities and thus high level of FCF. Therefore a firm with a low M/B may repurchase its own share to distribute FCF rather than to exploit market undervaluation. In order to provide a better comparison between the FCF and the market-timing hypotheses, I repeat the logit analyses as discussed above except that M/B is not included in the logit regressions. I emphasize these tests that only use stock return measures for undervaluation because they are employed by Lakonishok and Vermaelen (1990) to support the market-timing explanation for repurchases. The results are reported in Panel B of Table 4.

Qualitatively, results do not change. Both past and future abnormal returns have little effect on the tender-offer decisions while the variation in FCF has a greater effect. The strength of FCF effect is shown in Row 1 in Panel B of Table 4. With neutral market-timing opportunities, the estimated probability of conducting a tender-offer repurchase increases from 0.21% to 0.94% when the level of FCF changes from very low (5th percentile) to very high (95th percentile). The latter number is more than four times larger than the former number. Similar results hold for all market-timing scenarios in Panel B of Table 4.

The relative influence on tender-offer probability of market-timing opportunities and the level of FCF is best assessed by comparing Rows 12 and 13 in Panel B of Table 4. This comparison shows that a firm with high FCF and highly unfavorable timing opportunities has a tender-offer probability of 0.68% (Row 13), which is nearly three times larger than the tender-offer probability of 0.25% for a firm with low FCF and highly attractive timing opportunities (Row 12). Although the difference here is small, the difference in the case of general repurchase is much larger (19.14% versus 7.57%, see Panel B of Table 8). Hence the FCF effect dominates the market-timing effect.

Caution is needed in interpreting this result. Although the *relative* percentage change in probability of a tender-offer is large when a firm's level of FCF changes from very low to very high, the *absolute* change in the probability is moderate (e.g., 0.86%=1.11%-0.25%, Row 13). There are at least two possible explanations. First, firms conduct tender-offer repurchases highly infrequently. A randomly selected firm in my sample has a tender-offer probability of 0.55%, and hence the magnitude of estimated probability should not be too large. Nevertheless, the relative percentage change is significant. When a firm faces excellent market-timing opportunities and has a very high level of FCF, the estimated tender-offer probability reaches its maximal value at 1.11%. This is more than 100% above the 0.55% tender-offer probability for a randomly selected firm in the sample.

Second, although FCF has a larger influence on the tender-offer repurchase decision than do market-timing opportunities, it is not a complete theory that can fully explain all tender-offer repurchases. This is because too many firms with high FCF fail to conduct a tender offer. An alternative explanation is that firms with high level of FCF may choose other methods to distribute FCF, such as open-market repurchase or dividends. This is confirmed in the logit analyses on general repurchase and dividend decisions. For firms with high level of FCF and excellent timing opportunities, more than 30% of them repurchase at least 1% of their shares. Moreover, at least 68% of firms with high level of FCF pay dividends in all different hypothesized timing scenarios.

To assess the robustness of my inferences to alternative measures of timing opportunities, I re-run logit regressions using the mispricing indices in Rhodes-Kropf, Robinson, and Viswanathan (RRV, 2005)

and Polk and Sapienza (PS, 2009). The results also indicate that the FCF effect overrides the market-timing effect on the tender-offer repurchase decisions (see the Internet Appendix).

The logit regression results do not change qualitatively when I adjust operating cash flow by deducting industry median capital expenditure. The results are also robust to including firm and year fixed effects. To test whether firms use tender-offer repurchases to distribute temporary cash flow, I also include the temporary cash flow proxy in the similar regression. I follow Jagannathan, Stephens, and Weisbach (2000) and use the lagged values of non-operating income to proxy for temporary cash flow. The logit results show that the temporary cash flow has a statistically insignificant positive coefficient. Although this indicates firms with more temporary cash flow are more likely to conduct a tender offer, the economic impact is small. Large variation in non-operating income almost does not change tender-offer probability. Other proxies for cash levels are also used. Similar logit analyses suggest that cash holdings (cash and short-term investments/assets), and excess cash holdings as in Opler, Pinkowitz, Stulz, and Williamson (1999) have neither statistically nor economically significant effects on the probability that a firm conducts a tender-offer repurchase.

4.1.3 *The interaction between operating cash flow and market timing*

The logit regression result in Table 3 might be consistent with a conditional market-timing theory. In this theory, managers time the market to conduct repurchase when the firms have high level of FCF as proxied by operating cash flow (OCF). To test this, I include the interaction terms between OCF and market timing variables in the logit regressions. Since only M/B exerts statistically and economically significant effects on tender-offer decisions, I focus on the interaction effect between M/B and OCF. As emphasized by Ai and Norton (2003), standard statistical software packages do not correctly compute the marginal effects of interaction terms in Logit model. Nevertheless, Panel A of Table 5 still reports the marginal effects estimated by standard Logit program for comparison purpose. Ai and Norton have also made available a Stata program, *INTEFF*, to estimate the interaction effect in Logit model. The interaction effects computed by *INTEFF* are reported in Panel B of Table 5.

According to the conditional market-timing theory, when firms have high level of OCF, more undervalued ones as measured by lower M/B are more likely to conduct a tender offer. Therefore, the interaction term of OCF and M/B ratio should exert a negative effect on the probability of conducting a tender-offer repurchase. Although Panel B of Table 5 shows that on average, the interaction between M/B and OCF has a significantly negative effect on the tender-offer decisions, the magnitude is small. For a firm with a median OCF of 0.11, the interaction effect is -0.0018 (-0.016×0.11), significantly smaller than the marginal effect of OCF. Moreover, this interaction effect becomes positive when the estimated tender-offer probability is large (see the Internet Appendix).

Although the numbers above show some support for the conditional market-timing theory, this does not weaken the basic conclusion that free cash flow is more important than market timing in explaining tender-offer repurchases, as the magnitude of the interaction effect is small. Indeed, the analysis in Section 4.1.2 indicates that even though market timing makes repurchases more attractive, it does not constitute a primary reason for share repurchases.

**4.2 Employee stock options and market timing**

Repurchases experienced rapid growth in the 1990s. During the same period, there was also a surge in the use of employee stock options (Murphy, 1999). Many studies have noted this concurrence of the surges in both repurchases and employee stock options (ESOs) and attempted to attribute the growth of repurchases in the 1990s to the use of ESOs. For example, Lambert, Lanen and Larcker (1989) suggest that employee stock option plans give managers incentives to substitute buybacks for dividends. Specifically, paying dividends reduces the price of common stock and thus the value of a stock option with a fixed exercise price. In contrast, if a firm uses the same amount of cash as it would have paid as dividends to buy back its own shares, the market price of stock would not decline following the repurchase, nor will the stock option value. Therefore managers who have more stock options are more likely to buy back shares rather than pay dividends. Consistent with this view, Jolls (1996) reports that firms which rely more heavily on stock option compensations are more likely to buy back their shares,

while Fenn and Liang (2001) find a significantly positive relationship between repurchase and management stock options.

Moreover, an increase in the number of employee stock options also raises a firm's need to have shares available when ESOs are exercised. Kahle (2002) suggests that repurchase is one way to provide shares for the exercise of ESOs. And managers might choose repurchasing over issuing new shares because repurchase does not increase the number of shares outstanding and thus are able to avoid the dilution of basic earnings per share (EPS). Consistent with this, she finds that firms are more likely to repurchase stock when employees have large number of options currently exercisable, and the amount repurchased is positively related to the total options exercisable.

Even when employee stock options are not currently exercisable, they can also affect repurchase decisions because of their impact on the reported value of fully diluted EPS. Granting ESOs increases the number of shares outstanding that is used to compute the fully diluted EPS and therefore reduces diluted EPS. Diluted EPS is the measure often used by investors and analysts for valuation purpose and many studies find that diluted EPS is more associated with stock prices than does basic EPS (Core et al. 2002; Jennings et al., 1997). Therefore managers who care about their share price and have large number of ESOs outstanding have incentives to repurchase shares to avoid the dilutive effect in the reported value of fully diluted EPS. This is because buying back shares reduces the denominator in the calculation of diluted EPS and thus increases diluted EPS. Weisbenner (2000) and Bens et al. (2003) provide evidence that firms repurchase their shares to reverse the dilution of diluted EPS induced by ESOs.

In sum, ESOs may affect repurchase decisions for two reasons. First, when a firm increases its options outstanding, managers may choose to repurchase either because repurchases do not reduce the value of options or because repurchases can offset the dilution on fully diluted EPS induced by increasing options outstanding. Second, when more ESOs are expected to be exercised, firms can provide shares needed for option exercise through repurchases.

To assess the effect of employee stock options (ESOs) on tender-offer decisions and compare that to the market-timing effect, I run similar logit regressions as in Section 4.1, but include the option effect

variables instead of FCF as benchmark against market-timing variables. I first test whether the increase in option holdings is positively related to the probability of conducting a tender offer by include the change in options outstanding in the logit regressions. The change in options outstanding is computed as the difference between the ratios of Compustat options outstanding to common shares outstanding in the current and prior year. Compustat only provides options outstanding data after 1996, and so the sample period is limited to 1996 to 2010. The logit regressions yield similar results as in Tables 3 and 4: (1) option change is significantly and positively related to the estimated tender-offer probabilities (e.g., t-statistic=4.89), and (2) option change has a greater effect on estimated probability of conducting a tender-offer repurchase than do market-timing variables. Firms with poor timing opportunities and large changes in options outstanding is more likely to conduct a tender offer than firms with good timing opportunities and small changes in options outstanding (0.72% versus 0.43%, see the Internet Appendix).

To test whether repurchase is one way to provide available shares for the exercise of ESOs as suggested in Kahle (2002), I obtain the number of options exercisable held by executives and the number of shares acquired by executives from Compustat Execucomp. I divide these two numbers by common shares outstanding and include them in logit regressions instead of option change, respectively. Neither the options exercisable nor the shares acquired show a statistically significant effect on the tender-offer probability.

**4.3 Rebalancing capital structure and market timing**

Holding everything else equal, repurchases reduce the equity value of a firm and thus result in higher debt-to-equity ratios. Bagwell and Shoven (1988) and Hovakimian, Opler, and Titman (2001) suggest that if firms have an optimal capital structure, they can buy back their shares to increase leverage ratios toward the target capital structure. Indirect evidence is reported in Masulis (1980) and Vermaelen (1981), which document that announcement stock returns are higher when tender-offer repurchases are mostly financed by new debt instead of cash. Moreover, Dittmar (2000) shows that repurchasing firms usually have lower debt-to-equity ratios when compared to their industrial peers. Lie (2002) investigates capital structure around 286 repurchase tender offers from 1980 to 1997 and use a linear regression model to predict a

target leverage ratio. He finds that firms generally have debt-to-equity ratios below the predicted level before the offers. He also reports that leverage ratios following tender-offer repurchases are close to or above the predicted level.

To assess whether firms undertake tender-offer repurchases to adjust capital structure toward target leverage ratios, I run similar logit regressions but use the deviation from the firm's target leverage ratio instead of FCF as benchmark against the market-timing variables. The deviation from the firm's target leverage ratio (hereafter, the deviation from target) is the difference between the firm's debt to assets ratio and an estimated target leverage ratio at the end of the fiscal year prior to the year in question. Target leverage ratio is the fitted value from a linear regression of debt to assets ratio on variables often hypothesized to affect leverage decisions: log(sales), market-to-book ratio, profitability and asset tangibility (e.g., see Rajan and Zingales, 1995). The logit results show that the coefficient of the deviation from target is significantly negative (t-statistic = -4.31). This suggests firms that have a leverage ratio below the target are more likely to conduct a repurchase tender offer, consistent with the rebalancing hypothesis. Similarly to the FCF effect in Table 4, the deviation from target also shows a larger effect on the probability of conducting a tender-offer repurchase than do market-timing variables (see the Internet Appendix).

To further investigate the effect of the deviation from target on tender-offer decisions, I examine the histogram of deviations from target and the mean value of leverage determinants surrounding 539 tender-offer repurchases. Table 6 reports the mean values of deviations from target in event years from -3 to 3, where event year 0 refers to the year in which a firm conducts a tender-offer repurchase. The mean deviation from target is -0.044 in event year -1, and change to 0.010 in event year 1 (Row 2 in Table 6). However, Rows 3 and 4 show that when the industry median debt ratio (2-digit SIC or Fama-French 49 industries) is used as a proxy for the target debt ratio, the mean deviation from target is positive in all event years. This indicates that firms are not under-leveraged prior to tender-offer repurchases if we use a different proxy for target leverage ratios. And thus the finding on rebalancing explanation is not robust to use of different measures of target leverage ratio.

In addition, Table 6 suggests that the increase in debt to asset ratios after tender-offer repurchases is mostly contributed by the change in total debt. The average debt to assets ratio significantly increases by 5% from event year -1 to event year 1 while the mean deviation from target significantly increases from -4.4% in event year -1 to 0.9% in event year 1. During the same period, change in total debt also increases from 0.9% to 4.5%. In event year 0, average debt ratio increases by 4.2%. Meanwhile, total assets do not grow but the total debt increases by about 5% of prior year's total assets, suggesting that the increase in leverage ratio is mostly driven by the change in total debt.

