Insider trading and share repurchases: Do insiders and firms trade in the same direction?

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Abstract

Signaling undervaluation is often considered a primary motive for repurchasing stock, but insider trading activity by repurchasing firms is not always consistent with undervaluation. Net insider buying and selling are both more frequent in quarters when firms are repurchasing non-trivial amounts of stock, with the odds of observing a repurchase the highest in quarters with net insider selling. In multinomial logit models, shares repurchases associated with net insider selling are positively related to illiquidity, option exercises by insiders, and pre-repurchase returns and negatively correlated with industry-adjusted book to market ratios when compared to other repurchases. Hence, repurchases when insiders are selling stock are more likely done to support share prices or avoid dilution and are less likely undervaluation signals. We find that insider trades either validate or mitigate the undervaluation signal of the repurchase. Abnormal returns of repurchasing firms with net insider buying versus net insider selling in a given quarter are significantly higher for the quarter immediately after the repurchase and the three subsequent years. For repurchases accompanied by net insider selling, abnormal returns are negligible after only one year.

Keywords: Share repurchases; Insider trading; Long-run performance

JEL classification: G35, G14

Share repurchases have long been viewed as a means for management to signal firm undervaluation (e.g., Vermaelen (1981)). Consistent with the signaling rationale, repurchases are, on average, greeted with positive abnormal returns at their announcement, and abnormal returns persist in the three years after their announcement.[1] Managerial stock ownership lends credibility to repurchase signals because managers suffer a loss on their shares if the shares repurchased are overvalued. Consequently, repurchases might not convey positive information if management is selling their stock at the same time the repurchase is undertaken (e.g., Fried (2001)). Insider selling at the time of a repurchase could be viewed as using repurchases to enable management to reduce their holdings at a favorable price by supporting stock price levels. Yet, in most repurchase programs there is no prohibition on insider sales while repurchases are in progress.

This paper addresses three questions related to the relationship between insider trading and stock repurchase activity by a firm. First, do insiders trade in the same direction as their company in a given quarter in the case of share repurchases? If insider trades and stock repurchases are based on private information about stock valuation, then actual repurchases should occur more frequently conditional on net insider buying and less frequently conditional on net insider selling. Given that repurchase quantities can differ substantially from announced amounts (Stephens and Weisbach (1998) and Bonaime (2012)) based on market movements and real time valuation, and other repurchases are not pre-announced at all, we examine actual as opposed to announced repurchases and determine if insiders are more likely to be net buyers in quarters when their firm is repurchasing company stock.[2] Second, does the direction of insider

[1] See, e.g., Ikenberry, Lakonishok, and Vermaelen (1995), Stephens and Weisbach (1998), Ikenberry, Lakonishok, and Vermaelen (2000), Jagannathan and Stephens (2003), Chan, Ikenberry, and Lee (2004), and Chan, Ikenberry, Lee and Wang (2010).

[2] Stephens and Weisbach (1998) document that completion rates associated with open market repurchases conducted between 1981 and 1990 were between 74 and 82 percent on average. Using open market repurchases announced between 1988 and 2007, Bonaime (2012) finds average completion rates of 73 percent and that completion rates vary substantially across firms; the completion rate at the 10^{th} (90^{th}) percentile is 10 percent (100 percent) . Though

trades affect the strength of the undervaluation signal inherent in a share repurchase? More precisely, are returns after a repurchase quarter different based on the direction of insider trading in that same quarter? Third, to the extent insiders and firms do or do not trade in the same direction in a quarter, can we explain what factors cause variation in combinations of insider trading and repurchases in a quarter that are consistent with post repurchase return evidence?

We employ a simple empirical design. From 1989 through 2007,[3] we use Compustat quarterly data to identify whether or not a firm conducted a non-trivial common stock repurchase (at least one percent of the firm's market capitalization). We next use the Thomson Reuters Insiders data to calculate net insider trading as the dollar value of open market and private insider purchases less the dollar value of open market and private insider sales. Firms with insider buying exceeding insider selling by at least $200,000 or 0.01 percent of market capitalization are labeled "net buying" firms; firms whose insider selling surpasses insider buying by the same threshold are categorized as "net selling" firms. The remaining cases are classified as neutral. If the primary motivation for repurchases is stock price undervaluation, insiders should be net buyers (net sellers) more (less) frequently conditional on a firms repurchasing substantial amounts of stock in the same quarter.

We find that in quarters when companies are repurchasing, the frequency of net buying *and* net selling tends to be higher than usual. An alternative way of framing the data is that, conditional on the presence of insider selling or insider buying, share repurchases are more frequently observed relative to the case where insider trading is neutral. Surprisingly, share repurchases are most frequently observed conditional on insiders being net *sellers*.

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for other types of share repurchase plans (i.e., tender offers, Dutch auctions, and accelerated share repurchases), actual repurchase do not differ from announced amounts, open market repurchases account for 90 percent of all repurchases (Grullon and Michaely (2004)).

[3] We use Compustat firms with 2006 fiscal years. This includes firms with fiscal year ends through May 2007.

The fact that repurchases are more likely to be associated with insider net selling than net buying is puzzling in a signaling context, but could be explained by attempts to support price levels or provide liquidity for selling insiders. It could be explained by the exercise of stock options. For a sample of dividend increases and stock repurchase increases in the 1990s, Kahle (2002) finds that firms are more likely to repurchase shares when the firm has more options outstanding (see also Ditmar(2000)) and when employees are exercising options.[4] Kahle (2002) conjectures that repurchases are motivated to avoid dilution from employee option exercises and that the exercises provide funds to undertake repurchases.[5] Executives exercising options may also sell some of the acquired stock to cover their option exercise expenses (i.e., exercise price and taxes). The combination of these two factors suggests that the high frequency of joint repurchase/net insider selling quarters may result from option exercises. Consistent with this extension of Kahle's (2002) argument, we find that firms with higher levels of options exercised by insiders are more likely to have simultaneous repurchasing and net insider selling.[6] To determine if the concurrence of insider selling and repurchases is driven by insider option exercises coupled with liquidity driven open market insider sales, we exclude insider open market stock sales potentially associated with paying off the exercise cost of options from our calculation of net insider selling in a quarter. We continue to find that the frequency of a repurchase occurring conditional on net insider trading status, while smaller, is still highest with this alternative net trading measure. Our results also hold when we classify all share acquisition and disposition activities as buys or sells.

[4]Kahle (2002) finds that options outstanding have more explanatory power than option exercises, but firms with option exercises will tend to have more options outstanding and we do not have the latter variable.
[5]Kahle (2002) also notes that when options are outstanding, distributing cash via repurchases rather than dividends preserves managerial option values, giving managers an additional incentive to use repurchases.
[6]Kahle (2002) finds no incremental impact from executive stock option exercises above and beyond employee exercises, but that still implies an impact equal to employee exercises. She also does not examine selling activity accompanying insider option exercises.

While increased repurchases make sense in quarters with net insider buying, more repurchases with net insider selling seem inconsistent with repurchases signaling undervaluation. Hence, we investigate whether abnormal returns during and after firm repurchase quarters differ conditional on the direction of insider trading. Prior research has found that stocks perform well after open market repurchase announcements (e.g., Ikenberry, Lakonishok and Vermaelen (1995), Ikenberry, Lakonishok, and Vermaelen (2000), Chan, Ikenberry and Lee (2004), Peyer and Vermaelen (2009)) and after self-tender offers (Lakonishok and Vermaelen (1990)). A number of these papers also find higher post-repurchase announcement returns if there is insider buying in advance, but stock returns are also considerably higher in the year after insider buying and somewhat lower in the year after selling (Seyhun (2000)) without conditioning on repurchases. We anticipate that repurchasing firms with net insider buying in the same quarter are more likely to be undervalued (i.e., earn positive abnormal returns after repurchase) than firms with net insider selling.

Our results confirm this hypothesis. When insiders and firms are both buying in a given quarter, returns are abnormally high immediately after the actual repurchase and over the next three years. During the first quarter after a repurchase with net insider buying quarter, a firm's stock has an average positive abnormal return of 4.06 percent. Since investors may not have information on repurchases and insider trading early in this quarter, the first quarter return might be viewed as an announcement effect. By the end of the quarter subsequent to the repurchase/net insider buying quarter, investors would have the information, in most cases, to implement a trading strategy of buying these stocks.[7] Following a strategy of holding these stocks in the three

[7] In virtually all cases, except extremely late reporting, the insider trading data would be available. When we require that a purchase or sale be reported within 3 months of the repurchase quarter, only 7% of repurchase observations are lost and we obtain virtually identical results. The repurchase data should be available in most cases within three months of the end of a fiscal quarter. Current SEC rules require 10-Q and 10-K filings within three months of the

years subsequent to the first post-repurchase quarter with rebalancing at the beginning of each year, the average repurchase/net insider buying stock yields significant abnormal returns relative to a control group of 7.32, 4.95, and 3.82 percent in years one, two, and three, respectively. For the repurchase/net insider selling firm-quarters we find much smaller average abnormal stock returns, 0.92 percent, in the first post-repurchase quarter relative to the 4.06 percent return for the repurchase/net insider buying firms. In the subsequent three years, we find abnormal returns of 2.45 percent in year one, -0.02 percent in year two and -1.18 percent in year three, all significantly lower than the returns in the net buying case. The buy-and-hold, with annual rebalancing, three-year tradable abnormal stock return is only 1.23 percent for the average repurchase accompanied by net insider selling versus the 16.93 percent abnormal return for the average repurchase accompanied by net insider buying. Returns for neutral insider trading cases consistently fall between returns for net insider buying and net insider selling cases. The results differ little if we adjust our net insider trading measure by eliminating open market sales made pursuant to option exercises. Such sales arguably may be more liquidity than information driven, but return differentials between net buying and net selling stocks are only slightly smaller.

Our return results are stronger when we focus on the trading of top executives, consistent with them possessing more valuable information about their companies. Our results are robust to alternative insider trading classifications, which expand our base definition of insider purchases and sales and ensure that insider trading information is publicly available. Since the timeliness and accuracy of insider trading filings likely improved throughout our sample period, we verify that our results hold across time, but are stronger for the latter half of our sample. Finally, we control for time clustering by constructing monthly calendar-time portfolios and running Carhart

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end of a quarter, though some firms seek extensions, but such firms are often financially troubled and unlikely to be buying back stock.

(1997) four-factor calendar time regressions and obtain results that are similar, though lower in magnitude. This reflects the fact documented returns are greater in quarters that insider buys/repurchases happen in greater quantities and weaker when insider sell/repurchases happen in greater quantities.

As a final step, we estimate abnormal returns based on insider trading classifications for firms with no repurchase during a quarter. For firms with no repurchase, cumulative abnormal returns in the next quarter and three years after a net buying firm-quarter exceed cumulative abnormal returns after a net selling quarter by 8.84%. On the other hand, this buy versus sell difference is 17.96% after repurchasing firm-quarters. Therefore, our buy versus sell abnormal return difference exceeds the "normal" ex-post return differential associated with insider trading. This implies that post repurchase abnormal returns are affected by the interaction of insider trading and repurchase effects. We show that the larger differential is mainly due to more negative insider sell effects for repurchases than non-repurchase cases. In other words, many repurchases accompanying insider sells may not be motivated by undervaluation.