One possible explanation for this phenomenon is that firms use debt to finance tender-offer repurchases as this type of repurchases are generally large in size. Moreover, total debt continues to increase in event years 1, 2 and 3 and drives the realized leverage even higher above the target ratio. Moreover, on average, target leverage ratios and traditional leverage determinants – asset growth, capital expenditure, profitability, sales, M/B, and tangible assets are not significantly different one year before and one year after tender-offer repurchases. These findings together suggest that firms move their leverage ratios toward and beyond the estimated targets after tender-offer repurchases.

In addition, average total dollar values repurchased are higher in event years 1, 2, and 3 than in event years -1, -2 and -3. Since firms usually do not conduct multiple tender offers in a short period of time, this indicates that firms that conduct a tender-offer repurchase on average continue to buy back through other methods during the three years following the tender offer. The above results are robust to using survivor sample, in which I require sample firms have all data available in all event years.

To summarize, the deviation from target shows a larger effect than do market-timing opportunities on the probability that a firm conducts a tender-offer repurchase. However, there is also evidence that is difficult to reconcile with the rebalancing explanation. First, the finding that firms are typically under-leveraged prior to tender offers is not robust to alternative measures of target leverage ratios. Second, if firms conduct tender-offer repurchases simply because they want to increase debt ratio toward target capital structure, we should observe a sudden increase in the leverage ratio, regardless the level of target

leverage ratios. The leverage ratio should remain steady after tender-offer repurchases. In contrast to this, I find that leverage ratios continue to rise after tender offers.

## 5. Logit analysis of the decisions to conduct a repurchase

In this section, I implement similar logit analyses as in Section 4 on all repurchases. Unlike tender-offer repurchases, general repurchases cannot be measured as discrete events and therefore logit regressions cannot be applied directly. Huang and Ritter (2009) apply the logit regressions to general equity issues. A firm is defined as an equity issuer if the change in equity is at least 5% of prior year's total assets. Following their approach, I define a firm as a repurchaser if the firm buys back at least 1% of total shares in one year. Doing so enables me to conduct the logit analyses on general repurchases to access the relative importance of market timing on the decision of conducting a repurchase. Since data needed to compute net repurchase are only available on Compustat after 1971, the sample period in this section is from 1971 to 2010.

### 5.1 Free cash flow and market timing

As in Section 4.1, I run logit regressions to assess whether the probability that a firm conducts a repurchase is negatively related to its market-to-book ratio (M/B) and recent abnormal stock return, and positively related to its future abnormal stock return and the level of free cash flow (FCF) as proxied by operating cash flow. All these independent variables are defined as in the previous section. The dependent variable equal one if a firm repurchases at least 1% of its shares in a given year, and zero otherwise. Since Compustat does not report the number of shares a firm buys back in a year, I use the ratio of net repurchase to market capitalization at the end of the prior year to proxy the percent of shares a firm repurchases.

I pool all observations for 1971 to 2010 and compute standard errors clustered by both firm and time (per Petersen, 2009). The basic results are reported in Table 7. The structure of Table 7 is the same as that of Table 3, with the rows of the table differing in (1) the measure of market-timing variables, and (2) the inclusion of FCF effect. Rows A through C show that M/B is significantly and negatively (t-statistics=-

5.14, -3.32, and -4.25) related to the probability that a firm conducts a repurchases. The coefficients of future abnormal stock returns are positive and significantly different from zero. Although the coefficients of recent abnormal stock returns are negative in all Rows, they are only significant when the raw M/B is used instead of the standardized M/B. Therefore the basic logit results are not completely consistent with the market-timing hypothesis.

When I include FCF proxied by operating cash flow (OCF) as an independent variable in the logit regressions, the level of FCF is significantly and positively related (t-statistic > 10.0 in all rows) to the estimated repurchase probability, consistent with the FCF hypothesis. Moreover, the marginal probability of repurchase estimated at the median value of FCF is much larger than the marginal probability estimated at the median value of M/B. For instance, when standardized M/B and 12-month abnormal returns are used as explanatory variables, the former figure is 0.468, more than twelve times larger than the latter figure of -0.038. Similar as in the tender-offer logit analyses, the marginal probabilities of repurchases provide a quantitative feel for how a small change in each explanatory variable translates to changes in the repurchase probability. Moreover, the negative coefficients of recent abnormal stock return become statistically significant. The coefficients of M/B and future stock returns remain the same sign and significance.

To assess the relative importance of market timing versus FCF in explaining repurchase decisions, Table 8 shows the estimated repurchase probability conditional on specific hypothesized values of the explanatory variables. The structure of Table 8 is the same as that in Table 4. The probabilities in the far right column are estimated using the model in Row A of Table 7, which does not include the control for FCF effect. All other probabilities are estimated using the model in Row D of Table 7.

Similar to Section 4.1, two findings stand out from Table 8 when I examine the estimated repurchase probabilities in the last column. I find that (1) abnormal stock returns have almost no effect on the estimated repurchase probability and (2) M/B shows modest influence on the estimated repurchase probability. The estimated repurchase probability changes very little (the *absolute* changes in estimated probability are all around 1%, Rows 2 through 5 in Panel A of Table 8) no matter if the future (recent)

abnormal return  is extremely negative or positive. In contrast, when the standardized M/B decreases from its 95th to 5th percentiles, the estimated repurchase probability increases by 8.3% (i.e., it equals 19.46% instead of 11.15%, Rows 6 and 7). Holding M/B and past abnormal stock return constant at very high or very low levels, a huge swing of  in future abnormal stock returns (from its 5th to 95th percentiles) induces an *absolute* change in repurchase probability that is less than 1.5% (Rows 8 through 13).

The explanatory power of market timing can be best assessed from the last two rows in Panel A of Table 8. For firms facing excellent timing opportunities (standardized M/B and prior abnormal return equal their 95th percentiles, and future abnormal return equals its 5th percentile), 20.81% of them buy back more than 1% of their shares. This is more than twice the probability that a firm conducts a repurchase when it faces an extremely unfavorable timing opportunity (standardized M/B and prior abnormal return equal their 5th percentiles, and future abnormal return equals its 95th percentile).

The estimates above indicate that although the market-timing hypothesis can explain some repurchase activities, it cannot provide a stand-alone theory that can explain the majority of repurchase activities. This is because when the FCF effect is not considered, nearly 80% of firms facing extremely attractive timing opportunities choose not to conduct a repurchase.

On the other hand, FCF shows a greater effect on the estimated repurchase probability than do timing opportunities. First, the strength of FCF effect on the estimated repurchase probability can be shown from the middle columns in Panel A of Table 8. For example, Row 1 shows that for firms with neutral market-timing opportunities, the estimated repurchase probability increases from 5.42% to 27.42% when the level of FCF changes from very low (5th percentile) to very high (95th percentile). The latter is more than five times larger than the former. Meanwhile, the absolute change is also significant (22.0%=27.42%-5.42%). Similar results hold for all other market-timing scenarios in Panel A of Table 8.

Second, the relative importance in explaining repurchases of market-timing opportunities and the level of FCF is best assessed by comparing Rows 14 and 15 in Panel A of Table 8. Even when the M/B is used to measure timing opportunities, this comparison shows that a firm with a high level of FCF and highly unfavorable timing opportunities has a repurchase probability of 12.88% (Row 15), which is

almost twice larger than the repurchase probability of 7.19% for a firm with a low level of FCF and highly attractive timing opportunities (Row 14). Hence the FCF effect overrides the market-timing effect.

It is worth nothing that unlike the inference in tender offer analyses, the above inference is based on both the significant *relative* percentage change and the *absolute* change in repurchase probability (e.g., 5.69%=12.88%-7.19%, Rows 15 and 16).

As in Section 4.1, I also repeat the comparison between the FCF and market-timing effect, except that M/B is not included in the logit regressions. As shown in Panel B of Table 8, results do not change qualitatively. Abnormal stock returns show little influence on the estimated repurchase probability while FCF has much larger effect and overrides the market-timing effect. For example, for every one hundred firms with neutral future abnormal stock returns, roughly three additional firms decide to conduct a repurchase when they just experienced an extremely negative rather than an extremely positive abnormal return (Rows 2 and 3). On the other hand, when a firm faces an extremely unfavorable timing opportunity, if the level of FCF is very high, the repurchase probability is 11.57% higher (or more than twice larger) than when it faces an extremely attractive timing opportunity and with a low level of FCF (19.14% versus 7.57%, Rows 12 and 13). Similar to the results in Panel A, both the *relative* and the *absolute* changes in probability are significant. Findings here also suggest that the market-timing effect is dominated by the FCF effect.

Results in this section are robust to an alternative definition of repurchaser in which I define a firm as a repurchaser if it repurchases at least 0.5% of its shares in a given year. Results are also robust to using alternative mispricing measures in Rhodes-Kropf, Robinson, and Viswanathan (2005) and Polk and Sapienza (2009). Moreover, when I adjust operating cash flow by deducting industry median capital expenditure, similar results are obtained. I also run logit analyses by replacing FCF with temporary cash flow, cash holding, or excess cash holdings. The results do not change qualitatively compared to those in Section 4.1.

To test whether the conditional market-timing theory holds, I include the interaction terms between operating cash flow (OCF) and market timing variables in the logit regressions as in Section 4.1.3. As

shown in Table 9, similar results as in tender-offer repurchases are obtained. Although the interaction between OCF and M/B shows negative effects on the probability of conducting a repurchase, the economic impact is relatively small. For a firm with a median OCF of 0.11, the interaction effect is -0.008 (-0.073×0.11). Moreover, this interaction effect becomes positive when the estimated repurchase probability is large (see the Internet Appendix).

**5.2 Employee stock options and market timing**

To test whether the change in employee stock options (ESOs) affects the repurchase probability, I run similar logit regressions above but include option change instead of FCF as benchmark against market-timing variables. Similar to Section 4.2, I find that (1) option change is significantly and positively related to the estimated repurchase probability (e.g., t-statistic=5.22), and (2) option change effect also dominates the market-timing effect based on both large *relative* and *absolute* change in repurchase probability. Even when the M/B is used to measure timing opportunities, variations in option change induce large changes in the estimated repurchase probability regardless whether the timing opportunities are attractive or unfavorable. For example, a firm with a large change in options outstanding and highly unfavorable timing opportunities has a repurchase probability of 30.72%, which is 36% above the repurchase probability of 22.59% for a firm with a small change in options outstanding and highly attractive timing opportunities (see the Internet Appendix for details).

On the other hand, I do not find evidence supporting the option funding hypothesis as in Kahle (2002), which suggests that repurchase is one way to provide available shares for the exercise of ESOs. Neither the options exercisable nor the shares acquired by executives show a statistically significant effect on the estimated repurchase probability.

**5.3 Rebalancing capital structure and market timing**

To test whether firms buy back their shares to adjust capital structure toward a target leverage ratio, I run similar logit regressions but replace FCF by the deviation from the firm's target leverage ratio as benchmark against the market-timing variables. Recall that the deviation from the firm's target leverage ratio (hereafter, the deviation from target) is the difference between the firm's debt to assets ratio and an

estimated target leverage ratio at the end of the fiscal year prior to the year in question. The logit regression results show that the coefficient of the deviation from target is negative and statistically different from zero (t-statistic = -10.98). This indicates that the more under-leveraged firms are more likely to conduct a repurchase, consistent with the rebalancing hypothesis. Moreover, the effect of the deviation from target on the estimated repurchase probability also dominates the market-timing effect. Firms that are highly under-leveraged and face poor timing opportunities are more likely to conduct a repurchase than do firms that are highly overleveraged and face attractive timing opportunities (see the Internet Appendix for details).

The above inference is based on the assumption that my estimates of target leverage ratio are measured without error. For example, if the target ratios are underestimated, then the logit results may simply suggest that firms with lower debt-to-asset ratios are more likely to conduct a repurchase. The actual deviation from target may be positive in the year prior to repurchase. This would be inconsistent with the rebalancing hypothesis. Although the logit results are robust to the use of industry median debt ratios (2-digit SIC or Fama-French 49 industries) as the target ratios, I still cannot rule out the possibility that those target estimates are measured with error. The bottom line here is that I find evidence supporting the rebalancing hypotheses conditional on the assumption that my estimates of target ratios are correct.

**6. Abnormal stock returns after repurchases**

In this section, I report the median and mean post-repurchase abnormal stock returns. The median future abnormal stock returns are negative while the mean future abnormal stock returns are positive. Prior studies focus on the inferences drawn from the mean abnormal stock returns. I argue that these inferences are debatable and it is indeed more appropriate to use median rather than mean abnormal stock returns to test the market-timing explanation for share repurchase.

Moreover, the positive average post-repurchase abnormal returns are mostly driven by extreme abnormal returns following small repurchases that account for 6% of the aggregate dollar value repurchased.

### 6.1 Median and mean post-repurchase abnormal returns

The market-timing hypothesis claims that managers choose to buy back stock because their shares are underpriced. If this is true, we should expect most repurchases to be followed by positive abnormal stock returns. Although prior studies have found that the average future excess return following repurchases is significantly positive, this does not imply that the majority of repurchases are followed by positive abnormal returns.

In fact, I find that 54.0% of repurchases are followed by negative abnormal stock returns over the 12-month period beginning immediately after the year in question (see the Internet Appendix). Similar results hold for one-shot repurchasers (firms that only repurchase once during their time in the sample) and tender-offer repurchases. The results are also robust to using 36-month future abnormal stock returns. These findings cast doubt on the market-timing hypothesis. To further verify this, Table 10 reports the full distributions of post-repurchase abnormal stock returns.

All median post-repurchase abnormal returns are negative. For example, the median post-repurchase abnormal return is -3% during the 12 months following the year in which a firm repurchases shares. These negative median abnormal returns suggest that firms are more likely to experience abnormal stock price declines than abnormal stock price increases after repurchases. This is inconsistent with the market-timing hypothesis. The reason is that if managers time the market to buy back shares when they are cheap, more firms should experience positive abnormal future returns than negative abnormal returns. A finding that firms are more likely to experience negative post-repurchase abnormal returns indicates that either most managers do not time the market or their ability to time the market is poor.

In contrast to the median abnormal returns, all average post-repurchase abnormal returns are positive. For all repurchases, the mean post-repurchase abnormal return is 7% during the 12 months following the repurchase. The findings of positive mean abnormal returns are consistent with market inefficiency as semi-strong form market efficiency should prevent positive mean abnormal returns. Prior studies claim this finding of market inefficiency as strong evidence supporting the market-timing hypothesis. This inference is problematic for three reasons

First, the efficient market hypothesis (EMH) and the market-timing hypothesis deal with different subjects. The focus of the EMH is the experience of investors. If all shares are priced fairly based on public information as suggested by the EMH, investors should not be able to earn positive abnormal return on average. And thus the average abnormal returns should be examined. On the other hand, the focus of the market-timing hypothesis is the behavior of managers, as it suggests that managers undertake repurchases to take advantages of market undervaluation. Thus we should focus on most managers' behavior and examine what most post-repurchase abnormal returns are. The relevant research question is "what is likely to happen to the share prices if managers conduct a repurchase."

Second, market inefficiency is the assumption of the market-timing hypothesis.[2] The market-timing explanation suggests that managers exploit market undervaluation through repurchases. The possibility of market mispricing is thus an assumption. Because all shares should be priced fairly based on all public information in an efficient market, mispricing is equivalent to market inefficiency. A finding of market inefficiency only validates the assumption of the market-timing hypothesis, but does not show that managers systematically exploit mispricing.

Last but not least, the positive average post-repurchase abnormal returns are less informative than are negative median post-repurchase abnormal returns in the context of testing the market-timing hypothesis. This is because the focus here is to investigate what is more likely to happen to the share prices after repurchases. However, as shown later in this section, the average post-repurchase abnormal returns are distorted by extreme values, and thus cannot tell us what is more likely to happen after repurchases, abnormal stock price declines or increases. In contrast, the negative median value indicates more firms experience abnormal stock price deprecations than appreciations.

Therefore, the mean post-repurchase abnormal returns are less relevant to the market-timing hypothesis than are the median abnormal returns. The median post-repurchase abnormal returns are more

[2] The asymmetric information version of market timing in Baker and Wurgler (2002) does not assume the market inefficiency. Their results do not discriminate the mispricing and asymmetric information versions of market timing, but they do claim that the long-run return evidence points to the mispricing version of market timing. (see Baker and Wurgler, 2002, p. 4)

appropriately used in testing the market-timing hypothesis. For example, if 70% of managers do not buy back shares based on timing opportunities and one manager makes an extremely excellent timing decision to repurchase, the median post-repurchase abnormal returns will be zero but the average might be positive. However, this positive mean value does not indicate that managers systematically make repurchase decision based on timing opportunities.

The stock returns reported in Panels A and B in Table 10 are percentage returns. One drawback of a percentage stock return is that it doesn't tell us the economic importance (or the wealth effect) of repurchases. Specifically, according to the market-timing hypothesis, managers buy back shares when they believe this is a "good investment." The percentage return only tells us the rate of return on this "investment" not the absolute wealth gains from this "investment." For example, if a firm buys back a very small amount of shares (e.g., close to zero) and experiences a positive excess return after repurchases, the wealth effect of this repurchase is not economically important.

To investigate the economic importance (the wealth effect) of repurchases, I also examine the abnormal dollar stock returns, defined as the product of dollar amount repurchased and the future abnormal stock return. Overall, the abnormal dollar stock returns suggest that either managers do not systematically time the market or their timing decisions are poor as most repurchases are not followed by abnormal wealth gains. Panels C and D in Table 10 show that the distributions of future abnormal dollar returns are similar to those of future abnormal stock returns. For all repurchases, the mean 12-month future abnormal dollar return is $2.1 million and the median is slightly negative and close to zero. This also suggests that the wealth change for the median repurchase is nearly zero. For one-shot repurchases, both mean and median abnormal dollar returns are negative, suggesting firms on average experience wealth loss from these repurchases. For tender-offer repurchases, the average 12-month future abnormal dollar return is $3.2 million. And the median is zero. These results are also robust to using 36-month future abnormal dollar returns.

### 6.2 Distribution analyses of post-repurchase abnormal stock returns

Table 10 also documents that there are both very large positive and negative abnormal returns. However, the right tail is longer than the left tail. In the case of 12-month abnormal returns after all repurchases, the 99th percentile is 236% while the 1st percentile is -81%. Further investigation shows that 7.5% of all repurchases are followed by a future 12-month abnormal return above 75%, while 1.8% of all repurchases are followed by a future 12-month abnormal return below -75%, significantly skewing the distribution to the right (see the Internet Appendix). Thus the mean value is significantly greater than the median value and does not represent the stock price behavior of the majority of sample firms. Similar results are obtained for one-shot repurchases, tender-offer repurchases and for using future 36-month abnormal returns.

The evidence so far suggests that the abnormal future return distribution is positively skewed. As a result, the mean value may be distorted by extreme values. Since many studies draw inferences from the mean post-repurchase abnormal returns, it is important to understand how the mean values are affected by extreme positive values. To do so, I examine the biggest 20 winners and 20 losers of all repurchases based on future 12-month abnormal stock returns (see the Internet Appendix for details). Some firms do exhibit remarkably large positive abnormal returns after repurchases. The biggest winner is Mehl/Biophile, which spent $0.23 million on share repurchase in 1994 and earned an abnormal future return of 3,890% over the year following the repurchase. In addition, 12 other companies had a 12-month future abnormal return above 1,000%.

However, almost all of these 20 winners are trivial in the sense of total dollar value repurchased. More than half of them repurchased less than $1 million. And the average percent of shares repurchased is less than 5%. Moreover the majority of these firms have market capitalizations below $100 million. The exception is Liberty Media Capital Group, which had a market capitalizations of $15 billion and repurchased $460 million in 2008. It experienced a 1,026% abnormal return in the next 12 months.

On the other hand, large negative future returns are also observed. The worst repurchase was conducted by Colorcos Corporation in 1990, which experienced a -99.8% abnormal return in one year

after repurchases. Other losers earned similar negative abnormal returns. These losers also spent very little on their repurchases. Half of them repurchased less than $1 million. Similar results hold for using 36-month abnormal returns. It is worth nothing that, by the nature of rate of return calculations, the magnitude of the largest negative abnormal returns is much smaller than the magnitude of the largest positive abnormal returns, as the former can only go down to -100% while the later has no upper limit.

To investigate the magnitude of extreme wealth gains and losses, I examine the largest 20 winners and 20 losers based on abnormal dollar stock returns (see the Internet Appendix for details). The biggest dollar-based winner is Exxon in 2007, which earned an abnormal future dollar return of more than $10 billion in 12 months, or about 2.3% of its market value at the end of 2006. All of the largest dollar-based winners spent huge amount of money on their repurchases, ranging from $400 million to $30 billion, compared to the mean dollar value repurchased of $95 million and the median dollar value repurchased of $2 million in the full sample from 1971 to 2010. The biggest dollar-based loser is Exxon as well, which experienced an abnormal future dollar return of more than $12 billion in 12 months for its huge repurchase of $34 billion in 2008. Similarly, other big losers are also large in size. The dollar values of their repurchases range from $3 billion to $34 billion. Results are qualitatively the same when using 36-month future abnormal dollar returns.

The analysis above indicates that the extreme values of positive abnormal returns are much larger than the extreme values of negative abnormal returns in the sense of absolute value, suggesting the mean value is likely to be affected by extreme values. The full distributions of abnormal returns in Table 10 confirm this, as the means are significantly greater than the medians. To investigate how the extreme values affect the mean, Table 11 reports the full distributions of abnormal returns for large gain, large loss and the middle repurchases. Large gain (loss) repurchases are those with future 12-month abnormal returns belonging to the top (bottom) 10th percentile of whole sample.

An important finding from Table 11 is that, for the middle 80% of repurchases, the mean and median abnormal future returns are -1% and -3% respectively, inconsistent with the market-timing hypothesis. These repurchases represent 94% of the aggregate dollar value repurchased. The result is robust to using

future 36-month abnormal returns. When I define the middle 80% of the repurchase distribution based on future abnormal dollar returns, the average future 12-month abnormal dollar return becomes $0.1 million.

The above results suggest that the positive average future abnormal return is mostly driven by extreme values. However, these extreme cases only represent a small portion of aggregate dollar value repurchased. In the example of 12-month future abnormal return, the large gain and loss repurchases (the outer 20%) together represent 6% of aggregate dollar value repurchased, and drive the conclusion that the average future abnormal return is positive. To further investigate the effect of extreme values, Table 12 reports the full distributions of future abnormal returns for the middle 80%, 90%, 95%, and 99% of repurchases, and documents that the mean future abnormal return increases as more extreme values are included. If we focus on the middle 80% of all repurchases, the positive mean future abnormal return disappears and even turns out to be negative.

Lakonishok and Vermaelen (1990) report a positive mean abnormal return of 8% over two years starting from one month after the expiration date for 258 fixed price tender-offer repurchases. Based on the evidence above, their conclusions are likely to be driven by extreme returns of tender-offer repurchases that represents a small amount of total dollar value repurchased in tender offers. To test this, Table 13 documents the full distributions of future abnormal returns for the middle 80%, 90%, 95% and 99% tender-offer repurchases. When I focus on the middle 80% of the tender-offer distribution, the average abnormal returns become negative. These middle 80% of all tender offers account for 90% of aggregate dollar value repurchased through tender offers. When I focus on the middle 90% of tender-offer distribution, the average abnormal returns is 0.6%, close to zero. And these middle 90% of all tender offers account for more than 95% of aggregate dollar value repurchased through tender offers. On the other hand, the middle 99% of tender-offer repurchases do exhibit a positive future abnormal return of 3.9% in one year and 10.0% in three years. The numbers above indicate that the extreme values of future abnormal returns following tender-offer repurchases also drive the average values to be positive.

If one is concerned about the behavior of the "typical" manager, it is better to use the median rather than mean abnormal returns to test the market-timing hypothesis. Similar to all repurchases, the median

tender-offer repurchases are also followed by negative abnormal returns. The median 12-month post-repurchase abnormal return is -2.4% and the median 36-month post-repurchase abnormal return is -8.2%. The median firm experiences a zero abnormal dollar stock return during both the 12 months and 36 months after the year of tender-off repurchase. These negative median abnormal returns suggest that tender-offer repurchases are more likely to be followed by negative than positive post-repurchase abnormal returns and wealth changes. And hence the market-timing hypothesis is unlikely the primary motive for tender-offer repurchases.

**6.3 Characteristics of large gain and loss repurchases**

The evidence so far suggests that the extreme values of future abnormal returns drive the average abnormal returns to be positive. It is natural to examine whether those repurchases are different from the others in terms of firm and repurchase characteristics. Table 14 reports the firm and repurchase characteristics of large gain, large loss and the middle repurchases. Large gain and loss repurchases are generally smaller in dollar amount compared to the middle 80%. The mean dollar repurchase is $36 million for large gain repurchases and the mean dollar repurchase is $24 million for large loss repurchases, while the mean value for the middle 80% of repurchases is $118 million. However, in terms of percent of shares repurchased, all of them are similar. Large gain and loss repurchases are generally conducted by small firms which also have slightly higher debt-to-assets ratios. Large gain repurchases are conducted by firms with a lower mean market-to-book ratio (M/B) of 1.74, while large loss repurchases are conducted by firms with a higher mean M/B of 2.01, when compared to the middle 80% of repurchases which are conducted by firms with a mean M/B of 1.86.

When large gain and large loss repurchases are identified based on dollar abnormal returns, both of them are conducted by firms that have significantly higher average M/B ratios of 2.23 and 2.36, respectively. The middle 80% of repurchases are conducted by firms with an average M/B of 1.75. Similar results are obtained when 36-month abnormal returns are used instead of 12-month abnormal returns. Note that large gain and loss repurchases are generally large in terms of dollar value repurchased. This suggests that large dollar amount repurchases are associated with high M/B, a result that is

inconsistent with the market-timing hypothesis. The market-timing hypothesis predicts the opposite result, as it suggests that firms should repurchase less if their shares are overvalued as measured by high M/B.