Given returns evidence that the average repurchase accompanied by net insider selling has minimal stock undervaluation, we examine the determinants of the joint occurrence of firm quarter repurchase status with firm quarter insider trading status (net buying, neutral, net selling). One rationale for insiders selling while repurchasing could be managerial self-interest. Cook, Krigman, and Leach (2004) document liquidity increases during episodes of company share buybacks. If the goal is to create more liquidity or boost share prices for selling insiders, then repurchasing while insiders are selling in the open market or buying shares directly from insiders makes sense, and we should observe insider selling with repurchases for less liquid stocks. In a multinomial logit framework controlling for various factors, we document that repurchases in

conjunction with significant net selling are more likely with illiquid stocks. We also find that repurchase/net insider selling frequencies are more common when firm employees are exercising stock options. Kahle (2002) predicts that repurchases for such firms will tend to be less information driven. The result is weaker when we classify net insider trading activity with a measure that excludes open market stock sales that may be motivated by option exercise costs. Finally, firms with simultaneous repurchases and net insider selling tend to look less like "value stocks" than other repurchasing firms. We find that net insider stock sales are more common for repurchasing firms with lower book to market ratios and higher recent stock returns relative to other repurchasing firms. This is consistent with insiders reducing their stock exposure at "higher valuations" relative to other repurchasing firms. The logit results confirm the implications of the abnormal returns. Stock repurchases with same quarter net insider selling are associated with option exercises, less liquidity (all else held constant), lower B/M and higher prior returns, suggesting non-signaling motives are common for these repurchases.

. We also find that firms where insiders buy without a repurchase tend to have the most leverage, less cash, the lowest market capitalization, lower B/M ratios and lower prior stock returns than the average repurchase firm. This is consistent with insiders trying to take advantage of undervaluation via smaller capital market transactions when it might be more difficult for their firms to buy large quantities of undervalued stock due to firm liquidity constraints and the potential for larger trades to exacerbate the illiquidity of a small market cap stock. In a separate regression analysis, we also confirm our primary result that the magnitude of net insider buying (all buys less all sales scaled by market capitalization) tends to be smaller in repurchase quarters but slightly higher before and after a repurchase quarter.

Our evidence suggests that actual repurchases in conjunction with insider selling are more common than one might have expected and only marginally consistent with undervaluation motivating the repurchases. Long term investment strategies based on repurchases should note that significant superior performance does not occur when insiders are simultaneously net sellers of their stock, but far greater returns are available when insiders are net buyers.

The paper proceeds as follows. Section 1 reviews the related literature, and Section 2 describes the data employed in the study. Section 3 examines repurchase/insider trading frequencies. Section 4 examines abnormal stock returns during and after repurchases. Section 5 analyzes the characteristics of firms in each repurchasing/insider trading category in univariate and multivariate frameworks. Section 6 offers our conclusions.

1. Background literature and contribution of paper

This paper is most closely related to the literature that examines insider trading and stock returns around repurchases and stock issuances.

Unlike repurchases, stock issues are generally viewed as negative signals and are associated with negative abnormal stock returns in the long-run (e.g., Loughran and Ritter (1995) and Pontiff and Woodgate (2008)). Karpoff and Lee (1991) identify an increase in insider sales before announcements of common stock and convertible debt issues, but not before announcements of straight debt issues. Lee (1997) studies the relationship between insider trading and returns following stock issuances and finds that primary issuers underperform control firms, regardless of the direction of insider trading after the issue. However, secondary issuers underperform only when top executives sell their shares prior to issuance. His interpretation is that firms knowingly sell overvalued equity when insiders sell before secondary issuances.

Clarke, Dunbar and Kahle (2001) find that pre-filing insider trading is related to long-run returns for completed seasoned equity offerings, but not for cancelled offerings. Finally, Jenter (2005) finds that top executives decrease their exposure to company stock prior to seasoned equity offerings.

For repurchases, Lee, Mikkelson, and Partch (1992) find that managers sell fewer and buy more shares prior to self-tender offers but that insider trading returns to normal levels after the tender offer. Louis, Sun, and White (2010) identify abnormally high net insider selling during the quarter of fixed-price and Dutch-auction self-tender offer announcements. They also report a negative relationship between concurrent insider selling and future operating and stock performance in the case of Dutch-auction tender offers. Babenko, Tserlukevich, and Vedrashko (2012) identify more insider open market purchases in the *year before* an open market repurchase announcement, and more top level insider purchases in the year after the announcement. They report better performance for firms with higher levels of pre-announcement insider purchases at the announcement and over the next two years. They also note that announced repurchases are more likely to be executed if there are more ex-ante insider buys. No data on insider selling frequencies are presented. Chan, Ikenberry, Lee and Wang (2012) examine the effect of the interaction of open market repurchase announcements and insider trading on long-run stock returns, with a focus on value firms. They do not verify actual repurchases or examine in detail the determinants of the coincidence of repurchase announcements and insider trading. They note more sales and more purchases before a repurchase announcement relative to a control group of stocks, but these insider buy and sell

differentials are actually larger 12 to 24 months before the repurchase announcement and no evidence is provided on net selling.[8]

There are a few key differences between our work and the current literature. Most papers examine insider trading around the *announcements* of open market repurchases (e.g., Babenko, Tserlukevich, and Vedrashko (2012), Chan, Ikenberry, Lee and Wang (2012), Jategaonkar (forthcoming)). We differ by looking at *actual* share repurchase activity of all types in a quarter (self-tender offers, targeted repurchases, open market repurchases, etc…) and net insider buying (selling) in that *same* quarter to ascertain if insiders and the firm trade in the same direction.[9] This raises an important distinction with most prior studies since, in the case of open market repurchase announcements, the repurchases are frequently not fully executed. In fact, only about three-quarters of announced open market repurchases, which account for 90 percent of all repurchase activity (Grullon and Michaely (2004)), are fully executed on average (see Stephens and Weisbach (1998) and Bonaime (2012)). Further, the repurchases that do occur can vary dramatically in terms of their timing relative to announcement. A firm's management may wait multiple quarters before acting on an open market repurchase program, and often suggest that they will buy opportunistically at future dates when prices are "attractive." One would assume that insiders would behave this way as well, so our tests make more sense in terms of the timing of insider and actual firm repurchase decisions that may be based on valuation (or other factors). Additionally, our analysis is done for an exhaustive sample of all Compustat Industrial firms from 1989 to fiscal year 2006, making it more authoritative about general factors impacting joint repurchase insider trading outcomes in a particular quarter.[10]

[8] They focus on number of trades including trades as small as 100 shares, while we focus on dollar value of trades.
[9] Certain tests examine all types of stock acquisitions and dispositions, not just open market/private transactions..
[10] Our sample of firms also differs, because we exclude financial firms due to their unique concerns about capital adequacy that could impact repurchase activity.

In addition, our paper distinguishes between net insider buying, selling, and neutral cases. It could be argued that net insider buying is the most relevant case for signaling. While we find that actual repurchases are more likely conditional on concurrent quarterly net insider buying, we also find that they are even more likely conditional on concurrent quarterly net insider selling, contradicting expectations about signaling. We also demonstrate that this puzzling high joint frequency of net insider selling and repurchasing is not entirely driven by the documented tendency of firms to repurchase stock when option exercises are occurring. We also show that the insider trading impacts on stock returns for repurchase cases are larger than for non-repurchase cases, and our evidence suggests that repurchases accompanied by net insider sales appear to be less consistent with undervaluation. Finally, using a multinomial logit, we go beyond simply explaining the frequencies of and returns associated with combinations of repurchases and insider trading. We are able to investigate the factors that lead firms to fall into each repurchase/insider trading group. Minimal attention has been paid to the factors impacting the frequency and nature of insider trading in conjunction with actual share repurchases, such as providing liquidity for insider sales. In our case, it also allows us to demonstrate that weak insider net selling/repurchase returns are related to motives other than signaling.

2. Construction of sample and main variables

In devising our sample, we use Compustat quarterly data for firm-quarters ending February 1989 to May 2007 for firms with Compustat fiscal years 2006 or before. Following Billett and Xue (2007), we first remove financials and utilities, as these firms are in highly regulated industries and tend to have unreliable repurchase data.[11] We delete foreign firms from our sample since many are not required to disclose insider transactions to the Securities and

[11] During our sample period, banks and utilities have missing or combined values of Purchase of Common and Preferred Stock (Compustat quarterly data item 93) for 68.99 percent of their firm-quarter observations.

Exchange Commission.[12] To eliminate firms that have just raised capital via initial public offerings and to allow for the calculation of lagged variables, we remove companies without closing stock price data in at least eight of the prior nine quarters.[13] We also eliminate firms with less than 10,000 shares outstanding or with a market capitalization of less than or equal to $2 million in the prior quarter. We delete firms with a negative book value at the beginning of the fiscal quarter since book to market ratios are used in both univariate and multivariate analyses, and since these firms may have covenants in place that restrict buybacks. Finally, since part of our analysis is devoted to stock returns, we delete firms whose stock price is $1 or less at the beginning of the repurchase measurement quarter as calculating returns on these stocks may be problematic due to bid-ask bounce. We use long run stock returns data through the end of 2007; therefore, our results are unaffected by the financial crisis of 2008-09.

Our variables of interest include actual share repurchases and insider transactions. As a first pass, we calculate share repurchases as the Compustat quarterly purchase of common and preferred stock from the cash flow statement (adjusted for the fact that this variable is cumulative) minus any decrease in reported balance sheet preferred stock.[14] Banyi, Dyl, and Kahle (2008) identify this measure as the most accurate proxy for actual common shares repurchased, especially for firms with high levels of employee stock option exercises. To convert

[12] Companies classified as "Foreign Private Issuers" are exempt from disclosing insider transactions to the Securities and Exchange Commission. Since this classification depends on shareholdings, it is relatively easy for a firm to fall in and out of this status, creating inconsistent reporting. See http://www.law.uc.edu/CCL/34ActRls/rule3b-4.html for the full definition of "Foreign Private Issuer."

[13] We originally downloaded data going back to 1987, but the prior trading history precluded many observations in 1987 and 1988.

[14] Data item 93 from the older version of Compustat covers repurchases of stock and is generally taken from the cash flow from financing section of the cash flow statement. The repurchase numbers are cumulative for the year ending in that quarter. We calculate "any decrease in preferred stock" as the maximum of (1) any negative change in the carrying value of preferred stock (Compustat quarterly data item 55), (2) any negative change in the redemption value of preferred stock (Compustat quarterly data item 71), and (3) zero. If the data on preferred stock are missing, then we assume that there was no decrease in preferred stock. This measure also eliminates repurchases that result from pre-commitments to repurchase stock based on put options associated with merger, which are initiated by sellers in stock mergers when stock price falls below a certain repurchase price level. These are not firm based repurchase signals.

this measure to a percentage of shares outstanding, we divide our final proxy by the firm's market capitalization, defined as the number of shares outstanding at the beginning of the fiscal quarter times the minimum of the three monthly closing prices during the current quarter.[15] If the value of the ensuing repurchase statistic is 1% or greater we consider this firm-quarter a share repurchase firm-quarter. Banyi, Dyl, and Kahle (2008) find that eliminating firms with common stock repurchases equaling less than 1% of market capitalization improves the accuracy of the repurchase measure since many small values of "Purchases of Common and Preferred Stock" are solely due to preferred buybacks. Our 1% cutoff also ensures that the buybacks are non-trivial.