An alternative explanation is that M/B is not a good measure of market mispricing. If this is true, it is difficult to interpret the results from some studies such as Dittmar (2000). These studies show that M/B has a negative effect on repurchases and thus conclude that undervalued firms as measured by low M/B are more likely to repurchase their shares. But if M/B measures undervaluation poorly, their findings are not conclusive evidence supporting the market-timing hypothesis. In summary, whether or not M/B is a good measure of stock market undervaluation, there are findings that are difficult to reconcile with the market-timing explanation for repurchases.

## 7. Conclusion and discussion

Although market-timing and leverage-rebalancing motives are empirically important, free cash flow (FCF) and employee stock options (ESOs) considerations have considerably stronger effects on share repurchase decisions. Large changes in timing opportunities translate to only modest absolute changes in the estimated probability that a firm conducts a repurchase. This market-timing effect mainly comes from the market-to-book ratio as large changes in past and future abnormal stock returns have almost no influence on the decision to conduct a repurchase. Moreover, the vast majority of firms with attractive timing opportunities fail to repurchase shares. Leverage rebalancing could motivate some repurchases, but the evidence on this is sensitive to the model for estimating leverage targets. For example, firms are not under-leveraged before tender-offer repurchases when industry median leverage ratios are used to estimate leverage targets.

On the other hand, high levels of FCF greatly increase the probability of conducting a repurchase, and this effect dominates the market-timing consideration. Firms with excellent timing opportunities and low FCF are less likely to conduct a repurchase than firms with poor timing opportunities and high FCF. A large increase in ESOs also leads to a notably higher probability of conducting a repurchase, regardless

of whether market timing opportunities are favorable or unfavorable. All these findings together suggest that FCF and ESOs effects are empirically stronger than the market-timing effect.

Even when firms decide to repurchase stock, their decisions seem to be poor in a market-timing sense. Firms are more likely to experience negative abnormal stock return than positive abnormal stock return after repurchases, as the median post-repurchase abnormal returns are -3% over 12 months following the year in which a firm repurchases shares and -7% over 36 months following the year in which a firm repurchases shares. The mean post-repurchase abnormal returns are positive as in prior studies. However, these positive average post-repurchase abnormal returns are mostly driven by extreme abnormal returns of firms that repurchase trivial amounts in both percentage and dollar terms. As a result, the mean values are not as informative as the median values regarding what is more likely to happen to the stock price following repurchases.

Overall, the evidence on the post-repurchase abnormal returns and on the relative importance of market timing and other motives suggest that market-timing considerations are only marginally influential on the decision of whether or not to conduct a repurchase. Managers either do not systematically time the market to buy back shares or their timing ability is poor.

Why do managers fail to time the market by repurchasing undervalued shares? One possibility is that managers simply have little ability to predict stock returns. This explanation is consistent with the recent criticism from practitioners who blame managers for buying back shares at prices that seemed too high. For example, financial institutions such as AIG, Citigroup, JP Morgan, Wachovia, and WAMU all repurchased stock at high prices not long before the financial crisis in 2008. Their share prices fell sharply as the crisis developed and lead to significant loses on these repurchases.

Another possible reason why managers may fail to exploit market-timing opportunities is that investor rationality limits managers' attempts to intentionally and regularly buy back undervalued shares. If managers knowingly and regularly buy back undervalued shares, investors will eventually learn the ploy and implement trading strategy that can eliminate the timing opportunities. As a result, share repurchases would not become a pervasive economic phenomenon if market timing is the

primary motive. However, repurchases have become popular in recent years. For example, among firms that are listed at least 10 years during the period from 1997 to 2010, 36% of them repurchase at least one out of every two years, and 62.4% of them repurchase at least one out of every four years. It seems implausible that such consistent and frequent repurchase activities are driven by market-timing motive.

In sum, firms have a weak tendency to exploit market-timing opportunities via repurchases that is dominated by both FCF and ESO considerations. This finding suggests that a desire to time the market is not the primary motive driving the decision to repurchase stock. Rather, the fundamental desire to distribute FCF and/or managerial incentives to offset the dilution effects of ESOs are more important determinants of repurchase decisions.

Although "market timing" in the discussion above refers to the mispricing version of the timing hypothesis, similar analyses apply to the rational asymmetric information and the managerial perceptions versions. In both theories, firms are not systematically undervalued at a time when they buy back their own shares. This is consistent with the finding that both past and future abnormal stock returns have little influence on repurchase decisions, as well as the finding that post-repurchase abnormal returns are more likely to be negative than positive.

On the other hand, the fact that FCF and ESO considerations are more important than market timing in explaining repurchase decisions is inconsistent with the notion that managerial perceptions alone drive repurchase decisions. At the same time, however, the data do not rule out the possibility that managerial beliefs, which are inherently difficult to observe, have some effect on share repurchase decisions over and above the impact of FCF and OCF.

My main conclusion, then, is that the desire to exploit market undervaluation, either by rational or irrational managers, cannot be the primary motive for repurchase decisions. Given fundamental-based reasons to conduct repurchases, share repurchase decisions exhibit some degree of market timing behaviors.

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**Figure 1**
**Aggregate repurchases, dividends and level of S&P 500 index for each year from 1971 to 2010**

This figure depicts the total repurchases and dividends of all sample firms in each year from 1971 to 2010. Repurchase is net repurchase as in Fama and French (2001), measured as the increase in common treasury stock. If the treasury stock is zero in the current and previous year or the treasury stock is not available, repurchase is measured as the difference between stock purchase and stock issuance from Compustat. Dividends are the cash dividends paid by common shares reported by Compustat. The sample contains 14,958 industrial firms in the CRPS/Compustat merged files over 1971 to 2010. The sample excludes the firms (i) with SIC codes in the intervals 4900-4949 (utilities) and 6000-6999 (financials), (ii) without CRSP share codes 10 or 11, (iii) incorporated outside the US, and (iv) without non-missing total assets from Compustat. Level of S&P 500 index is the average of daily S&P 500 index value in each year. All dollar amounts are inflation adjusted using the Consumer Price Index (CPI) and are expressed in 2010 dollars.

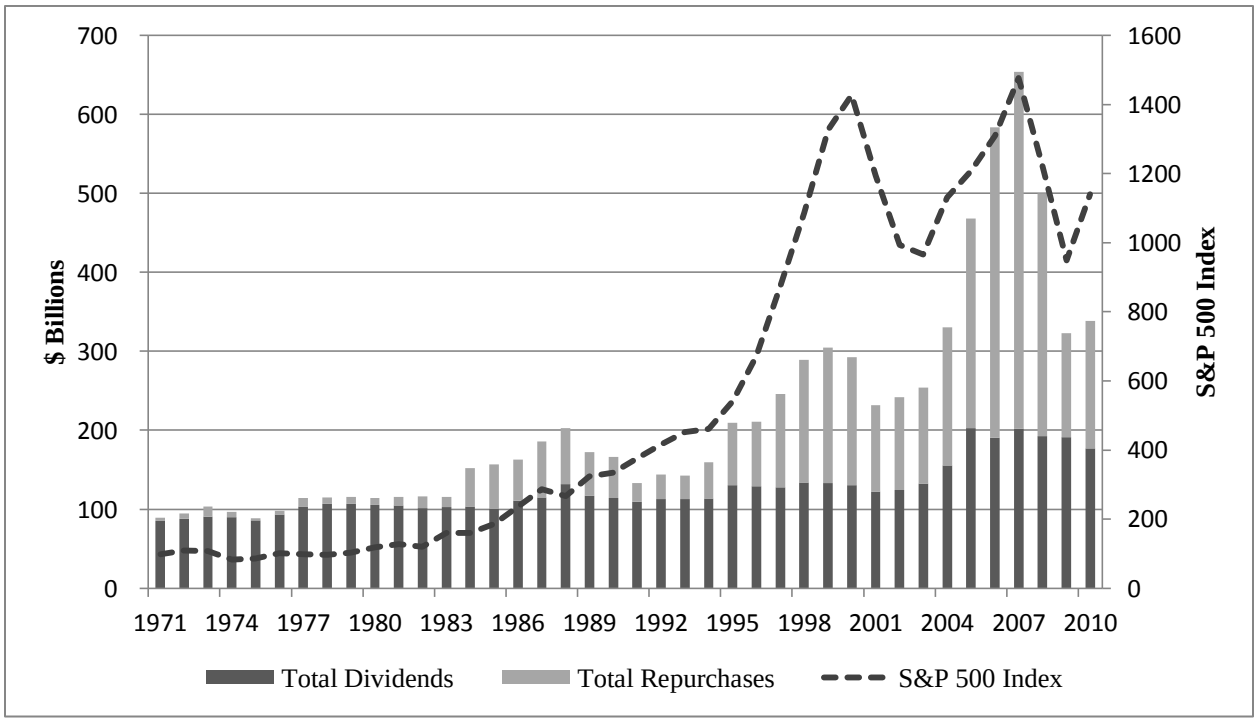

**Figure 2**
**Percent of firms that repurchase and pay dividends from 1971 to 2010**

This figure depicts the percent of all sample firms that are repurchasers and dividend payers in each year from 1971 to 2010. A firm is a repurchaser if it has a positive net repurchase as defined in Figure 1. A dividend payer is a firm that pays cash dividends to common shareholders. A payers is a firm that is either a repurchaser or a dividend payer. The sample contains 14,958 industrial firms in the CRPS/Compustat merged files over 1971 to 2010. The sample excludes the firms (i) with SIC codes in the intervals 4900-4949 (utilities) and 6000-6999 (financials), (ii) without CRSP share codes 10 or 11, (iii) incorporated outside the US, and (iv) without non-missing total assets from Compustat.

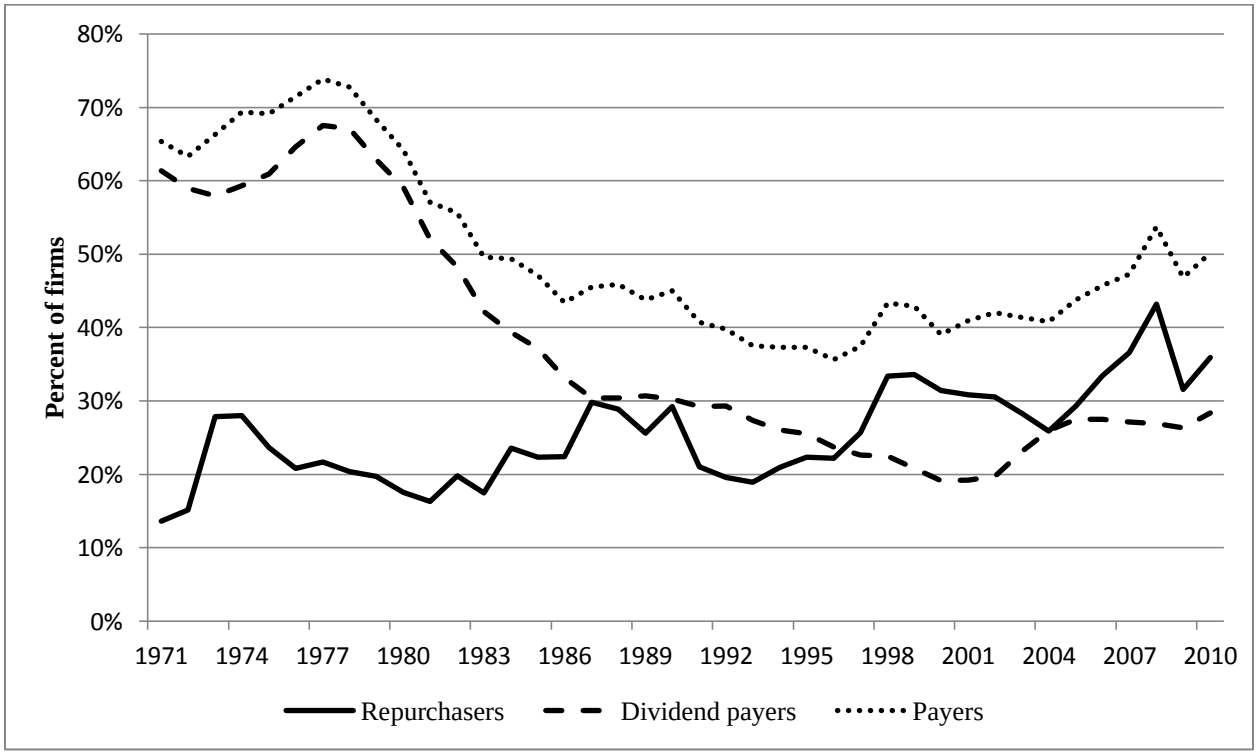

**Table 1**
**Three versions of the market-timing theory of share repurchases**

This table lists key features of different versions of market-timing theories that explain share repurchase behavior. The standardized M/B ratio is the firm's M/B ratio divided by the median M/B in the same year for all firms.