While our definition for repurchases is deemed best by Banyi, Dyl and Kahle (2008) relative to alternative estimates based on changes in treasury stock or changes in shares outstanding, it still has flaws. For instance, if shares are purchased by issuance of debt or stock purchase payables, the cash payment might not show up on the cash flow statement at all or may show up in quarters after the actual repurchase. In some cases, Compustat may fail to identify repurchases that are recorded in the investment rather than financing section of the cash flow statement. In other cases, reductions in preferred stock are not due to company purchases of preferred stock, but rather conversion of convertible preferred to common stock. Also, there are cases where firms are repurchasing stock, but simultaneously issuing even more stock via public offerings or mergers, which undercuts the signaling rationale for repurchases (or may be viewed as net stock issues). Given such difficulties,, we screened on certain data attributes (e.g., changes in shares outstanding, changes in preferred stock, increases in treasury stock), and investigated those observations by inspecting 10-Ks and 10-Qs. This led to numerous reclassifications of repurchase observations. The details of our adjustments are in a data appendix.

[15] By using the minimum monthly closing price, we assume that managers somewhat attempt to buy back shares when stock prices are depressed. Share repurchases calculated using the average monthly closing price instead are highly correlated (correlation coefficient = 0.99) with our proxy.

After making adjustments for proper classification of share repurchases, we are left with 243,412 firm-quarter observations where our prior data requirements are met and a repurchase measure can be identified. Of our sample, 19,909 observations (8.18 percent) qualify as conducting non-trivial repurchases of 1% or more of common stock in a firm fiscal quarter.

We obtain data on insider transactions reported in SEC form 4 from the Thomson Reuters Insiders database. For each firm fiscal quarter, we calculate the total dollar value of insider purchases, which are initially restricted to open market and private purchases (transaction code "P") and open market and private sales (transaction code "S").[16] In our base definition we calculate insider sales based on the Thomson "S" codes, but due to concerns that certain sales (and joint frequencies of insider selling and repurchases) may result from option exercise related liquidity sales, we also construct an alternative definition of sales for our net insider trading variables. This adjustment defines insider sales as max (dollar value of open market and private sales minus the dollar cost of options exercised, 0), which assumes shares are sold to pay option exercise costs.[17] We label firms as "net selling" if total insider sales exceed total insider purchases by at least $200,000 and/or 0.01 percent of the firm's market capitalization at the end of the prior fiscal quarter. If total insider purchases surpass total insider sales by the same cutoff, then we say that these insiders are "net buying." When the difference between recorded insider purchases and sales satisfies neither criteria or if no insider transactions occur during the quarter, then we classify insider trading as "neutral."[18]

Insert Table 1here.

[16] All results are robust to expanding our definition of purchases (sales) to include all acquisitions (dispositions). These classifications come from Thomson Reuters.
[17] All results are the same if we also take out some additional portion of sales to cover taxes on sales.
[18] Our results are essentially the same when we use $100,000 or 0.005 percent of market cap as alternative cutoffs.

3. Do insiders and firms trade in the same direction?

Our first empirical question is whether insiders tend to trade in the same direction as their firm. Panel A of Table 1 presents statistics that describe the general direction of insider trades conditional on whether or not a firm has a non-trivial share repurchase in the same quarter. Firms repurchase non-trivial amounts of stock in 8.18 percent of our 243,412 firm-quarter observations. Using our base definition of insider selling, we find that insiders are net sellers (buyers) for 32.11 percent (13.04 percent) of our sample, implying roughly a 2.46 ratio of net selling quarters to net buying quarters for the entire sample. Only 3.17 percent of firms-quarters have significant net insider selling and non-trivial repurchases. Only 1.13 percent of firm-quarters have a significant repurchase and significant insider net buying. 3.88 percent of all firms fall into the neutral insider trading/repurchase classification. Chi-square statistics reject the hypothesis that repurchases are evenly distributed between insider trading categories. On the same basis, we also reject the hypothesis that that repurchases are evenly distributed by insider trading categories using our alternative definition of net insider trading with adjustments for option exercise related sales.

Panel B compares the frequency of observed insider trading activity for firms that repurchase in a quarter versus those that do not. We find that both net insider purchasing and net insider selling occur with greater frequency during the firm-quarters with repurchases. Conditional on a qualifying repurchase, 38.72 percent of firms have net insider selling, while only 31.52 percent of firms have net insider selling during quarters with minimal or no repurchases. The 7.2 percent increase is statistically different from zero at the one percent level. The frequency of net insider buying also increases when a firm repurchases stock. Conditional on significant repurchasing, 13.83 percent of firms have net insider buying, while only 12.97 percent of insiders have net buying when the firm is not repurchasing shares. The obvious

inference is that neutral insider trading activity declines when a firm is repurchasing stock. Neutral insider trading drops from 55.51 percent conditional on no repurchase to 47.46 percent conditional on a repurchase.

Results are qualitatively similar when we adjust insider selling for option exercise. Conditional on a repurchase, 33.17 percent of firms have net insider selling compared to 28.13 percent of firms that have net insider selling during quarters with minimal or no repurchases. The 5.04 percent increase in option adjusted net selling in repurchase quarters is smaller with this adjustment, as our prior discussions would suggest, but still non-trivial in magnitude. The frequency of net insider buying increases from 13.38 percent to 14.55 percent and the proportion of firms classified as neutral drops from 58.49 percent to 52.29 percent for firm repurchasing quarters. All differences are statistically different from zero at the one percent level.

In Panel C, conditional on insider trading behavior, we find that firms with net insider selling are most likely to repurchase shares, followed by firms with net insider buying. Firms with net selling have repurchase activity 9.86 percent of the time, firms with net buying have repurchase activity 8.67 percent of the time, and firms with neutral insider activity have repurchase activity only 7.08 percent of the time. When we adjust insider selling for options exercise, we observe a similar pattern. Firms with net selling have repurchase activity 9.51 percent of the time, firms whose insiders are net buyers have repurchase activity 8.83 percent of the time, and firms with neutral insider activity have repurchase activity only 7.38 percent of the time. Hence, firms are more likely to repurchase conditional on net insider selling or net insider buying, but less likely to repurchase when net insider trading is neutral. The surprising result that repurchases are most likely when there is net insider selling is statistically significantly higher than the probability of observing a repurchase conditional on net insider buying. Furthermore,

this result is not merely due to definitions of net insider trading being influenced by open market selling related to potential option exercise liquidity trades. Additionally, in untabulated results we find the same pattern of results when we define insider trading based on all acquisitions and dispositions of shares as opposed to only open market and private trades.[19]

In unreported results, we only look at top executives (Chairman of the Board, CEO, Chief Operating Officer, General Counsel, or President), defined by Thomson Reuters as "Level 1" insiders. Insider trading frequencies drop considerably, which is not surprising given the smaller number of firm officials in this this category. We continue to find increased net buying and net selling by top executives during repurchasing quarters, and increased repurchasing during net buying and net selling quarters. Again, repurchases are most likely conditional on net insider selling.

While ex-ante we expected to find more frequent net insider buying in quarters with repurchases, the surprising result is an even greater increased frequency of net insider selling in quarters with repurchases. Our results are similar to those of Louis, Sun, and White (2010), but their sample pertains to a small fraction of all repurchases and is tilted toward larger buybacks via Dutch auction. It is also roughly consistent with Chan, Ikenberry, Lee and Wang (2012), who find higher levels, relative to a control group, of insider selling and buying transactions in the 6 months before an open market repurchase announcement and in the 12 months after an announcement. They also find, however, even higher levels of "abnormal" buying and selling transactions in the 12 to 24 months before the repurchase announcement. That said, more buying and selling after a repurchase announcement is consistent with insiders engaging in these

[19]Note that using all insider acquisitions and dispositions is in some cases problematic. It picks up routine events like grants of restricted stock or gifts by executives to charities or children and transfers between trusts. It may, however, capture insider stock sales directly to the company, the ultimate provision of liquidity.

transactions in quarters that shares may have been repurchased, though no guidance is given on net insider trading and whether net selling is more common than buying.

4. Does insider trading alter repurchase signals and post-repurchase abnormal returns?

Calculating long-run stock returns following repurchase activity is a natural empirical test to determine if a company's stock was actually undervalued at the time of a stock buyback. Insider purchases give some credence to an undervaluation signal while insider sales seemingly detract from it, suggesting non-signaling motives. We explore this idea further by segmenting post-repurchase abnormal returns based on the direction of net insider trades.

4.1. Abnormal returns methodology

Barber and Lyon (1997) introduce abnormal returns in random samples of stocks and find that matching on size and book to market yields well specified tests of abnormal performance. Our base analysis is based on this approach, but we verify the robustness of our results to alternative methods. Quarterly and annual buy-and-hold abnormal returns are calculated using monthly returns from CRSP. Abnormal returns are the difference in the buy-and-hold return on the repurchasing firm's stock and the buy-and-hold return on a size and book to market matched portfolio. The portfolio of control firms is constructed by identifying all firms in the same size decile as the repurchasing firm during the quarter of the repurchase. We then select the 20 firms that are closest in book to market to the repurchasing firm, and equal weights are assigned to each firm at the beginning of the investment period. If a firm delists during the investment period, we assume that all proceeds are placed in a market portfolio with returns equal to the value-weighted CRSP index until the end of the quarterly or annual investment period. The

control portfolio is rebalanced at the beginning of each investment period.[20] Quarter 0 is the fiscal quarter in which share repurchases and net insider trading are evaluated.

Since quarterly repurchase data may take up to three months to be reported, investors should have the information to implement a trading strategy regarding these stocks by the end of the quarter after the repurchase/insider trading measurement quarter (quarter 1). Hence, Quarter 1 could be viewed as the "announcement" quarter. Therefore, annual abnormal returns beginning at quarter 2 are used to assess the tradability of the repurchase/insider trading data. Specifically, annual returns are measured over four quarters beginning in quarters 2, 6, and 10 for years 1, 2, and 3, respectively, where the return in year 1 is presumably the first return that could unambiguously be acted on by investors. Nevertheless, quarter 1 does show how the market views a repurchase signal conditional on insider trading status.[21]

Bootstrapping is used to infer the statistical significance of long-run returns. We replace each firm in our sample with a randomly selected firm not in the subset of firms being examined, but in the same size and book to market quintiles at quarter 0. Using the procedure described in the above, we calculate abnormal returns for quarters -1, 0, and 1 and years 1, 2, and 3 for each firm in our new random sample as well as the mean abnormal returns for the entire sample. This process is repeated for a total of 1,000 random samples so that the simulated *p*-values for positive values (for negative values) reflect the percentage of the 1,000 random samples that have mean abnormal returns greater than (less than) the mean abnormal return for our sample.

Insert Table 2 here.

[20] If a control firm drops out in year one after a repurchase, we rebalance with only 19 control firms rather than 20 during the next period (year 2).

[21] Given our return series ends in December 2007, we do not observe the full series of returns for repurchasing/insider trading firm-quarters at the end of our sample. Therefore, the total number of observations drops over time. Also, some longer window returns get truncated at the December 2007 data return cutoff.

4.2. Abnormal returns results

Table 2 presents abnormal returns for firms that repurchased more than one percent of shares outstanding in a quarter, conditional on insider trading status in that quarter. The results in Panel A show that abnormal returns for the quarters immediately before, during, and immediately after the repurchase quarter and for the following three years are correlated with the direction of net insider trading. Returns leading up to and during repurchasing quarters with net insider buying are significantly lower than those with net insider selling, implying that insiders and firms both buy stocks that appear to have larger underperformance. This reinforces the notion that actual repurchases are opportunistic. During the quarter immediately after the repurchase quarter, average abnormal buy-and-hold returns are 4.06 percent for firms with concurrent net insider buying versus only 0.92 percent for firms with concurrent net insider selling. The 3.14 percent difference is statistically significant at the one percent level. For the subsequent 3 years, which we deem as "tradable," repurchasing firms with significant net insider buying have average abnormal returns of 7.32, 4.95, and 3.82 percent in years one, two, and three, respectively, for a compounded three-year abnormal return of 16.93 percent. For repurchase/insider selling firms we find much smaller average abnormal returns of 2.45, -0.02, and -1.17 percent in years one, two and three, respectively, for a compounded three-year abnormal return of only 1.23 percent. The return differences for each year are statistically higher for the buying group at the one percent level as is the 15.70 percent compounded 3 year return differential between the net insider buying and net insider trading groups which assumes rebalancing portfolios for surviving firms at the end of each investment interval. Abnormal returns for repurchase firms whose concurrent insider trading status is considered neutral

consistently fall between those of net sellers and buyers, implying that abnormal returns increase with the extent to which insider trades suggest undervaluation.

In Panel B we examine trading by top executives of the firm, defined as Thomson Reuters "Level 1" insiders (Chairman of the Board, CEO, Chief Operating Officer, General Counsel, or President). Presumably, top executives are better informed of the firm's prospects and have more influence over repurchase decisions. The drawback is that the number of net buys and net sells shrinks considerably for this group. Nevertheless, the results in Panel B are a bit stronger than those in Panel A. For instance, abnormal returns are smaller in quarter 1, and years 1 and 2 for repurchasing firms with net insider selling. Conversely, abnormal returns are greater in the long run (years 1, 2, and 3) when top executives are net buyers relative to when all insiders are net buyers. The return differences for each year are statistically higher for the net buying group at the one percent level as is the 20.23 percent compounded 3 year return differential between the net insider buying and net insider trading groups. Our abnormal returns results show that net insider trading in the same quarter as actual share repurchases provides information about future returns, particularly in the case of more informed insiders.

Insert Table 3 here.

4.3. Robustness of abnormal return results

We conduct a battery of robustness tests to ensure that our results are not driven by our definition of insider trading, by cases where insider trading and repurchase information may not be publicly available, by time period, or by abnormal return methodology. The results are presented in Table 3. Panel A verifies the robustness of our results if we adjust for option exercises to eliminate potential liquidity selling from our definition of insider selling. Our results for firm-quarters with repurchases are similar in magnitude and statistical significance to results

using our base definition of insider selling. The cumulative difference of means between net buy and net sell groups drops by only 106 basis points over Quarter 1 thru Year 3. While not reported, the cumulative abnormal return for Quarter 1 thru Year 3 for net selling firms that exclude option related sells is 2.31% versus 2.18% for net sellers before option adjustment. The slight increase reflects that firm quarters dropped from the net selling sample (i.e., not in Panel A because they don't qualify as net selling without option related sales), have cumulative abnormal returns of 1.39%. This supports the extension of Kahle's (2002) argument that repurchases in quarters with option exercise related selling may not be valuation motivated, but the results also demonstrate that buy less sell return differentials after repurchase quarters (and low returns after net selling/repurchase quarters) are not just driven by option related liquidity selling.

To ensure that our results are not driven by cases where insider trading and repurchase information is not publicly available, we restrict our insider trades to those reported to the Securities and Exchange Commission within 90 days of the repurchase quarter. Panel B of Table 3 presents the difference in abnormal returns for repurchases accompanied by net insider buying and net insider selling for only these cases. We only lose 7% of repurchase observations and obtain virtually identical results; net insider buying firms significantly outperform net selling firms during the quarter after the repurchase and the next three years. The results confirm that a trading strategy based on repurchases and insider trades is implementable.

Since many insider transactions, like restricted share grants and gifts of common stock, might be less informative, our main results are based on open market and private trades by insiders. To ensure that we have not excluded trades with valuable information, we expand our definition of insider trading to include all insider "buys" (acquisition/disposition flag = "A") and "sells" (acquisition/disposition flag = "D"). This, for instance, would capture direct sales of stock

to an insider's company not classified as "S" by Thomson Reuters. In Panel C of Table 3 we continue to find strong evidence that repurchases with same quarter net insider buying outperform repurchases with same quarter net insider selling. For the first three tradable years after the share repurchase quarter, we identify significant differences in annual abnormal buy-and-hold returns of 2.62, 4.27, and 3.46 percent. The results are smaller, as many acquisitions and dispositions are apparently not as informative as open market/private transactions.

In Panel D we segment our results by time period. We do so because we believe that the accuracy and timeliness of reported insider trading increased throughout our sample period. Therefore, we should arguably place more weight on results based on the latter part of our sample. In addition, if our results do not hold using more recent data, one might question the applicability today. Using repurchases implemented during the first half of our sample (between 1989 and 1997), we find that firms whose insiders were net buying outperformed repurchasing firms whose insiders were net selling by 5.94 percent during the three years after the share repurchase was tradable. However, this figure jumps to 20.41 percent for repurchases announced during the second half of our sample (between 1998 and early 2007). So, if one views more recent insider trading data to be more complete and applicable, our results are actually stronger.

Insider trading and repurchasing are possibly clustered in time. While bootstrapping accounts for clustering's impact on statistical significance, one might question the implementation of a trading strategy based on post event abnormal return averages. By equally weighting each time period as opposed to each repurchase announcement event, a calendar-time portfolio approach accounts for time clustering (Fama (1998), Mitchell and Stafford (2000)). To control for time clustering, we construct portfolios in calendar time as opposed to event time to

determine how the strategy of pairing insider trades with repurchases can be implemented over a long calendar based time period.

Again, we identify share repurchases/net insider trading status in Quarter 0, measure quarterly returns in Quarters 0 and 1 and measure annual returns over four quarters (12 months) beginning in Quarters 2, 6, and 10 for Years 1, 2, and 3, respectively. A repurchasing firm with insider selling during the quarter ending in December of 2000, for example, would be included in the "Selling/Quarter 0" portfolio in October, November, and December of 2000, "Selling/Quarter 1" portfolio for January, February, and March 2001 and in the "Selling/Year 1" portfolio from April 2001 until March 2002, etc.

We equally weight portfolios and rebalance at the beginning of each month. Abnormal returns are the difference in the average CRSP monthly returns on the repurchase/insider trading portfolio and on a size and book to market matched portfolio. The 20 firms in the same size decile closest in book to market to the sample firm during the quarter of the repurchase constitute the portfolio of control firms and are rebalanced every month. If any firm delists during the investment period, the returns are replaced by the returns equal to the value-weighted CRSP index until the end of the quarterly or annual investment period. At the next investment interval, the matching portfolio just retains surviving firms from the control group. Differences in means tests are used to infer statistical significance.

Panel D of Table 3 presents the *monthly* average calendar time abnormal returns. As with our event time analysis, firms with concurrent repurchases and insider buying experience lower abnormal returns leading up to and during the repurchase quarter and higher abnormal returns after the repurchasing quarter. The difference in cumulative returns in buying and selling firms is 2.08 percent in Quarter 1 and is significantly different from zero at the 1% level. For the three

years after quarter 1, the mean monthly return is largest and statistically significant in year 1, and the three-year cumulative "tradable" return difference between repurchasing firms with net insider buying and net insider selling sums to 6.95 percent.[22]

As a final robustness test, we use the Carhart (1997) four factor model based on Fama-French's (1993) calendar-time portfolio approach, which accounts for risk factors associated with the market, firm size, book-to-market, and momentum factors. To gauge the difference in monthly returns for firms around repurchases associated with net insider buying and net selling, we restrict our repurchase sample to net buying and net selling firms and calculate the following time series regression for repurchasing firms that fall into each period of interest (Quarter -1, Quarter 0, Quarter +1, Years 1, 2, and 3) in a given month t:

$$Net\ Return_t = \alpha + \beta_1(R_{mkt,t} - R_{f,t}) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 MOM_t + \varepsilon_t. \quad (1)$$

Net Return$_t$ is the return for month *t* on an equally weighted portfolio of repurchasing firm stocks with net insider buying that qualify for inclusion in the given month less the equally weighted return for month t on a portfolio of repurchasing stocks with net insider selling that qualify for inclusion in the given month. $R_{f,t}$ and $R_{mkt,t}$ are the risk-free rate and the value weighted return of the market at month *t*. SMB_t, HML_t, and MOM_t are the monthly returns on the Fama-French size, book-to-market, and momentum factors in month *t*. The intercept term (α) of the regression represents the average monthly excess return of repurchasing firms with net insider buying less repurchasing firms with net insider selling for the period of interest.

Our general post repurchase return results hold using the four-factor approach: During the quarter immediately after the repurchase, returns on insider buying stocks are significantly greater than returns on insider selling stocks. Finally, cumulative returns inferred from the

[22] We also obtain very similar results when we only include insider buys and sells reported within 90 days of the actual insider trade.

intercepts over the three years after the repurchase quarter are 7.32 percent, but for the individual years only the year 1 return differential alpha is significantly different from zero at the 10% level. Though the difference in abnormal returns for the net buying and net selling groups is less pronounced using the calendar time approach as opposed to the event time approach, the general pattern holds: Short and long term performance for firms repurchasing stock is sensitive to the concurrent signals sent by insiders. This also suggests that abnormal return differences tend to be larger when there is clustering of repurchase events.[23]

4.4. Are observed returns effects additive or interactive?

While we find ex-post abnormal returns are higher after net buys versus net sells taking place in a repurchase quarter, an insider trading effect also exists for non-repurchasing firms. In our sample, for firms classified as non-repurchasing with an insider trading status in Quarter 0, the summed mean returns for Quarter 1 thru Year 3 (cumulative abnormal returns) are 7.49% for net buying, -0.36% for neutral, and -1.35% for net selling. Firms with repurchases should have an insider trading effect *and* repurchase effect. For repurchasing firms with an insider trading status in Quarter 0, summed mean returns for Quarter 1 thru Year 3, (cumulative abnormal returns) are 20.14% for net buyers, 8.83% for neutral insiders, and 2.18% for net sellers. Note that the difference in cumulated mean returns between buys and sells is 17.96% after repurchase quarters and only 8.84% after non-repurchase quarters. Therefore, post-repurchase insider trading return differentials are greater than conventional insider trading effects, suggesting an "interaction" between repurchase and insider trade signals.

Since insider buys and repurchases both suggest undervaluation, ex-ante it is unclear if insider buys should amplify repurchase signals or reduce them due to redundancy. The difference

[23] In untabulated results, we find that the weighted average of four-factor regression residuals tend to be positive for regressions of net insider buying/repurchasing monthly returns when the weight is the number of firms in the portfolio. This largely explains differences in calendar and event time approaches.

between cumulative returns for Quarter 1 thru Year 3 for insider net buys and neutral quarters is 7.85% without repurchases and 11.31% with repurchases. This suggests an extra 3.46% return over quarter 1 thru year 3 for net buying relative to neutral trading quarters with a repurchase versus no repurchase. The extra return, however, is not statistically significant at conventional levels and net buy less neutral abnormal returns are about the same after repurchase and non-repurchase quarters at shorter time intervals. Thus, we cannot reject the hypothesis that repurchase/buy returns are additive: an insider buying effect plus a repurchase effect.