| | Assumptions | | Stock market implications | | | Requiring |
|---|---|---|---|---|---|---|
| | Managers | Investors | Abnormal recent stock return | Standardized M/B ratio | Abnormal future stock return | other motives for repurchase? |
| 1. Mispricing | Rational | Irrational | negative | relatively low | positive | No |
| 2. Rational asymmetric information | Rational | Rational | zero | no prediction | zero | Yes |
| 3. Managerial perceptions | Overconfident | Either | zero/positive | moderate/relatively high | zero/negative | No |

**Table 2**
**Distribution of percent of shares repurchased**

Dollar value of repurchases is the total amount repurchased reported by SDC for tender-offer repurchases. For other repurchases, dollar value of purchases is net repurchases as in the Fama and French (2001). Percent of shares repurchased is the exact percent of shares repurchased reported by SDC for tender-offer repurchases. For other repurchases, percent of shares repurchased is measured as the ratio between the dollar value of the repurchase and the end of year market capitalization in year t-1. Percent of total dollar repurchases is the total dollar amount of repurchases of every firm that has a percent of shares repurchased in a specified interval divided by total dollar amount of all repurchases in the sample. All firms in the sample (i) have SIC codes outside the intervals 4900-4949 (utilities) and 6000-6999 (financials), (ii) have CRSP share codes 10 or 11, (iii) are incorporated within the US, and (iv) have non-missing total assets from Compustat. The sample period is from 1985 to 2010.

| | Percent of shares repurchased in the interval: | | | |
|---|---|---|---|---|
| A. All Repurchasers | 0% to 1% | 1% to 5% | 5% to 10% | above 10% |
| Percent of firms that repurchase stock | 43.8% | 37.4% | 11.7% | 7.1% |
| Cumulative percent of firms that repurchase stock | 43.8% | 81.2% | 92.9% | 100.0% |
| Percent of total dollar repurchases | 4.4% | 46.6% | 30.1% | 18.9% |
| Cumulative percent of total dollar repurchases | 4.4% | 51.0% | 81.1% | 100.0% |
| B. Repurchasers using tender offers | | | | |
| Percent of firms that repurchase stock | 10.2% | 14.8% | 19.9% | 55.2% |
| Cumulative percent of firms that repurchase stock | 10.2% | 24.9% | 44.8% | 100.0% |
| Percent of total dollar repurchases | 2.5% | 6.4% | 20.6% | 70.5% |
| Cumulative percent of total dollar repurchases | 2.5% | 8.9% | 29.5% | 100.0% |

**Table 3**
**Logit analysis of tender-offer repurchase decisions**

Tender-offer repurchase announcements are obtained from SDC over 1985-2010. The dependent variable equals one if the firm conducts a tender-offer repurchase in the year in question or zero otherwise. The independent variables are (i) the standardized market-to-book (M/B) ratio at the end of the fiscal year prior to the year in question, (ii) the market-adjusted abnormal return over the 12 months (or over the 36 months in rows C and F) ending immediately before the year in question, (iii) the market-adjusted excess return over the 12 months (or over the 36 months in rows C and F) beginning immediately after the year in question, and (iv) operating cash flow at the end of the fiscal year immediately before the year in question. The standardized M/B ratio is the firm's M/B ratio for the fiscal year immediately before the year in question, divided by the median M/B in that year for all firms. The abnormal return is the firm's actual stock return minus the contemporaneous return on the value-weighted market index. Operating cash flow is operating income before depreciation (OIBDP in Compustat) deflated by total assets. Sample period is from 1985 to 2010.

| | Intercept | Market to book ratio | Prior stock return | Future stock return | Operating cash flow |
|---|---|---|---|---|---|
| A. All firms | | | | | |
| Coefficient | -4.204 | -0.775 | 0.096 | -0.010 | |
| (Marginal probability) | | (-0.005) | (0.001) | (-0.000) | |
| [t-statistic] | [-32.91] | [-7.49] | [1.86] | [-0.27] | |
| B. All firms with raw M/B in lieu of standardized M/B | | | | | |
| Coefficient | -4.284 | -0.477 | 0.087 | -0.010 | |
| (Marginal probability) | | (-0.003) | (0.001) | (-0.000) | |
| [t-statistic] | [-33.67] | [-6.90] | [1.68] | [-0.25] | |
| C. All firms with 36-month market-adjusted return in lieu of 12-month return | | | | | |
| Coefficient | -4.144 | -0.763 | -0.002 | -0.028 | |
| (Marginal probability) | | (-0.006) | (-0.000) | (-0.000) | |
| [t-statistic] | [-28.56] | [-6.74] | [-0.04] | [-0.90] | |
| D. All firms | | | | | |
| Coefficient | -4.398 | -0.892 | 0.003 | -0.005 | 2.858 |
| (Marginal probability) | | (-0.006) | (0.000) | (-0.000) | (0.020) |
| [t-statistic] | [-31.09] | [-7.63] | [0.05] | [-0.14] | (5.71) |
| E. All firms with raw M/B in lieu of standardized M/B | | | | | |
| Coefficient | -4.492 | -0.540 | -0.011 | -0.005 | 2.762 |
| (Marginal probability) | | (-0.004) | (-0.000) | (-0.000) | (0.019) |
| [t-statistic] | [-32.13] | [-6.65] | [-0.15] | [-0.14] | (5.69) |
| F. All firms with 36-month market-adjusted return in lieu of 12-month return | | | | | |
| Coefficient | -4.406 | -0.937 | -0.078 | -0.032 | 3.645 |
| (Marginal probability) | | (0.007) | (-0.001) | (-0.000) | (0.028) |
| [t-statistic] | [-25.00] | [-6.75] | [-1.22] | [-0.97] | [5.96] |

**Table 4**
**Estimated probability of tender-offer repurchases**

This table reports the probability of a tender-offer repurchase conditional on specific hypothesized values of the independent variables. In Panel A, the estimated probabilities are based on the model in Row D of Table 3, which include standardized M/B, prior and future 12-month market-adjusted excess returns, and operating cash flow. Row 1 reports the probability of a tender-offer repurchase for a firm that faces neutral market-timing opportunities. Rows 2-7 show the impact of changing each timing variable by large amounts, while holding other timing variables neutral. Rows 8-13 describe the impact of large swings in future abnormal returns while holding M/B and prior excess stock return highly favorable or unfavorable. The probability of conducting a tender-offer repurchase for firms face highly unfavorable versus highly favorable timing opportunities is given in Rows 14-15 respectively. The estimated probabilities in far right column are based on the model in Row A of Table 3, which includes only the market-timing variables and no control for operating cash flow effect. Panel B are similar to Panel A, except that standardized M/B ratio is not used to estimate the probabilities.

Panel A.

| | Percentile of standardized M/B ratio | Percentile of prior excess stock return | Percentile of future excess stock return | Estimated probability of a tender-offer repurchase as a function of percentile of operating-cash-flow/assets | | | | | Tender-offer probability as a function of market-timing variables only (no operating cash flow effect) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 5th | 25th | 50th | 75th | 95th | |
| Neutral market-timing opportunities | | | | | | | | | |
| 1. | 50th | 50th | 50th | 0.15% | 0.52% | 0.68% | 0.81% | 1.10% | 0.67% |
| Effect of large variation in each market-timing variable | | | | | | | | | |
| 2. | 50th | 95th | 50th | 0.15% | 0.53% | 0.68% | 0.81% | 1.10% | 0.76% |
| 3. | 50th | 5th | 50th | 0.15% | 0.52% | 0.67% | 0.81% | 1.10% | 0.64% |
| 4. | 50th | 50th | 95th | 0.15% | 0.52% | 0.67% | 0.80% | 1.09% | 0.67% |
| 5. | 50th | 50th | 5th | 0.15% | 0.53% | 0.68% | 0.81% | 1.10% | 0.68% |
| 6. | 95th | 50th | 50th | 0.01% | 0.04% | 0.05% | 0.06% | 0.09% | 0.07% |
| 7. | 5th | 50th | 50th | 0.23% | 0.79% | 1.02% | 1.22% | 1.66% | 0.97% |
| Future returns effect, given very low M/B and prior returns | | | | | | | | | |
| 8. | 5th | 5th | 5th | 0.23% | 0.79% | 1.02% | 1.22% | 1.66% | 0.92% |
| 9. | 5th | 5th | 50th | 0.23% | 0.79% | 1.02% | 1.22% | 1.65% | 0.91% |
| 10. | 5th | 5th | 95th | 0.23% | 0.79% | 1.01% | 1.21% | 1.64% | 0.90% |
| Future returns effect, given very high M/B and prior returns | | | | | | | | | |
| 11. | 95th | 95th | 5th | 0.01% | 0.04% | 0.05% | 0.06% | 0.09% | 0.08% |
| 12. | 95th | 95th | 50th | 0.01% | 0.04% | 0.05% | 0.06% | 0.09% | 0.08% |
| 13. | 95th | 95th | 95th | 0.01% | 0.04% | 0.05% | 0.06% | 0.09% | 0.08% |
| Extremely unfavorable versus favorable timing opportunities | | | | | | | | | |
| 14. | 95th | 95th | 5th | 0.01% | 0.04% | 0.05% | 0.06% | 0.09% | 0.08% |
| 15. | 5th | 5th | 95th | 0.23% | 0.79% | 1.01% | 1.21% | 1.64% | 0.90% |

Panel B.

| | Percentile of prior excess stock return | Percentile of future excess stock return | Estimated probability of a tender-offer repurchase as a function of percentile of operating-cash-flow/assets | | | | | Tender-offer probability as a function of market-timing variables only (no operating cash flow effect) |
|---|---|---|---|---|---|---|---|---|
| | | | 5th | 25th | 50th | 75th | 95th | |
| Neutral market-timing opportunities | | | | | | | | |
| 1. | 50th | 50th | 0.21% | 0.54% | 0.65% | 0.74% | 0.94% | 0.63% |
| Effect of large variation in each market-timing variable | | | | | | | | |
| 2. | 95th | 50th | 0.16% | 0.39% | 0.48% | 0.55% | 0.69% | 0.54% |
| 3. | 5th | 50th | 0.25% | 0.62% | 0.75% | 0.86% | 1.09% | 0.68% |
| 4. | 50th | 95th | 0.22% | 0.55% | 0.66% | 0.76% | 0.95% | 0.64% |
| 5. | 50th | 5th | 0.21% | 0.53% | 0.64% | 0.74% | 0.93% | 0.63% |
| Future returns effect, given very low prior returns | | | | | | | | |
| 6. | 5th | 5th | 0.24% | 0.62% | 0.75% | 0.85% | 1.08% | 0.68% |
| 7. | 5th | 50th | 0.25% | 0.62% | 0.75% | 0.86% | 1.09% | 0.68% |
| 8. | 5th | 95th | 0.25% | 0.63% | 0.77% | 0.88% | 1.11% | 0.69% |
| Future returns effect, given very high prior returns | | | | | | | | |
| 9. | 95th | 5th | 0.15% | 0.39% | 0.47% | 0.54% | 0.68% | 0.54% |
| 10. | 95th | 50th | 0.16% | 0.39% | 0.48% | 0.55% | 0.69% | 0.54% |
| 11. | 95th | 95th | 0.16% | 0.40% | 0.49% | 0.56% | 0.70% | 0.55% |
| Extremely unfavorable versus favorable timing opportunities | | | | | | | | |
| 12. | 95th | 5th | 0.15% | 0.39% | 0.47% | 0.54% | 0.68% | 0.54% |
| 13. | 5th | 95th | 0.25% | 0.63% | 0.77% | 0.88% | 1.11% | 0.69% |

**Table 5**
**The interaction between operating cash flow and market timing, tender-offer repurchases**

Tender-offer repurchase announcements are obtained from SDC over 1985-2010. The dependent variable equals one if the firm conducts a tender-offer repurchase in the year in question or zero otherwise. The independent variables are (i) the standardized market-to-book (M/B) ratio at the end of the fiscal year prior to the year in question, (ii) the market-adjusted abnormal return over the 12 months ending immediately before the year in question, (iii) the market-adjusted excess return over the 12 months beginning immediately after the year in question, (iv) operating cash flow in the fiscal year immediately before the year in question, and (v) the interactions between operating cash flow and M/B ratio, prior stock return, and future stock return. The standardized M/B ratio is the firm's M/B ratio for the fiscal year immediately before the year in question, divided by the median M/B in that year for all firms. The abnormal return is the firm's actual stock return minus the contemporaneous return on the value-weighted market index. Operating cash flow is operating income before depreciation (OIBDP in Compustat) deflated by total assets. Panel A reports the marginal probabilities estimated using standard Logit regression, and Panel B reports the interaction effects estimated as in Ai and Norton (2003).

Panel A. Marginal probabilities estimated using standard Logit regression

| | Market to book ratio | Prior stock return | Future stock return | Operating cash flow | Market to book ratio × Operating cash flow | Prior stock return × Operating cash flow | Future stock return × Operating cash flow |
|---|---|---|---|---|---|---|---|
| Model 1 | | | | | | | |
| Marginal probability | -0.006 | 0.000 | 0.000 | 0.020 | | | |
| [t-statistic] | [-6.70] | [0.05] | [-0.14] | [5.32] | | | |
| Model 2 | | | | | | | |
| Marginal probability | -0.006 | 0.000 | 0.000 | 0.021 | -0.001 | | |
| [t-statistic] | [-6.70] | [0.03] | [-0.14] | [5.62] | [-7.84] | | |
| Model 3 | | | | | | | |
| Marginal probability | -0.006 | 0.000 | 0.000 | 0.020 | | -0.002 | |
| [t-statistic] | [-6.59] | [0.56] | [-0.13] | [5.19] | | [-0.81] | |
| Model 4 | | | | | | | |
| Marginal probability | -0.006 | 0.000 | 0.000 | 0.020 | | | -0.002 |
| [t-statistic] | [-6.75] | [0.04] | [0.17] | [5.91] | | | [-3.60] |
| Model 5 | | | | | | | |
| Marginal probability | -0.006 | 0.000 | 0.000 | 0.021 | -0.001 | -0.002 | -0.002 |
| [t-statistic] | [-6.65] | [0.55] | [0.23] | [6.03] | [-8.01] | [-0.86] | [-3.46] |

Panel B. Interaction effects estimated as in Ai and Norton (2003)

| | Mean Interaction effect | Mean T-statistics |
|---|---|---|
| Market to book ratio × Operating cash flow | -0.016 | -4.71 |
| Prior stock return × Operating cash flow | -0.001 | -0.46 |
| Future stock return × Operating cash flow | -0.002 | -1.92 |

**Table 6**
**Leverage and traditional leverage determinants surrounding tender offer repurchases**

This table presents the histogram of deviation from target and the mean values of leverage, target leverage, and various other financial variables surrounding tender-offer repurchases for 539 tender-offer repurchases that have required data before and after the year of tender-offer repurchases. Deviation from target is the difference between the debt to assets ratio and an estimated target leverage ratio. Target leverage 1 is the fitted value from a liner regression of debt to assets ratio on variables often hypothesized to affect leverage decisions: log(sales), market-to-book ratio, profitability and asset tangibility. Target leverage 2 (3) is the median debt to assets ratio in 2-digit SIC (Fama-French 49) industries. Asset growth equals assets in year t minus assets in year t-1, all divided by assets in year t-1. The same divisor is applied to the year t change in debt, capital expenditures and EBITDA. For tangible assets in year t, I divide by assets in year t. Numbers in the parentheses in Panel are cumulative percent. I use *** to identify a significant difference at the 0.01 level or better between the t=-1 mean value of a variable and its t=1 value. The variables in row 4 to 10 show no significant differences at the 0.10 level.

| | Event year relative to tender-offer repurchase | | | | | | |
|---|---|---|---|---|---|---|---|
| Mean value of | -3 | -2 | -1 | 0 | 1 | 2 | 3 |
| 1. Debt/Total Assets | 0.238 | 0.226 | 0.215 | 0.257 | 0.266*** | 0.271 | 0.276 |
| 2. Leverage deviation 1 | -0.025 | -0.034 | -0.044 | 0.003 | 0.010*** | 0.013 | 0.014 |
| 3. Leverage deviation 2 | 0.032 | 0.020 | 0.009 | 0.050 | 0.061*** | 0.065 | 0.067 |
| 4. Leverage deviation 3 | 0.026 | 0.014 | 0.002 | 0.043 | 0.051*** | 0.055 | 0.059 |
| 5. Change in debt | 0.043 | 0.030 | 0.009 | 0.050 | 0.045*** | 0.031 | 0.029 |
| 6. Target leverage 1 | 0.260 | 0.260 | 0.258 | 0.259 | 0.258 | 0.256 | 0.262 |
| 7. Target leverage 2 | 0.206 | 0.206 | 0.207 | 0.208 | 0.206 | 0.206 | 0.210 |
| 8. Target leverage 3 | 0.212 | 0.211 | 0.213 | 0.214 | 0.215 | 0.216 | 0.218 |
| 9. Asset growth | 0.154 | 0.176 | 0.078 | -0.001 | 0.068 | 0.079 | 0.083 |
| 10. Capital expenditures | 0.083 | 0.073 | 0.068 | 0.067 | 0.071 | 0.067 | 0.071 |
| 11. EBITDA | 0.148 | 0.152 | 0.141 | 0.136 | 0.140 | 0.118 | 0.157 |
| 12. Log(Sales) | 6.055 | 6.102 | 6.105 | 6.086 | 6.156 | 6.263 | 6.364 |
| 13. Market-to-book | 1.578 | 1.518 | 1.425 | 1.485 | 1.866 | 1.713 | 1.590 |
| 14. Tangible assets | 0.333 | 0.321 | 0.316 | 0.315 | 0.319 | 0.321 | 0.326 |

**Table 7**
**Logit analysis of repurchase decisions**

The dependent variable equals one if a firm repurchases at least 1% of its shares during the year in question or zero otherwise. The independent variables are (i) the standardized market-to-book (M/B) ratio at the end of the fiscal year prior to the year in question, (ii) the market-adjusted abnormal return over the 12 months (or over the 36 months in rows C and F) ending immediately before the year in question, (iii) the market-adjusted excess return over the 12 months (or over the 36 months in rows C and F) beginning immediately after the year in question, and (iv) operating cash flow at the end of the fiscal year immediately before the year in question. The standardized M/B ratio is the firm's M/B ratio for the fiscal year immediately before the year in question, divided by the median M/B in that year for all firms. The abnormal return is the firm's actual stock return minus the contemporaneous return on the value-weighted market index. Operating cash flow is operating income before depreciation (OIBDP in Compustat) deflated by total assets. Sample period is from 1971 to 2010.

| | Intercept | Market to book ratio | Prior stock return | Future stock return | Operating cash flow |
|---|---|---|---|---|---|
| A. All firms | | | | | |
| Coefficient | -1.300 | -0.212 | -0.043 | 0.052 | |
| (Marginal probability) | | (-0.031) | (-0.006) | (0.008) | |
| [t-statistic] | [-20.36] | [-5.14] | [-1.15] | [2.08] | |
| B. All firms with raw M/B in lieu of standardized M/B | | | | | |
| Coefficient | -1.430 | -0.077 | -0.083 | 0.056 | |
| (Marginal probability) | | (-0.011) | (-0.012) | (0.008) | |
| [t-statistic] | [-23.07] | [-3.32] | [-2.11] | [2.20] | |
| C. All firms with 36-month market-adjusted return in lieu of 12-month return | | | | | |
| Coefficient | -1.295 | -0.174 | -0.001 | 0.047 | |
| (Marginal probability) | | (-0.026) | (-0.000) | (0.007) | |
| [t-statistic] | [-18.47] | [-4.25] | [-0.05] | [3.10] | |
| D. All firms | | | | | |
| Coefficient | -1.623 | -0.254 | -0.198 | 0.066 | 3.093 |
| (Marginal probability) | | (-0.038) | (-0.030) | (0.010) | (0.468) |
| [t-statistic] | [-25.99] | [-5.01] | [-4.46] | [2.86] | (12.33) |
| E. All firms with raw M/B in lieu of standardized M/B | | | | | |
| Coefficient | -1.797 | -0.058 | -0.257 | 0.069 | 2.817 |
| (Marginal probability) | | (-0.009) | (-0.038) | (0.010) | (0.418) |
| [t-statistic] | [-31.85] | [-2.05] | [-5.21] | [2.94] | (10.97) |
| F. All firms with 36-month market-adjusted return in lieu of 12-month return | | | | | |
| Coefficient | -1.637 | -0.233 | -0.075 | 0.047 | 3.248 |
| (Marginal probability) | | (-0.036) | (-0.012) | (0.007) | (0.504) |
| [t-statistic] | [-24.16] | [-4.36] | [-2.43] | [3.40] | [11.31] |

**Table 8**
**Estimated probability of repurchases**

This table reports the probability of a repurchase conditional on specific hypothesized values of the independent variables. A firm is defined as a repurchaser if it buys back at least 1% of its shares. In Panel A, the estimated probabilities are based on the model in Row D of Table 7, which include standardized M/B, prior and future 12-month market-adjusted excess returns, and operating cash flow. Row 1 reports the probability of a repurchase for a firm that faces neutral market-timing opportunities. Rows 2-7 show the impact of changing each timing variable by large amounts, while holding other timing variables neutral. Rows 8-13 describe the impact of large swings in future abnormal returns while holding M/B and prior excess stock return highly favorable or unfavorable. The probability of conducting a repurchase for firms face highly unfavorable versus highly favorable timing opportunities is given in Rows 14-15 respectively. The estimated probabilities in far right column are based on the model in Row A of Table 7, which includes only the market-timing variables and no control for operating cash flow effect. Panel B are similar to Panel A, except that standardized M/B ratio is not used to estimate the probabilities.

Panel A.

| | Percentile of standardized M/B ratio | Percentile of prior excess stock return | Percentile of future excess stock return | Estimated probability of a repurchase as a function of percentile of operating-cash-flow/assets 5th | 25th | 50th | 75th | 95th | Repurchase probability as a function of market-timing variables only (no operating cash flow effect) |
|---|---|---|---|---|---|---|---|---|---|
| Neutral market-timing opportunities | | | | | | | | | |
| 1. | 50th | 50th | 50th | 5.42% | 15.01% | 18.22% | 21.23% | 27.42% | 18.03% |
| Effect of large variation in each market-timing variable | | | | | | | | | |
| 2. | 50th | 95th | 50th | 4.38% | 12.37% | 15.11% | 17.72% | 23.19% | 17.33% |
| 3. | 50th | 5th | 50th | 6.04% | 16.54% | 20.00% | 23.22% | 29.77% | 18.41% |
| 4. | 50th | 50th | 95th | 5.81% | 15.99% | 19.36% | 22.51% | 28.94% | 18.92% |
| 5. | 50th | 50th | 5th | 5.21% | 14.49% | 17.61% | 20.54% | 26.60% | 17.56% |
| 6. | 95th | 50th | 50th | 2.84% | 8.27% | 10.21% | 12.09% | 16.16% | 11.15% |
| 7. | 5th | 50th | 50th | 6.02% | 16.49% | 19.94% | 23.16% | 29.70% | 19.46% |
| Future returns effect, given very low M/B and prior returns | | | | | | | | | |
| 8. | 5th | 5th | 5th | 6.45% | 17.54% | 21.15% | 24.50% | 31.27% | 19.34% |
| 9. | 5th | 5th | 50th | 6.71% | 18.14% | 21.85% | 25.28% | 32.16% | 19.85% |
| 10. | 5th | 5th | 95th | 7.19% | 19.29% | 23.16% | 26.72% | 33.82% | 20.81% |
| Future returns effect, given very high M/B and prior returns | | | | | | | | | |
| 11. | 95th | 95th | 5th | 2.19% | 6.46% | 8.02% | 9.54% | 12.88% | 10.37% |
| 12. | 95th | 95th | 50th | 2.28% | 6.72% | 8.33% | 9.91% | 13.35% | 10.68% |
| 13. | 95th | 95th | 95th | 2.46% | 7.21% | 8.92% | 10.60% | 14.25% | 11.25% |
| Extremely unfavorable versus favorable timing opportunities | | | | | | | | | |
| 14. | 95th | 95th | 5th | 2.19% | 6.46% | 8.02% | 9.54% | 12.88% | 10.37% |
| 15. | 5th | 5th | 95th | 7.19% | 19.29% | 23.16% | 26.72% | 33.82% | 20.81% |

Panel B.

| | Percentile of prior excess stock return | Percentile of future excess stock return | Estimated probability of a repurchase as a function of percentile of operating-cash-flow/assets | | | | | Repurchase probability as a function of market-timing variables only (no operating cash flow effect) |
|---|---|---|---|---|---|---|---|---|
| | | | 5th | 25th | 50th | 75th | 95th | |
| Neutral market-timing opportunities | | | | | | | | |
| 1. | 50th | 50th | 5.98% | 14.84% | 17.66% | 20.27% | 25.59% | 17.42% |
| Effect of large variation in each market-timing variable | | | | | | | | |
| 2. | 95th | 50th | 4.37% | 11.12% | 13.34% | 15.44% | 19.80% | 15.35% |
| 3. | 5th | 50th | 7.02% | 17.13% | 20.28% | 23.18% | 28.98% | 18.58% |
| 4. | 50th | 95th | 6.46% | 15.90% | 18.88% | 21.63% | 27.18% | 18.43% |
| 5. | 50th | 5th | 5.75% | 14.31% | 17.06% | 19.60% | 24.80% | 16.92% |
| Future returns effect, given very low prior returns | | | | | | | | |
| 6. | 5th | 5th | 6.75% | 16.54% | 19.61% | 22.44% | 28.12% | 18.05% |
| 7. | 5th | 50th | 7.02% | 17.13% | 20.28% | 23.18% | 28.98% | 18.58% |
| 8. | 5th | 95th | 7.57% | 18.32% | 21.63% | 24.66% | 30.69% | 19.64% |
| Future returns effect, given very high prior returns | | | | | | | | |
| 9. | 95th | 5th | 4.20% | 10.71% | 12.86% | 14.89% | 19.14% | 14.89% |
| 10. | 95th | 50th | 4.37% | 11.12% | 13.34% | 15.44% | 19.80% | 15.35% |
| 11. | 95th | 95th | 4.72% | 11.95% | 14.31% | 16.53% | 21.13% | 16.26% |
| Extremely unfavorable versus favorable timing opportunities | | | | | | | | |
| 12. | 95th | 5th | 4.20% | 10.71% | 12.86% | 14.89% | 19.14% | 14.89% |
| 13. | 5th | 95th | 7.57% | 18.32% | 21.63% | 24.66% | 30.69% | 19.64% |

**Table 9**
**The interaction between operating cash flow and market timing, all repurchases**

The dependent variable equals one if a firm repurchases at least 1% of its shares during the year in question or zero otherwise. The independent variables are (i) the standardized market-to-book (M/B) ratio at the end of the fiscal year prior to the year in question, (ii) the market-adjusted abnormal return over the 12 months ending immediately before the year in question, (iii) the market-adjusted excess return over the 12 months beginning immediately after the year in question, (iv) operating cash flow in the fiscal year immediately before the year in question, and (v) the interactions between operating cash flow and M/B ratio, prior stock return, and future stock return. The standardized M/B ratio is the firm's M/B ratio for the fiscal year immediately before the year in question, divided by the median M/B in that year for all firms. The abnormal return is the firm's actual stock return minus the contemporaneous return on the value-weighted market index. Operating cash flow is operating income before depreciation (OIBDP in Compustat) deflated by total assets. Sample period is from 1971 to 2010. Panel A reports the marginal probabilities estimated using standard Logit regression, and Panel B reports the interaction effects estimated as in Ai and Norton (2003).