The cumulated mean abnormal returns for Quarter 1 thru Year 3 for net selling less insider neutral trading equals -0.99% for firm-quarters without repurchases and -6.65% for firm-quarters with repurchases. Hence, relative to neutral insider trading firms, net insider sells underperform by 5.66% more for a repurchase versus no repurchase firm-quarter. The more negative net selling effect for post-repurchase quarter returns is significant at the 10% level, is negative in quarter 1 and each of years 1, 2, and 3 and is statistically significant at the 10% level for year 1. This supports the idea that repurchases accompanied by net insider selling are more likely motivated by non-valuation considerations, such as price support, liquidity provision for insiders, and efforts to combat dilution due to option exercises (with liquidity selling).

5. What explains patterns in repurchases and net insider trading?

5.1. Determinants of share repurchase and insider trading joint frequencies

Given the larger negative impact of net selling on repurchase outcome returns, and the surprisingly high joint frequency of net selling and repurchase outcomes, we now turn to the determinants of simultaneous quarterly insider trade and repurchase outcomes. We are most

interested in the determinants of the relationship between share repurchases and insider trading, which include liquidity, dilution, undervaluation, and other standard control variables.

Following Amihud (2002), we measure liquidity as the average daily price impact of order flow (the absolute percentage price change per dollar of trading volume) over the 250 trading days prior to the quarter. We condition on having a minimum of 100 trading days available. If repurchases are designed to help insiders sell stock by supporting stock price, then we would expect more combined outcomes of net insider selling and repurchasing for more illiquid firms.

Option exercise is the quarterly sum of the number of options exercised by those identified by Thomson Reuters as insiders, times the market price on the day of exercise, from CRSP daily, divided by the stock's market capitalization at the start of the quarter.[24] Companies may try to offset dilution from options by repurchasing stock when numerous options are outstanding or exercised. Option exercises also generate cash to fund repurchases. Additionally, repurchases could be used to support price levels of a stock if managers are eager to sell some of their exercised options either because they view the stock as overvalued or need to sell to cover option exercise costs. Hence, we would expect more combined outcomes of net insider selling and repurchases for high levels of option exercises. Dittmar (2000) finds more repurchasing activity for firms with more options outstanding using annual data and Kahle (2002) finds more repurchases for firms where employees are exercising options.

Book to market ratios and recent past returns can proxy for managerial perception of firm valuation. Undervaluation is often cited as one of the primary motives for share repurchases (e.g., Vermaelen (1981)). Since book to market ratios potentially vary with time and industry, we calculate net book to market as the ratio of the book value of common equity to the market

[24] This will only track option exercises by individuals classified as insiders.

capitalization of the firm minus the industry median book to market ratio for the calendar quarter. Industry is defined broadly by the first two digits of a firm's SIC code. Book to market is calculated using Compustat data from the fiscal quarter prior to the repurchase measurement quarter. Lagged returns are calculated from CRSP as the buy-and-hold stock returns for the prior quarter minus the value-weighted returns on the market during the same time period. Higher values of book to market or lower lagged returns may indicate that the stock is perceived as more undervalued by insiders and managers responsible for stock purchasing/selling decisions. Hence, we would expect higher book to market ratios and lower lagged returns for firms with net insider buying and repurchases relative to firms with net insider selling and repurchases (or firms with net insider selling and no repurchases).

In addition, when examining the probability that a firm conducts a repurchase, we also include variables that have been shown to affect the unconditional odds of doing a share repurchase (see Dittmar (2000)). These include firm size decile (based on market capitalization decile rank at the beginning of a quarter with 10 being the largest firms and 1 the smallest), cash divided by total assets, and financial leverage defined as the ratio of all financial liabilities to assets net of the industry (2-digit SIC code) median leverage ratio.

Insert Table 4 here.

5.2. Characteristics of firms in various subsamples

We examine the characteristics of the firms in each of the six different repurchase/insider trading classifications in Table 4. We are particularly interested in whether the characteristics of repurchasing firms with net insider selling are different in a way that might suggest that repurchases are inconsistent with signaling motivations. Table 4 presents summary statistics describing the intersection of repurchasing status and insider trading classification. A number of

items stand out. Untabulated t-tests reveal that repurchasing firms tend to have significantly more liquidity, more option exercises, lower past returns, larger market capitalizations, less cash, and lower industry adjusted leverage ratios than non-repurchasing firms. Interestingly, repurchasing and non-repurchasing firms have similar adjusted book to market ratios.

But of more interest is how repurchasing firms with net insider selling differ from repurchasing firms with net insider buying or neutral trading. For instance, repurchasing firms with net insider selling have lower net book to market ratios and higher lagged returns. Conversely, repurchases accompanied by net insider buying tend to have the highest net book to market ratios and the lowest past stock return performance, consistent with contrarian market timing. Repurchasing cases where insider trading is neutral have net book to market ratios and lagged returns between the net buying and net selling cases. Hence, repurchases accompanied by net insider sales do not look as contrarian or value oriented as other stock repurchases.[25]

It is also the case that the dollar value of options exercised deflated by market capitalization is much higher when insiders are significant net sellers. The options variable is also slightly larger for repurchasing firms. Table 4 shows that repurchasing firms with net insider selling tend to be less illiquid and tend to be larger firms as evidenced by their higher market capitalization deciles.

Also of note, firms with net insider buying and no repurchases have the highest average net leverage, the smallest average market capitalization, and the highest net B/M ratio. They also have lower average levels of cash to assets and lagged returns than the average repurchasing firm. This is consistent with insiders buying when it is more difficult for the company to buy undervalued shares (e.g., high B/M and low lagged returns). For instance, if the firm is more

[25] Chan, Ikenberry, Lee and Wang (2012) find similar characteristics for firms that have more insiders selling versus buying around share repurchase announcements. Our results pertain to actual repurchases and net insider trading actions, which we also documented in an earlier version of this paper.

highly leveraged, repurchases may be infeasible due to capital structure concerns, but purchases may be feasible for insiders. Insiders can also increase their proportionate holding with much smaller purchases than what is required via a repurchase. Repurchasing large quantities may be unattractive for a small firm because shrinking market capitalization may harm liquidity, so insiders may increase their position with small stock purchases rather than large repurchases.

For any of the aforementioned variables, mean comparisons are problematic without controlling for all factors affecting share repurchase and insider trading decisions. Therefore, we use multivariate analysis in the next section to further investigate the intersection of repurchases and insider trading.

Insert Table 5 here.

5.3. Multinomial logits

We conduct a multinomial logit analysis to determine which variables influence the joint choice of repurchasing shares (or not) and net insider stock trading status (sell, neutral, buy). We choose repurchasing/net selling firms quarters as our base case since in many ways this case is the most interesting. Multinomial results are cumbersome to report and often difficult to interpret. To get a complete interpretation of the multinomial logit models, we present coefficient estimates in Panel A of Table 5, and we report the estimates of marginal effects for the models in Panel B. Independent variables are the variables from Table 4 and annual time fixed effects. We use clustered standard errors by firm.

Coefficients in Panel A represent the effect of a one unit increase in the explanatory variable on the log odds ratio (the probability of the repurchase/net insider trading outcome

divided by the probability of net repurchasing and net insider selling).[26] We observe that firms with simultaneous repurchasing and net insider selling tend to be more illiquid relative to non-repurchasing firms and to repurchasing firms with insider buying once we control for all other variables, in particular firm market capitalization. This suggests, holding all else constant, that repurchasing/insider net selling firm quarters are more likely relative to repurchasing/net buying quarters to be done to create liquidity or price pressure so as to aid insiders trying to sell their stock. We see that the coefficients are uniformly negative and significant for the level of options exercised and firm size, implying that firms with higher levels of options exercised (deflated by market capitalization) and larger firms are the most likely candidates for the repurchase/net selling outcome. The options result is consistent with the idea that insiders will be inclined to sell stock when they are exercising options for liquidity reasons and that firms may wish to repurchase stock to avoid dilution (see Kahle (2002)). Arguably, repurchases motivated by avoiding dilution of share count are less likely to serve as signals. The joint proclivity of larger firms to repurchase stock while insiders sell is less easily explained. To the extent that larger companies are less likely to be mispriced in the market, it suggests that firms repurchasing stock with this profile will be less apt to have a signaling motivation.

Relative to the other repurchasing outcomes, higher levels of prior stock returns and lower net book to market ratios increase the odds of net insider selling outcomes. If repurchasing is viewed as a contrarian strategy in which managers repurchase stock of firms that "appear" undervalued, the repurchasing/net selling outcomes seem to be less influenced by these considerations relative to other repurchasing outcomes. The most negative coefficient for lagged returns and second most positive coefficient on net book to market are for the repurchasing/net

[26] For more information on interpreting multinomial logit coefficients, see Stata's annotated multinomial logit output at http://www.ats.ucla.edu/stat/stata/output/stata_mlogit_output.htm.

buying outcome, suggesting that, consistent with our stock return evidence, these firms have the most contrarian (value) outlook. Finally, it is worth noting that the stocks with the least contrarian/value outlook, when controlling for other factors, are the non-repurchasing/net insider selling group. This group has the highest prior return coefficient and most negative net book to market coefficient relative to the repurchasing/net insider selling outcome. This result is consistent with managers of recent stellar performers with high relative valuations behaving in the most "bearish fashion" by being more likely to sell their stock and refrain from repurchases.

It is instructive to examine marginal effects, presented in Panel B of Table 5. "Marginal effects" or partial effects show the impact of a one standard deviation change around the mean of any independent variables on the probability of observing an outcome evaluated at the mean of all the sample variables. The coefficients of all the marginal effects for each possible outcome sum to zero by construction. Thus, an increase in the odds of observing one outcome as one variable increases must lead to a reduction in the odds of some other outcomes occurring.

The frequencies of repurchase/net buying and repurchase/net selling outcomes are rather low, so we would expect the boost in probabilities of observing these outcomes to be fairly low for a change in any variable. Similar to the results in Panel A, illiquidity is positively correlated with the probability of simultaneous insider selling and repurchasing: A one standard deviation increase in illiquidity around the mean corresponds to a 0.13 percent increase in the probability of simultaneous net insider selling and repurchasing, while the same increase in illiquidity corresponds to a 0.23 percent decrease in the probability of simultaneous net insider buying and repurchasing. For "valuation" variables, a one standard deviation change in net book to market increases the probability of repurchase/net selling by 0.14 percent and increases the probability of repurchase/net buying by 0.20. A one standard deviation change in lagged stock returns

decreases the probability of repurchase/net selling by 0.16 percent but decreases the probability of repurchase/net buying by a much larger 0.32 percent. So, contrarian investing seems to apply to both of these repurchase classifications, but is more important for the net buying case. Consistent with the multinomial logit coefficients, larger firms with higher levels of option exercises are associated with significantly higher odds of repurchasing/net selling. A standard deviation increase around the mean for option exercises is associated with an increase in the probability of simultaneous repurchasing and net insider selling of approximately 1.30 percent; a one standard deviation increase in size decile is associated with a 2.03 percent increase in the probability of concurrent repurchases and net insider selling. Given that the unconditional odds of observing a repurchase/net insider selling outcome are only 3.17 percent, these values are economically important. While the signs of the marginal effects are the same for the repurchasing/net selling and the repurchasing/net buying cases with respect to size and option exercises, the economic significance differs greatly.

In untabulated results, we conduct several additional tests. Multinomial logit results are almost identical in sign and significance if we adjust insider selling for option exercises, though the impact on probabilities of a one standard deviation increase in option exercise falls from 1.3 percent to 0.63 percent for the repurchase/net insider selling outcome.[27] Results also tend to be very similar if we condition on trades by top executives only (as opposed to all insiders) or if we include all acquisitions and dispositions (as opposed to open market and private transactions).

The overall takeaway with respect to insider net selling/repurchase outcomes is that they are more likely with more option exercises, larger firms, firms with less liquidity (holding all

[27] If we also adjust the option exercise cases under the assumption that open market sales may be to cover not just exercise price, but taxes on option gains, the impact of a one standard deviation change drops to 0.5 percent.

else constant), and fewer undervaluation indicators than the average repurchasing firm. These results are consistent with repurchases that are less likely to be motivated by undervaluation.

Insert Table 6 here.

5.4.Explaining net insider buying conditional on repurchasing behavior

We have emphasized two insider trading outcomes that are quite different; insider buying with repurchases in the same quarter, in which insiders trade in the same direction as the firm, and insider selling with repurchases in the same quarter, in which insiders trade in a different direction than the firm. By using dummy variables, we have potentially overlooked differing magnitudes of insider trades in both the buy and sell direction conditional on repurchase activity.

To further investigate if insiders trade in a manner consistent with the presumed signaling intent of a repurchase, we estimate a final set of regressions. In Table 6, we seek to explain variation in net insider buying (the dollar value of insider purchases less the dollar value of insider sales scaled by market capitalization of the firm). This continuous variable takes into account the magnitudes of both buying and selling. We regress net insider buying against our control variables (illiquidity, scaled option exercises, net book to market ratio, lagged returns, and market cap decile), and also current quarter, prior quarter, and future quarter repurchases, and annual time fixed effects. The dependent variable and the continuous variables are all winsorized at the 1% and 99% level. All models either include firm fixed effects or have standard errors clustered at the firm level, as noted. The repurchase variables are in continuous form as a percentage of market capitalization for the first two columns and are in dummy variable form, repurchase amount of at least 1 percent, for the second two columns.

If insiders and firms trade in the same direction during repurchase quarters, controlling for all other factors, then the coefficients on the current quarter repurchase variables should be

positive. We also include one quarter lagged repurchases to see if firms might be repurchasing to abet future selling in the firm's stock (or alternatively that insiders latter validate firm repurchases) and next quarter repurchases to see if insiders buy before their company does, which could be interpreted as managerial front running of firm repurchases that boost share prices. Confirming trades suggest a positive coefficient on the lagged repurchase variable and possible front running trades suggest a positive coefficient on the lead repurchase variables.

We continue to find a large negative coefficient on net insider buying on the contemporaneous quarter repurchase variables (both dummy and continuous). This confirms our results in Table 1 with dummy categorizations of insider trading status. Firms and managers, on average, do not trade in the same direction during share repurchase quarters. We find that coefficients on lead and lagged repurchases, whether defined as continuous or indicator variables, are positive and significant, implying more net insider buying in the quarter before and after a repurchase quarter. It is worth noting that the coefficients on the lead and lagged repurchase variables are only a third to one-half of the magnitude of the contemporaneous repurchase coefficient, so the same quarter tendency for insiders and the firm to trade in opposite directions is much stronger than the lead and lag effects. We also confirm that net insider buying is negatively related to option exercises, lagged returns, and firm size, and positively related to illiquidity and net book to market ratio.

While the positive coefficients on the lagged repurchase variables suggests ex-post insider confirmation of the repurchase signal, the positive coefficients on the lead variables hint at the possibility of front running by insiders. Front-running implies knowledge of future repurchases that augur good news. There is evidence consistent with this notion. When insiders are net buyers the quarter before a repurchase quarter, the subsequent repurchases are less

inclined to be a reaction to a falling stock price in that quarter, and hence may be pre-planned. The average abnormal return is 1.81% in a repurchase quarter (quarter 0) when the prior quarter is classified as net buying versus an average abnormal return of -3.11% in a repurchase quarter not preceded by net buying. Both returns are statistically significant at the 1% level. Inside buyers also fare well longer term, earning an additional 10.39% cumulative abnormal return in the next five quarters (quarter 1 thru year 1) as opposed to a 5.23% five quarter abnormal return after a repurchase quarter not preceded by net buying. This suggests that insiders have "good foresight" with respect to future repurchase activity and the stock returns associated with those repurchases.

6. Conclusion

Though share repurchases are generally viewed as a signal that a firm's stock is trading below its fundamental value, the validity of such a signal is questionable when firm insiders are simultaneously selling significant amounts of stock. This study adds to the extant literature by examining the general direction of insider trades during actual share repurchases, the effect of the direction of insider trading on the strength of the undervaluation signal implied by a buyback, and the determinants of joint insider trading/share repurchase outcomes.

We find that both net insider buying and net insider selling are more likely during the quarter of a share repurchase. Similarly, we find that stock repurchases are more prevalent in quarters where insiders are selling or buying and less frequent when insider trading activity is neutral. While net insider buying during a share repurchase is consistent with expectations, net insider selling during a share repurchase is more puzzling, especially since the odds of observing a repurchase actually increase the most when insiders are net sellers. We investigate whether the

result that repurchases occur most frequently with net insider selling is driven by individuals selling stock to cover liquidity needs related to option exercise costs; the result is weakened, but is still there in terms of magnitude and statistical significance.

We investigate the relationship between insider trading and share repurchases and the strength of the undervaluation signal implied by the repurchase by examining stock returns in the period of and after the stock repurchases. We find that net insider buying reinforces this signal while net insider selling weakens it. In fact, repurchases in association with same quarter net insider stock sales tend to generate little in the way of long run abnormal returns. Repurchases with net insider buying outstrip returns to repurchases with net insider selling by as much as 15.70 percent during the three years after the repurchasing quarter, and by an even greater 20.36 percent when conditional on the trades of top executives. In cases where insiders are "neutral" when the firm is repurchasing stock, the abnormal returns fall between the cases where insiders are net buyers and insiders are net sellers. We also document that the magnitude of the buy versus sell return differentials for repurchasing firms are larger than what we observe in non-repurchasing situations. This is mainly due to stronger negative net selling effects for repurchases, suggesting repurchases coupled with sells are viewed as being more likely motivated by non-information reasons.

We also investigate the nature of firms that engage in net insider selling and non-trivial repurchases in the same quarter versus other firms that repurchase with net insider buying. Results from a multinomial logit indicate that repurchasing firms with net selling tend to have less liquidity (controlling for the levels of other independent variables), larger amounts of stock options exercised, lower book to market ratios and higher lagged returns than firms engaging in repurchases and net insider buying. They also tend to be larger. Repurchases for liquidity

purposes or to offset dilution may not be motivated by undervaluation, which may explain the lower returns after repurchase quarters with net insider selling. We also find that firm quarters where insiders buy and firms don't repurchase, tend to be associated with low valuations, high net leverage, and low market capitalization. This is consistent with insiders buying when their firms will not repurchase due to financial constraints or fear of shrinking market capitalization and firm liquidity.

Regressions explaining levels of net buying by insiders confirm that insiders are more likely to be net sellers of their company's stock during repurchase quarters (controlling for other factors), but more likely to be net buyers in the quarter before and the quarter after a repurchase quarter; though the magnitude of the net selling result is much greater. The results confirm our original dummy variable results for insiders being more likely to trade in the same direction as their firm and also hint at ex-ante front running of actual repurchases and ex-post insider trading confirmation of certain repurchases. With respect to "front running," we present evidence suggesting that insiders have "good foresight" with respect to future repurchase activity and the stock returns associated with those repurchases, consistent with front running.

Taken together, our findings suggest that insider selling during the same quarter as a share repurchase is only marginally consistent with undervaluation as a motive for repurchasing. We suggest that long term investing strategies based on repurchases as a signal of undervaluation incorporate simultaneous insider transactions, which help to clarify the validity of the signal.

Data Appendix:

It is well known that most definitions for historical share repurchase levels in a given quarter or year employing Compustat and CRSP data are flawed. We initially employ the definition generally deemed to be the most accurate by Banyi, Dyl, and Kahle (2008), which for quarterly data is dollar value of shares repurchased (derived from cash flow statement item 93) less the maximum of (0, decreases in item 55, decreases in item 72). Items 55 and 72 are balance sheet items for preferred stock. The subtraction of preferred stock declines attempts to account for the dollar value of repurchases (item 93) including preferred stock. It is also possible, however, that preferred stock declines because it is convertible preferred that is converted to equity in that quarter. Other problems with our base definition for amount of common stock repurchased include: simple data entry error; repurchases that are recorded in the investment section of the cash flow statement (as opposed to financing section) and hence are missed by Compustat data collectors; dollar values for item 93 in quarters 2 through 4 preceded by a missing or combined figures in the prior quarter (making the actual repurchase for the quarter incalculable); large stock issues via mergers or public offerings in the same quarter (making the signaling status of the repurchase questionable); missing repurchases that are done with debt exchanged for shares; and repurchases that came at the end of a quarter but were not paid for until the next quarter.[28]

To address these issues, we constructed numerous data screens to identify errors in quarterly repurchase data. The first screen identified cases where shares outstanding dropped at least 1%, but there was no repurchase event in that quarter using our base definition. In many cases, share drops are due to data errors (e.g., treasury shares are inconsistently subtracted from shares originally issued), shares are recovered from escrow due to some external event, or shares

[28] In this case a repurchase in quarter 2 might incorrectly be classified as occurring in quarter 3.

outstanding are not reported on the quarterly balance sheet, with Compustat recording shares outstanding at the 10-Q filing date after the end of the quarter. A second screen examined cases where an increase in treasury stock could result in a 1% or greater share repurchase. Again, in some cases increases in treasury stock are unrelated to common stock repurchases. They arise from preferred stock being treated as treasury stock, from an acquisition, from the market value of ESOP shares being counted as treasury stock by Compustat, or from treasury stock being identified by a firm only in the fourth quarter with all other quarters recorded as zero.

While changes in shares outstanding and/or changes in treasury stock can be misleading, we found numerous repurchases that occurred in a quarter based on these screens via manual inspection of 10-q and 10-k filings. These included shares acquired via debt exchanges, missing or incorrect figures from data item 93, repurchases occurring at the end of a quarter but not paid for in cash until the next quarter, and shares accepted from employees as payment for the exercise price on an option. Some of these fixes were identified by reading firm financial notes. In each case, we added missing repurchases to the correct quarter and in some cases shifted the repurchase event from a future quarter to a prior quarter.[29]

In a third screen, we identified all cases of data item 93 suggesting a possible 1% repurchase in a quarter, and for this subset of firms examined any firm that also listed a preferred stock balance sheet item in the current or prior quarter and/or a preferred dividend in the present or prior quarter. Since preferred stocks are often listed on balance sheets at less than their sales price value (the liquidation value or par value may be given with the remainder placed in additional paid in capital), there are cases where preferred stock redemption explains the dollar

[29] In a few isolated cases we found repurchases where shares were acquired in return for note forgiveness to executives, the exchange of a business division, or the issuance of convertible stock. These cases generally seemed to involve factors unrelated to signaling and were not counted as repurchases. These cases are rare and do not influence our results.

value of shares repurchased even though the decline of the preferred is small. By examining 10-Ks and 10-Qs, we reclassified quarters as non-repurchase quarters when preferred stock was repurchased as opposed to common stock. We also found cases where a drop in preferred was not due to preferred redemption, but conversion of preferred stock into common stock. These cases caused reclassifications from no repurchase to repurchase.

Our fourth screen examined cases where there was a positive entry in data item 93, but missing or combined values in the prior quarters. For quarters 2 through 4, this makes calculation of a repurchase impossible. In these cases we often verified that the repurchase did take place in the quarter with the item 93 value, and reclassified a missing value to a repurchase. In other cases, we found that repurchases were spread out, but not recorded beforehand. When the repurchase amounts are verified from the cash flow statement or financial notes, we correctly classified which quarters satisfied the one percent repurchase criteria and which did not.

A fifth screen identified quarters that showed more than a 1% repurchase using our base definition, but shares outstanding increased by 10% relative to our estimate of the percentage share repurchase. In these cases, a repurchase did occur, but shares often increased due to conversions of convertible securities or warrants. However, a significant number of these cases were situations where the company issued stock to outside investors or issued shares via a merger. If the shares issued in mergers and voluntary stock issues exceeded the shares repurchased, we treated this as a non-repurchase quarter. Arguably, the company's management of shareholder equity is not consistent with signaling in these quarters.

To construct a final data base of quarterly repurchases, we made an adjustment to the base definition for cases where there was a missing value or combined value for item 93 and/or for the lag of item 93 (in fiscal quarters 2, 3, and 4). An inspection of 500 cases revealed that in

over 99% of the cases, there were no significant repurchases for cases where shares fell by less than 0.5%. To be conservative, we took cases with missing or combined figures and assigned a value of zero to a repurchase dummy if the percentage shares outstanding in the quarter was -0.1% or greater. Cases where changes in percentage shares outstanding fell by more than -0.1% were classified as missing.

Given these initial data classifications, 7,858 quarter observations (1.12% of our final sample) for which we could not calculate a dollar value of repurchases were initially classified as no repurchase quarters rather than missing. Subsequently, using the five screens and data inspection, 433 observations that were initially classified as repurchases were reclassified as non-repurchase quarters. 817 observations that were classified as zero repurchase quarters were reclassified as repurchase quarters. 312 observations that were classified as missing became repurchase quarters and 81 observations originally classified as missing became non-repurchase quarters.

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Table 1: Insider trading and repurchase frequencies for quarters

This table presents summary statistics on the interaction of actual share repurchases with insider transactions using 243,412 firm quarters from 1989 until 2007. Actual share repurchases are calculated as the dollar value of purchases of common and preferred stock reported in Compustat quarterly minus any decrease in preferred stock. Actual share repurchases are expressed as a percentage of shares outstanding and broken into two groups: less than or equal to 1% of shares outstanding and greater than 1% of shares outstanding. Insider trading categories are based on open market trades by all insiders. Net selling implies that the difference in sales and purchases is greater than $200,000 or 0.01% of last quarter's market capitalization, net buying implies that the difference in purchases and sales is greater than $200,000 or 0.01% of last quarter's market capitalization, and all other cases are classified as neutral insider trading. When we adjust for options, insider sales are equal to max($insider sales-$cost options exercised, 0).

Panel A: Joint frequencies of insider trading and share repurchase classifications

Each cell in this panel presents the frequency (expressed as a number of observations and as a percentage of total observations) of the intersection of the events represented in each row and each column.

Direction of insider trading	No options adjustment		Options adjustment	
	Repurchases ≤ 1%	Repurchases > 1%	Repurchases ≤ 1%	Repurchases > 1%
Net selling	70,444	7,708	62,862	6,603
	28.94%	3.17%	25.83%	2.71%
Neutral	124,071	9,448	130,736	10,410
	50.97%	3.88%	53.71%	4.28%
Net buying	28,988	2,753	29,905	2,896
	11.91%	1.13%	12.29%	1.19%

Panel B: Insider trading conditional on share repurchases

This panel presents the frequency of insider trading, conditional on whether the firm engaged in repurchases exceeding 1% of shares outstanding. The columns labeled "Difference" present the difference in the proportion of insider trading frequency between repurchasing and non-repurchasing firms.

	No options adjustment			Options adjustment		
Direction of insider trading	Repurchases ≤ 1%	Repurchases > 1%	Difference	Repurchases ≤ 1%	Repurchases > 1%	Difference
Net selling	31.52%	38.72%	7.20% (20.05)***	28.13%	33.17%	5.04% (14.53)***
Neutral	55.51%	47.46%	-8.06% (-21.82)***	58.49%	52.29%	-6.21% (-16.82)***
Net buying	12.97%	13.83%	0.86% (3.37)***	13.38%	14.55%	1.17% (4.62)***

Panel C: Share repurchases conditional on insider trading

This panel presents the percentage of firms with quarterly repurchases above 1% of shares outstanding, conditional on the direction of insider trading. The last three columns present the difference in the proportion of repurchasing firms among different insider trading classifications.

No options adjustment					
Direction of insider trading			Net selling -	Net selling -	Net buying -
Net selling	Neutral	Buying	Neutral	Net buying	Neutral
9.86%	7.08%	8.67%	2.79%	1.19%	1.60%
			(21.83)***	(6.09)***	(9.24)***
Options adjustment					
Direction of insider trading			Net selling -	Net selling -	Net buying -
Net selling	Neutral	Buying	Neutral	Net buying	Neutral
9.51%	7.38%	8.83%	2.13%	0.68%	1.45%
			(16.23)***	(3.48)***	(8.48)***

Table 2: Abnormal returns around share repurchase quarters

This table presents quarterly and annual buy-and-hold abnormal returns for repurchasing firms (repurchases > 1% of market cap) segmented on the direction of trading by all insiders in Panel A and by top executives (Thomson Financial Level 1) in Panel B. Control returns are based on size and book to market matched portfolios, and abnormal returns are the difference between the repurchase sample returns and control returns. Repurchase and insider trading data are from quarter 0. Year 1 begins at quarter 2, year 2 at quarter 6, and year 3 at quarter 10. Net selling implies that the difference in sales and purchases is greater than $200,000 or 0.01% of last quarter's market capitalization. Net buying implies that the difference in purchases and sales is greater than $200,000 or 0.01% of last quarter's market capitalization. All other cases are classified as neutral insider trading. P-values represent the percent of randomly selected control firms based on 1,000 bootstrap simulations that have abnormal returns greater than (for positive values) or less than (for negative values) our sample's abnormal returns.

Panel A: All insiders

Insider trading	Time period	N	Total sample returns	Total control returns	Abnormal returns	P-value
Selling	Quarter -1	7,587	4.437%	4.929%	-0.494%	0.059
	Quarter 0	7,590	3.136%	4.447%	-1.312%	0.000
	Quarter 1	7,588	5.000%	4.079%	0.918%	0.001
	Year 1	7,579	16.792%	14.325%	2.452%	0.002
	Year 2	6,637	15.171%	14.990%	-0.015%	0.523
	Year 3	5,479	14.423%	15.116%	-1.174%	0.143
Neutral	Quarter -1	9,244	-1.581%	2.195%	-3.776%	0.000
	Quarter 0	9,244	-1.803%	1.288%	-3.090%	0.000
	Quarter 1	9,239	5.600%	4.451%	1.148%	0.000
	Year 1	9,215	20.226%	15.155%	5.058%	0.000
	Year 2	8,414	14.945%	12.858%	1.949%	0.004
	Year 3	7,410	18.461%	17.860%	0.678%	0.191
Buying	Quarter -1	2,713	-5.658%	1.160%	-6.819%	0.000
	Quarter 0	2,713	-4.598%	-0.461%	-4.138%	0.000
	Quarter 1	2,712	9.002%	4.955%	4.057%	0.000
	Year 1	2,710	25.152%	17.818%	7.320%	0.000
	Year 2	2,513	17.811%	12.961%	4.948%	0.002
	Year 3	2,228	23.653%	19.057%	3.817%	0.023
Buying - Selling	Quarter -1		-10.095%	-3.769%	-6.325%	0.000
	Quarter 0		-7.734%	-4.908%	-2.826%	0.000
	Quarter 1		4.003%	0.876%	3.140%	0.000
	Year 1		8.360%	3.494%	4.868%	0.009
	Year 2		2.641%	-2.028%	4.963%	0.005
	Year 3		9.231%	3.941%	4.991%	0.008

Panel B: Top executives

Insider trading	Time period	N	Total sample returns	Total control returns	Abnormal returns	P-value
Selling	Quarter -1	3,747	5.081%	5.013%	0.068%	0.431
	Quarter 0	3,747	3.327%	4.481%	-1.154%	0.004
	Quarter 1	3,745	4.694%	3.894%	0.786%	0.048
	Year 1	3,739	16.418%	14.396%	1.997%	0.031
	Year 2	3,187	12.808%	14.416%	-1.819%	0.078
	Year 3	2,575	15.470%	15.015%	0.486%	0.311
Neutral	Quarter -1	14,700	-0.654%	2.759%	-3.414%	0.000
	Quarter 0	14,703	-0.835%	1.971%	-2.806%	0.000
	Quarter 1	14,698	5.896%	4.428%	1.470%	0.000
	Year 1	14,670	19.893%	15.224%	4.657%	0.000
	Year 2	13,354	15.802%	13.569%	2.086%	0.000
	Year 3	11,639	17.776%	17.379%	0.134%	0.352
Buying	Quarter -1	1,097	-5.223%	1.366%	-6.589%	0.000
	Quarter 0	1,097	-5.038%	-1.243%	-3.796%	0.000
	Quarter 1	1,096	8.993%	5.337%	3.680%	0.000
	Year 1	1,095	26.113%	17.657%	8.449%	0.002
	Year 2	1,023	18.919%	12.687%	6.516%	0.006
	Year 3	903	24.124%	18.801%	4.742%	0.071
Buying - Selling	Quarter -1		-10.304%	-3.647%	-6.657%	0.000
	Quarter 0		-8.365%	-5.724%	-2.641%	0.000
	Quarter 1		4.299%	1.442%	2.893%	0.002
	Year 1		9.695%	3.262%	6.452%	0.001
	Year 2		6.112%	-1.730%	8.334%	0.000
	Year 3		8.654%	3.786%	4.256%	0.025

Table 3: Robustness of abnormal returns around share repurchases

This table examines the robustness of our results on the difference in abnormal returns for repurchasing firms (repurchases > 1% of market cap) with insider buying and those with insider selling. Repurchase and insider trading data are from quarter 0. Year 1 begins at quarter 2, year 2 at quarter 6, and year 3 at quarter 10. Net selling implies that the difference in sales and purchases is greater than $200,000 or 0.01% of last quarter's market capitalization. Net buying implies that the difference in purchases and sales is greater than $200,000 or 0.01% of last quarter's market capitalization.

Panel A: Options adjusted insider trading

This panel verifies the robustness of our results to adjusting for options in our definition of insider selling. When we adjust for options, insider sales are equal to max($insider sales-$cost options exercised, 0). Control returns are based on size and book to market matched portfolios, and abnormal returns are the difference between the repurchase sample returns and control returns. P-values represent the percent of randomly selected control firms based on 1,000 bootstrap simulations that have abnormal returns greater than (for positive values) or less than (for negative values) our sample's abnormal returns.

		All insiders		Top Executives	
Insider trading	Time period	Abnormal returns	P-value	Abnormal returns	P-value
Buying - Selling	Quarter -1	-6.178%	0.000	-6.480%	0.000
	Quarter 0	-2.882%	0.000	-2.569%	0.001
	Quarter 1	2.936%	0.000	2.895%	0.000
	Year 1	4.673%	0.009	5.624%	0.004
	Year 2	4.606%	0.005	8.005%	0.000
	Year 3	4.692%	0.010	3.894%	0.029

Panel B: Alternative insider trading classifications

This panel verifies the robustness of our quarterly and annual buy-and-hold abnormal returns to alternative insider trading classifications. "Only publicly available transactions" uses only those insider trades that were filed with the Securities and Exchange Commission—and therefore were publicly available—within 90 days. "All buys and sells" classifies any insider acquisition as a "buy" and any insider disposition as a "sell." Control returns are based on size and book to market matched portfolios, and abnormal returns are the difference between the repurchase sample returns and control returns. P-values represent the percent of randomly selected control firms based on 1,000 bootstrap simulations that have abnormal returns greater than (for positive values) or less than (for negative values) our sample's abnormal returns.

		Only publicly available transactions		All buys and sells	
Insider trading	Time period	Abnormal returns	P-value	Abnormal returns	P-value
Buying - Selling	Quarter -1	-6.260%	0.000	-4.256%	0.000
	Quarter 0	-2.818%	0.000	-1.765%	0.009
	Quarter 1	3.093%	0.001	2.245%	0.004
	Year 1	4.212%	0.016	2.623%	0.074
	Year 2	5.238%	0.004	4.265%	0.012
	Year 3	5.337%	0.008	3.459%	0.060

Panel C: Time periods

This panel verifies the robustness of our quarterly and annual buy-and-hold abnormal returns across time periods, which are based on the calendar year of Quarter 0. Control returns are based on size and book to market matched portfolios, and abnormal returns are the difference between the repurchase sample returns and control returns. P-values represent the percent of randomly selected control firms based on 1,000 bootstrap simulations that have abnormal returns greater than (for positive values) or less than (for negative values) our sample's abnormal returns.

		1988-1997		1998-2007	
Insider trading	Time period	Abnormal returns	P-value	Abnormal returns	P-value
Buying - Selling	Quarter -1	-4.702%	0.000	-7.161%	0.000
	Quarter 0	-2.164%	0.011	-3.254%	0.000
	Quarter 1	1.749%	0.058	3.831%	0.000
	Year 1	-0.091%	0.555	7.018%	0.005
	Year 2	2.973%	0.158	5.927%	0.009
	Year 3	2.975%	0.229	6.219%	0.007

Panel D: Monthly calendar time abnormal returns

This panel verifies the robustness of our quarterly and annual abnormal returns to calendar time methodology. The calendar time approach places equal weights on each month. "Calendar time" returns are the difference in the monthly abnormal average returns on insider buying and selling portfolios. Abnormal returns on insider buying and selling portfolios are the difference in returns on a portfolio that equally weights each sample firm at the beginning of each month and a portfolio that equally weights each control portfolio each month. "Carhart 4-factor" calendar time returns are the estimated intercept from a regression of the difference in monthly abnormal returns on the insider buying and selling repurchase portfolios against the 4-factor Carhart model the four factors being with excess market return, SMB, HML, and a momentum factors taken from Ken French's website.

		Calendar time		Carhart 4-factor	
Insider trading	Time period	Monthly abnormal returns	P-value	Monthly abnormal returns	P-value
Buying - Selling	Quarter -1	-1.613%	0.000	-2.071%	0.000
	Quarter 0	-0.603%	0.022	-1.371%	0.000
	Quarter 1	0.692%	0.001	0.957%	0.000
	Year 1	0.288%	0.018	0.283%	0.065
	Year 2	0.179%	0.128	0.125%	0.476
	Year 3	0.112%	0.442	0.202%	0.219

Table 4: Summary statistics classified by repurchase and insider trading activity

This table presents means and standard deviations of variables related to insider trading and share repurchases. Actual share repurchases are calculated as the dollar value of purchases of common and preferred stock reported in Compustat quarterly minus any decrease in preferred stock. Actual share repurchases are expressed as a percentage of shares outstanding and broken into two groups: less than or equal to 1% of shares outstanding and greater than 1% of shares outstanding. Insider trading categories are based on open market trades by all insiders. Net selling implies that the difference in sales and purchases is greater than $200,000 or 0.01% of last quarter's market capitalization. Net buying implies that the difference in purchases and sales is greater than $200,000 or 0.01% of last quarter's market capitalization. All other cases are classified as neutral insider trading. *Ln(Illiquidity)* is the natural log of illiquidity, defined as the average daily percentage stock price change per dollar of daily trading volume, measured 250 trading days prior to the quarter. *Options* is the total dollar value of options exercised (the number of shares times the stock price on the day of exercise) divided by the stock's market capitalization at the start of the period. *Net B/M* is the ratio of book value of common equity to market capitalization minus the industry median book to market ratio. *Lagged returns* are the buy-and-hold stock returns for the prior quarter minus the value-weighted returns on the market during the same time period. *Size decile* is the size decile of the firm, based on market cap and calculated each calendar quarter with 10 being the largest firms and 1 the smallest. *Cash* is cash and short-term investments, scaled by total assets. *Net leverage* is leverage ratio (total liabilities scaled by total assets) minus the industry median leverage ratio. All variables are winsorized at the 1% and 99% level.

	Repurchasing ≤ 1%							
	Net selling N = 70,141		Neutral N = 121,851		Net buying N = 28,757		All N = 220,749	
Variable	Mean	StdDev	Mean	StdDev	Mean	StdDev	Mean	StdDev
Ln(Illiquidity)	0.0002	0.0010	0.0005	0.0027	0.0005	0.0020	0.0004	0.0022
Options	0.0022	0.0045	0.0003	0.0019	0.0006	0.0026	0.0010	0.0032
Net B/M	-0.0262	0.3455	0.1683	0.5138	0.2465	0.5462	0.1167	0.4823
Lagged returns	0.0690	0.2809	0.0022	0.2818	-0.0349	0.2845	0.0186	0.2842
Size decile	6.5553	2.6048	5.0415	2.8521	4.2896	2.5058	5.4244	2.8494
Cash	0.1844	0.2145	0.1649	0.2134	0.1533	0.2134	0.1696	0.2140
Net leverage	-0.0066	0.1945	0.0065	0.2098	0.0254	0.2064	0.0048	0.2048

	Repurchasing > 1%							
	Net selling N = 7,677		Neutral N = 9,394		Net buying N = 2,746		All N = 19,817	
Variable	Mean	StdDev	Mean	StdDev	Mean	StdDev	Mean	StdDev
Ln(Illiquidity)	0.0001	0.0006	0.0003	0.0016	0.0002	0.0010	0.0002	0.0012
Options	0.0022	0.0044	0.0004	0.0023	0.0007	0.0029	0.0012	0.0035
Net B/M	-0.0027	0.3552	0.1800	0.4870	0.2339	0.5126	0.1167	0.4550
Lagged returns	0.0136	0.1980	-0.0418	0.2013	-0.0843	0.2236	-0.0262	0.2062
Size decile	7.4598	2.5163	6.3050	2.8889	5.4825	2.6797	6.6384	2.8112
Cash	0.1686	0.1865	0.1558	0.1831	0.1498	0.1882	0.1599	0.1853
Net leverage	0.0078	0.1891	-0.0178	0.1981	-0.0176	0.1928	-0.0079	0.1943

Table 5: Multinomial logits

This table presents multinomial logit regressions that examine the intersection of insider transactions and non-trivial share repurchases, where the base case is repurchasing and net insider selling. Panel A presents coefficients and associated *t*-statistics, while Panel B presents marginal effects, *z*-statistics, and the effect on moving from half of a standard deviation below the mean to half of a standard deviation above the mean. *Ln(Illiquidity)* is the natural log of illiquidity, defined as the average daily percentage stock price change per dollar of daily trading volume, measured 250 trading days prior to the quarter. *Options* is the total dollar value of options exercised (the number of shares times the stock price on the day of exercise) divided by the stock's market capitalization at the start of the period. *Net B/M* is the ratio of book value of common equity to market capitalization minus the industry median book to market ratio for that calendar quarter. *Lagged returns* are the buy-and-hold stock returns for the prior quarter minus the value-weighted returns on the market during the same time period. *Size decile* is the size decile of the firm, based on market cap and calculated each calendar quarter with 10 being the largest firms and 1 the smallest. *Cash* is cash and short-term investments, scaled by total assets. *Net leverage* is leverage ratio (total liabilities scaled by total assets) minus the industry median leverage ratio. Year dummies are included in all models, and standard errors are clustered at the firm level. All variables are winsorized at the 1% and 99% level. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Panel A: Multinomial logit coefficients

	Repurchases < 1%			Repurchases ≥ 1%	
	Net selling	Neutral	Net buying	Neutral	Net buying
Ln(Illiquidity)	-53.577***	-7.821**	-55.703***	0.747	-137.151**
	(-5.311)	(-1.986)	(-4.928)	(0.364)	(-2.278)
Options	-18.201***	-277.425***	-147.542***	-201.665***	-120.989***
	(-5.863)	(-34.542)	(-28.549)	(-13.961)	(-11.010)
Net B/M	-0.565***	0.004	0.099	0.436***	0.303***
	(-8.477)	(0.057)	(1.422)	(6.781)	(4.315)
Lagged returns	0.726***	0.182***	-0.180***	-0.434***	-0.944***
	(16.162)	(4.005)	(-3.512)	(-7.281)	(-9.528)
Size decile	-0.184***	-0.355***	-0.463***	-0.156***	-0.288***
	(-16.988)	(-30.408)	(-37.896)	(-14.304)	(-19.910)
Cash	0.147	0.090	-0.050	-0.161	-0.471***
	(1.267)	(0.725)	(-0.363)	(-1.335)	(-2.903)
Net leverage	0.034	0.536***	1.021***	-0.375***	-0.288*
	(0.277)	(4.055)	(7.278)	(-2.758)	(-1.746)
Number of observations			240,566		
Adjusted R2			0.0966		

Panel B: Marginal effects

	Repurchases < 1%								
	Net selling			Neutral			Net buying		
Variable	Marginal Effect	z-stat	± σ/2	Marginal Effect	z-stat	± σ/2	Marginal Effect	z-stat	± σ/2
Ln(Illiquidity)	-7.4252	-3.94	-0.0161	10.2354	5.81	0.0222	-3.3839	-3.14	-0.0074
Options	44.9518	34.40	0.1425	-52.4875	-29.35	-0.1661	3.7081	6.80	0.0115
Net B/M	-0.1230	-21.60	-0.0590	0.0689	12.34	0.0330	0.0265	10.60	0.0127
Lagged returns	0.1320	33.86	0.0368	-0.0382	-9.05	-0.0106	-0.0511	-17.88	-0.0142
Size decile	0.0335	34.80	0.0953	-0.0273	-25.54	-0.0779	-0.0187	-34.44	-0.0536
Cash	0.0207	1.95	0.0044	0.0093	0.76	0.0020	-0.0145	-1.96	-0.0031
Leverage	-0.1021	-8.82	-0.0208	0.0730	5.65	0.0149	0.0733	10.67	0.0150

	Repurchases ≥ 1%								
	Net selling			Neutral			Net buying		
Variable	Marginal Effect	z-stat	± σ/2	Marginal Effect	z-stat	± σ/2	Marginal Effect	z-stat	± σ/2
Ln(Illiquidity)	0.6193	5.61	0.0013	1.0195	5.68	0.0022	-1.0650	-1.88	-0.0023
Options	4.1000	25.12	0.0130	-0.8332	-1.69	-0.0027	0.5607	5.22	0.0018
Net B/M	0.0029	1.96	0.0014	0.0206	15.15	0.0099	0.0041	8.76	0.0020
Lagged returns	-0.