Panel A. Marginal probabilities estimated using stand Logit regression

| | Market to book ratio | Prior stock return | Future stock return | Operating cash flow | Market to book ratio × Operating cash flow | Prior stock return × Operating cash flow | Future stock return × Operating cash flow |
|---|---|---|---|---|---|---|---|
| Model 1 | | | | | | | |
| Marginal probability | -0.038 | -0.030 | 0.010 | 0.468 | | | |
| [t-statistic] | [-5.39] | [-4.06] | [2.95] | [8.93] | | | |
| Model 2 | | | | | | | |
| Marginal probability | -0.037 | -0.030 | 0.010 | 0.477 | -0.006 | | |
| [t-statistic] | [-5.32] | [-4.07] | [2.83] | [9.04] | [-6.43] | | |
| Model 3 | | | | | | | |
| Marginal probability | -0.037 | -0.021 | 0.010 | 0.463 | | -0.065 | |
| [t-statistic] | [-5.38] | [-2.80] | [2.86] | [8.92] | | [-1.86] | |
| Model 4 | | | | | | | |
| Marginal probability | -0.038 | -0.030 | 0.010 | 0.468 | | | 0.000 |
| [t-statistic] | [-5.40] | [-4.06] | [3.59] | [8.93] | | | [-0.01] |
| Model 5 | | | | | | | |
| Marginal probability | -0.037 | -0.021 | 0.010 | 0.471 | -0.004 | -0.063 | -0.003 |
| [t-statistic] | [-4.95] | [-2.68] | [3.55] | [6.86] | [-0.22] | [-1.92] | [-0.17] |

Panel B. Interaction effects estimated as in Ai and Norton (2003)

| | Mean Interaction effect | Mean T-statistics |
|---|---|---|
| Market to book ratio × Operating cash flow | -0.073 | -5.63 |
| Prior stock return × Operating cash flow | -0.110 | -2.85 |
| Future stock return × Operating cash flow | 0.018 | 0.93 |

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**Table 10**
**Distribution of abnormal return and abnormal dollar return of repurchases**

All firms in this table are from the same sample in Figure 1. Future 12(36)-month cumulative abnormal return is the market-adjusted buy-and-hold abnormal return over 12(36) months beginning immediately after the year in question. The abnormal return is the firm's actual return minus the contemporaneous return on the value-weighted market index. Future 12(36)-month abnormal dollar stock returns is the product of dollar amount of repurchase and future 12(36)-month cumulative abnormal return. Repurchase is net repurchase as in Fama and French (2001). One-shot repurchasers are firms that only repurchase once during their time in the sample. Tender-offer repurchases and the corresponding dollar amounts of repurchase (if available) are reported by SDC. The sample period in Panel A and C is from 1985 to 2009 while the sample period in Panel B and D is from 1985 to 2007.

| | Mean | Median | Min | 1st percentile | 10th percentile | 25th percentile | 75th percentile | 90th percentile | 99th percentile | Max | N |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Panel A. 12-month abnormal stock return | | | | | | | | | | | |
| All | 0.07 | -0.03 | -1.00 | -0.81 | -0.47 | -0.26 | 0.23 | 0.61 | 2.36 | 38.91 | 26,775 |
| One Shot | 0.06 | -0.14 | -1.00 | -0.94 | -0.74 | -0.50 | 0.30 | 0.92 | 4.27 | 10.56 | 976 |
| Tender-offer | 0.06 | -0.02 | -0.93 | -0.78 | -0.41 | -0.24 | 0.23 | 0.56 | 2.33 | 7.70 | 530 |
| Panel B. 36-month abnormal stock return | | | | | | | | | | | |
| All | 0.18 | -0.07 | -1.00 | -0.95 | -0.68 | -0.42 | 0.39 | 1.14 | 4.58 | 44.57 | 20,327 |
| One Shot | 0.00 | -0.41 | -1.00 | -0.99 | -0.92 | -0.75 | 0.31 | 1.51 | 5.48 | 7.99 | 364 |
| Tender offer | 0.13 | -0.08 | -0.95 | -0.91 | -0.65 | -0.44 | 0.30 | 1.14 | 4.05 | 6.73 | 411 |
| Panel C. 12-month abnormal dollar stock return ($m) | | | | | | | | | | | |
| All | 2.1 | -0.0 | -12,491.9 | -183.4 | -7.4 | -0.6 | 0.6 | 9.1 | 221.8 | 10,163.5 | 26,775 |
| One Shot | -1.7 | -0.0 | -890.5 | -78.8 | -2.4 | -0.2 | 0.1 | 2.1 | 58.2 | 246.1 | 976 |
| Tender-offer | 3.2 | 0.0 | -890.5 | -388.0 | -56.5 | -8.7 | 6.3 | 50.4 | 576.0 | 1,790.5 | 530 |
| Panel D. 36-month abnormal dollar stock return ($m) | | | | | | | | | | | |
| All | 5.8 | -0.0 | -6,412.3 | -301.2 | -12.5 | -1.0 | 1.3 | 20.0 | 399.3 | 14,662.8 | 20,327 |
| One Shot | 0.0 | -0.0 | -147.0 | -72.0 | -3.4 | -0.5 | 0.0 | 1.2 | 83.2 | 209.6 | 364 |
| Tender offer | 8.3 | -0.0 | -1,302.3 | -553.7 | -77.9 | -15.5 | 4.9 | 82.5 | 634.0 | 2,112.8 | 411 |

**Table 11**
**Distribution of future abnormal return (dollar return) for large gain, loss, and other repurchases**

All firms in this table are from the same sample in Figure 1. Large gain (loss) repurchase are those with future 12 (36)-month abnormal returns (or dollar return) belong to the top (bottom) 10th percentile of whole sample. Future 12(36)-month abnormal stock return is the market-adjusted buy-and-hold abnormal return over 12(36) months beginning immediately after the year in question. The abnormal return is the firm's actual return minus the contemporaneous return on the value-weighted market index. Future 12(36)-month abnormal dollar returns is the product of dollar amount of repurchase and future 12 (36)-month abnormal return. Dollar repurchase is net repurchase as in Fama and French (2001). Dollar amount repurchased is the total dollar repurchase of all repurchases in the specified groups. Percent of aggregate value repurchased is the dollar amount repurchased divided by the sum of dollar amount repurchased in all three groups.The sample period in Panel A and C is from 1985 to 2009 while the sample period in Panel B and D is from 1985 to 2007.

| | Mean | Median | Min | 1st percentile | 10th percentile | 25th percentile | 75th percentile | 90th percentile | 99th percentile | Max | N | $ amount repurchased | % of aggregate value repurchased |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Panel A. 12-month abnormal stock return | | | | | | | | | | | | | |
| Large gain | 1.38 | 0.97 | 0.61 | 0.61 | 0.66 | 0.75 | 1.44 | 2.36 | 7.16 | 38.91 | 2,677 | 92.4 | 3.5% |
| Middle 80% | -0.01 | -0.03 | -0.47 | -0.45 | -0.34 | -0.21 | 0.16 | 0.35 | 0.57 | 0.61 | 21,421 | 2484.4 | 94.2% |
| Large loss | -0.63 | -0.60 | -1.00 | -0.94 | -0.81 | -0.71 | -0.52 | -0.49 | -0.47 | -0.47 | 2,677 | 61.4 | 2.3% |
| Panel B. 36-month abnormal stock return | | | | | | | | | | | | | |
| Large gain | 2.65 | 1.84 | 1.14 | 1.15 | 1.23 | 1.40 | 2.90 | 4.58 | 15.25 | 44.57 | 2,033 | 57.7 | 2.8% |
| Middle 80% | -0.01 | -0.08 | -0.68 | -0.66 | -0.53 | -0.35 | 0.27 | 0.63 | 1.07 | 1.14 | 16,262 | 1991.5 | 94.9% |
| Large loss | -0.81 | -0.80 | -1.00 | -0.99 | -0.95 | -0.89 | -0.73 | -0.70 | -0.68 | -0.68 | 2,032 | 48.4 | 2.3% |
| Panel C. 12-month abnormal dollar stock return ($m) | | | | | | | | | | | | | |
| Large gain | 115.0 | 33.1 | 9.1 | 9.3 | 11.6 | 16.4 | 83.6 | 221.8 | 1,518.7 | 10,163.5 | 2,677 | 1181.7 | 44.0% |
| Middle 80% | 0.1 | 0.0 | -7.4 | -6.2 | -1.8 | -0.3 | 0.2 | 2.1 | 7.7 | 9.1 | 21,421 | 226.0 | 8.4% |
| Large loss | -95.0 | -26.7 | -12,491.9 | -1,097.8 | -183.4 | -68.1 | -13.0 | -9.1 | -7.5 | -7.4 | 2,677 | 1279.6 | 47.6% |
| Panel D. 36-month abnormal dollar stock return ($m) | | | | | | | | | | | | | |
| Large gain | 196.7 | 65.6 | 20.0 | 20.3 | 24.7 | 35.2 | 168.0 | 399.3 | 1,890.0 | 14,662.8 | 2,033 | 924.5 | 43.3% |
| Middle 80% | 0.4 | 0.0 | -12.5 | -10.7 | -2.9 | -0.5 | 0.5 | 4.5 | 16.9 | 20.0 | 16,262 | 183.8 | 8.6% |
| Large loss | -141.9 | -41.4 | -6,412.3 | -1,494.2 | -301.2 | -110.1 | -21.4 | -15.5 | -12.8 | -12.5 | 2,032 | 1027.8 | 48.1% |

**Table 12**
**Distribution of future abnormal return (dollar return) for middle repurchases**

All firms in this table are from the same sample in Figure 1. Middle repurchases are those with future 12 (36)-month abnormal returns (or dollar return) in the middle 80% (90%, 95%, and 99%) of the whole sample. Future 12(36)-month abnormal stock return is the market-adjusted buy-and-hold abnormal return over 12(36) months beginning immediately after the year in question. The abnormal return is the firm's actual return minus the contemporaneous return on the value-weighted market index. Future 12(36)-month abnormal dollar returns is the product of dollar amount of repurchase and future 12 (36)-month abnormal return. Dollar repurchase is net repurchase as in Fama and French (2001). Dollar amount repurchased is the total dollar repurchase of all repurchases in the specified groups. Percent of aggregate value repurchased is the dollar amount repurchased divided by the sum of dollar amount repurchased in all three groups.The sample period in Panel A and C is from 1985 to 2009 while the sample period in Panel B and D is from 1985 to 2007.

| | Mean | Median | Min | 1st percentile | 10th percentile | 25th percentile | 75th percentile | 90th percentile | 99th percentile | Max | N | $ amount repurchased | % of aggregate value repurchased |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Panel A. 12-month abnormal stock return | | | | | | | | | | | | | |
| Middle 80% | -0.012 | -0.035 | -0.470 | -0.454 | -0.341 | -0.209 | 0.165 | 0.355 | 0.572 | 0.607 | 21,421 | 2528.7 | 94.1% |
| Middle 90% | 0.002 | -0.035 | -0.597 | -0.568 | -0.397 | -0.234 | 0.198 | 0.459 | 0.877 | 0.975 | 24,099 | 2642.4 | 98.3% |
| Middle 95% | 0.016 | -0.035 | -0.707 | -0.656 | -0.430 | -0.247 | 0.214 | 0.526 | 1.219 | 1.442 | 25,437 | 2668.9 | 99.3% |
| Middle 99% | 0.042 | -0.035 | -0.863 | -0.769 | -0.462 | -0.256 | 0.228 | 0.590 | 1.963 | 3.473 | 26,509 | 2682.8 | 99.8% |
| Panel B. 36-month abnormal stock return | | | | | | | | | | | | | |
| Middle 80% | -0.008 | -0.075 | -0.678 | -0.663 | -0.526 | -0.348 | 0.272 | 0.630 | 1.070 | 1.136 | 16,262 | 2026.3 | 94.9% |
| Middle 90% | 0.032 | -0.075 | -0.802 | -0.778 | -0.600 | -0.384 | 0.328 | 0.829 | 1.652 | 1.843 | 18,295 | 2096.9 | 98.2% |
| Middle 95% | 0.068 | -0.075 | -0.890 | -0.855 | -0.638 | -0.401 | 0.356 | 0.971 | 2.377 | 2.900 | 19,311 | 2121.0 | 99.3% |
| Middle 99% | 0.128 | -0.075 | -0.966 | -0.928 | -0.670 | -0.415 | 0.383 | 1.105 | 3.798 | 6.464 | 20,125 | 2134.2 | 99.9% |
| Panel C. 12-month abnormal dollar stock return ($m) | | | | | | | | | | | | | |
| Middle 80% | 0.1 | 0.0 | -7.4 | -6.2 | -1.8 | -0.3 | 0.2 | 2.1 | 7.7 | 9.1 | 21,421 | 226.0 | 8.4% |
| Middle 90% | 0.3 | 0.0 | -26.7 | -20.4 | -3.5 | -0.4 | 0.4 | 4.2 | 25.0 | 33.1 | 24,099 | 516.8 | 19.2% |
| Middle 95% | 0.5 | 0.0 | -68.1 | -44.7 | -5.0 | -0.5 | 0.5 | 6.2 | 58.0 | 83.6 | 25,437 | 862.7 | 32.1% |
| Middle 99% | 1.0 | 0.0 | -357.1 | -127.3 | -6.8 | -0.6 | 0.6 | 8.4 | 141.6 | 436.8 | 26,509 | 1669.2 | 62.1% |
| Panel D. 36-month abnormal dollar stock return ($m) | | | | | | | | | | | | | |
| Middle 80% | 0.4 | 0.0 | -12.5 | -10.7 | -2.9 | -0.5 | 0.5 | 4.5 | 16.9 | 20.0 | 16,262 | 183.8 | 8.6% |
| Middle 90% | 1.2 | 0.0 | -41.4 | -32.4 | -5.8 | -0.7 | 0.8 | 9.2 | 51.8 | 65.6 | 18,295 | 427.0 | 20.0% |
| Middle 95% | 2.1 | 0.0 | -109.7 | -72.0 | -8.4 | -0.9 | 1.0 | 13.3 | 115.4 | 168.0 | 19,310 | 701.9 | 32.9% |
| Middle 99% | 3.8 | 0.0 | -589.5 | -192.1 | -11.6 | -1.0 | 1.2 | 18.4 | 281.8 | 746.8 | 20,125 | 1380.8 | 64.6% |

**Table 13**
**Distribution of future abnormal return (dollar return) for middle repurchases, tender offers**

Tender-offer repurchases and the corresponding dollar amounts of repurchase (if available) are obtained from SDC. Middle repurchases are those with future 12 (36)-month abnormal returns (or dollar return) in the middle 80% (90%, 95%, and 99%) of the whole sample. Future 12(36)-month abnormal stock return is the market-adjusted buy-and-hold abnormal return over 12(36) months beginning immediately after the year in question. The abnormal return is the firm's actual return minus the contemporaneous return on the value-weighted market index. Future 12(36)-month abnormal dollar returns is the product of dollar amount of repurchase and future 12 (36)-month abnormal return. Dollar amount repurchased is the total dollar repurchase of all repurchases in the specified groups. Percent of aggregate value repurchased is the dollar amount repurchased divided by the sum of dollar amount repurchased in all three groups.The sample period in Panel A and C is from 1985 to 2009 while the sample period in Panel B and D is from 1985 to 2007.

| | Mean | Median | Min | 1st percentile | 10th percentile | 25th percentile | 75th percentile | 90th percentile | 99th percentile | Max | N | $ amount repurchased | % of aggregate value repurchased |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Panel A. 12-month abnormal stock return | | | | | | | | | | | | | |
| Middle 80% | -0.008 | -0.024 | -0.412 | -0.400 | -0.305 | -0.198 | 0.159 | 0.309 | 0.512 | 0.556 | 424 | 140.5 | 89.7% |
| Middle 90% | 0.006 | -0.024 | -0.509 | -0.499 | -0.362 | -0.226 | 0.188 | 0.428 | 0.789 | 0.833 | 478 | 149.4 | 95.3% |
| Middle 95% | 0.017 | -0.025 | -0.614 | -0.576 | -0.386 | -0.238 | 0.211 | 0.495 | 1.143 | 1.212 | 503 | 154.5 | 98.6% |
| Middle 99% | 0.039 | -0.025 | -0.863 | -0.705 | -0.410 | -0.243 | 0.221 | 0.524 | 1.733 | 2.494 | 525 | 155.7 | 99.3% |
| Panel B. 36-month abnormal stock return | | | | | | | | | | | | | |
| Middle 80% | -0.044 | -0.083 | -0.655 | -0.647 | -0.535 | -0.359 | 0.196 | 0.498 | 1.016 | 1.134 | 328 | 115.2 | 90.8% |
| Middle 90% | 0.006 | -0.082 | -0.822 | -0.801 | -0.604 | -0.393 | 0.261 | 0.745 | 1.709 | 1.786 | 371 | 123.4 | 97.3% |
| Middle 95% | 0.035 | -0.083 | -0.894 | -0.879 | -0.629 | -0.417 | 0.277 | 0.968 | 2.338 | 2.991 | 390 | 124.7 | 98.3% |
| Middle 99% | 0.100 | -0.082 | -0.926 | -0.905 | -0.653 | -0.419 | 0.295 | 1.134 | 3.754 | 4.531 | 407 | 126.5 | 99.7% |
| Panel C. 12-month abnormal dollar stock return ($m) | | | | | | | | | | | | | |
| Middle 80% | -1.7 | 0.0 | -56.3 | -53.4 | -21.9 | -3.4 | 3.3 | 14.7 | 39.4 | 49.8 | 424 | 31.7 | 20.3% |
| Middle 90% | -1.9 | 0.0 | -124.3 | -114.4 | -40.3 | -6.2 | 4.5 | 23.6 | 112.6 | 133.6 | 478 | 69.0 | 44.1% |
| Middle 95% | -1.7 | 0.0 | -215.7 | -158.2 | -46.4 | -7.3 | 5.2 | 34.8 | 171.4 | 246.1 | 503 | 88.4 | 56.4% |
| Middle 99% | 1.1 | 0.0 | -648.7 | -353.1 | -54.7 | -8.5 | 6.2 | 43.2 | 419.9 | 923.0 | 526 | 141.0 | 90.0% |
| Panel D. 36-month abnormal dollar stock return ($m) | | | | | | | | | | | | | |
| Middle 80% | -2.5 | 0.0 | -54.7 | -53.4 | -22.9 | -4.0 | 3.1 | 12.8 | 34.8 | 38.9 | 329 | 25.5 | 20.1% |
| Middle 90% | -3.1 | 0.0 | -114.4 | -95.0 | -40.2 | -6.9 | 3.8 | 19.0 | 79.3 | 112.6 | 370 | 52.5 | 41.4% |
| Middle 95% | -2.6 | 0.0 | -205.3 | -158.2 | -46.0 | -8.5 | 4.9 | 24.3 | 169.5 | 229.7 | 390 | 68.1 | 53.6% |
| Middle 99% | 1.7 | 0.0 | -559.7 | -286.9 | -54.2 | -9.2 | 5.2 | 36.5 | 318.8 | 923.0 | 407 | 109.3 | 86.2% |

**Table 14**
**Characteristics of large gain, large loss and other repurchases**

This table reports the characteristics for large gain, large loss and other repurchases from 1985 to 2009. Large gain (loss) repurchase are those with future 12-month abnormal returns (or dollar return) belong to the top (bottom) 10th percentile of whole sample. Dollar repurchase is net repurchase as in Fama and French (2001). Future (past) 12-month abnormal return is the market-adjusted buy-and-hold abnormal return over 12 months beginning immediately after (before) the year in question. The abnormal return is the firm's actual return minus the contemporaneous return on the value-weighted market index. Dollar abnormal return is the product of dollar repurchase and future 12-month abnormal return. Assets are book value of total assets at the end of year in question. Market capitalization is the end of year stock price multiplied by number of common shares outstanding. Debt to assets ratios is the book value of total debt divided by book value of total assets. Market to book ratios is the book value of total assets less book value of equity plus market capitalization all divided by book value of total assets.

| | Large gain repurchases (1) | | | Large loss repurchases (2) | | | Other repurchases (3) | | | *p*-value (1) - (2) | | *p*-value (1) - (3) | | *p*-value (2) - (3) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variable | N | Mean | Median | N | Mean | Median | N | Mean | Median | Mean | Median | Mean | Median | Mean | Median |
| Panel A. Large gain and loss based on future 12-month abnormal return | | | | | | | | | | | | | | | |
| $ repurchase ($m) | 2,677 | 35.7 | 1.32 | 2,677 | 23.6 | 0.72 | 21,421 | 118.0 | 3.55 | 0.0228 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| $ repurchase/market capitalization | 2,676 | 0.04 | 0.01 | 2,674 | 0.04 | 0.01 | 21,413 | 0.03 | 0.01 | 0.1357 | 0.0000 | 0.0086 | 0.2045 | 0.7000 | 0.0000 |
| Assets ($m) | 2,677 | 998 | 142 | 2,677 | 848 | 107 | 21,421 | 3,501 | 357 | 0.1095 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Market capitalization ($m) | 2,675 | 1,088 | 92 | 2,670 | 945 | 82 | 21,410 | 4,279 | 350 | 0.3968 | 0.1289 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Prior year debt/assets | 2,677 | 0.211 | 0.165 | 2,677 | 0.236 | 0.193 | 21,420 | 0.203 | 0.178 | 0.0000 | 0.0110 | 0.0443 | 0.2435 | 0.0000 | 0.0345 |
| Prior year market-to-book | 2,672 | 1.735 | 1.296 | 2,670 | 2.007 | 1.398 | 21,364 | 1.857 | 1.458 | 0.0000 | 0.0000 | 0.0004 | 0.0000 | 0.0000 | 0.0004 |
| Past 12-month abnormal return | 2,677 | -0.045 | -0.161 | 2,677 | -0.004 | -0.148 | 21,421 | 0.036 | -0.042 | 0.0520 | 0.3119 | 0.0000 | 0.0000 | 0.0018 | 0.0000 |
| Future 12-month abnormal return | 2,677 | 1.384 | 0.975 | 2,677 | -0.626 | -0.597 | 21,421 | -0.012 | -0.035 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Future 12-month abnormal $ return ($m) | 2,677 | 35.4 | 1.5 | 2,677 | -13.8 | -0.5 | 21,421 | -0.1 | 0.0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Panel B. Large gain and loss based on future 12-month abnormal $ return | | | | | | | | | | | | | | | |
| $ repurchase ($m) | 2,677 | 441.4 | 119.36 | 2,677 | 478.0 | 130.00 | 21,421 | 10.6 | 1.20 | 0.3472 | 0.1328 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| $ repurchase/market capitalization | 2,676 | 0.07 | 0.04 | 2,677 | 0.07 | 0.04 | 21,410 | 0.03 | 0.01 | 0.8073 | 0.2566 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Assets ($m) | 2,677 | 9,738 | 2,564 | 2,677 | 11,522 | 2,665 | 21,421 | 1,074 | 169 | 0.0411 | 0.6818 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Market capitalization ($m) | 2,677 | 12,697 | 2,859 | 2,677 | 15,136 | 3,349 | 21,401 | 1,053 | 139 | 0.0148 | 0.0058 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Prior year debt/assets | 2,677 | 0.215 | 0.199 | 2,677 | 0.213 | 0.195 | 21,420 | 0.205 | 0.172 | 0.6226 | 0.3387 | 0.0112 | 0.0000 | 0.0536 | 0.0000 |
| Prior year market-to-book | 2,670 | 2.234 | 1.806 | 2,668 | 2.360 | 1.831 | 21,368 | 1.750 | 1.355 | 0.0034 | 0.2503 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Past 12-month abnormal return | 2,677 | 0.047 | -0.002 | 2,677 | 0.067 | 0.005 | 21,421 | 0.016 | -0.080 | 0.1019 | 0.6422 | 0.0172 | 0.0000 | 0.0001 | 0.0000 |
| Future 12-month abnormal return | 2,677 | 0.567 | 0.334 | 2,677 | -0.293 | -0.254 | 21,421 | 0.049 | -0.038 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Future 12-month abnormal $ return ($m) | 2,677 | 115.0 | 33.1 | 2,677 | -95.0 | -26.7 | 21,421 | 0.1 | 0.0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |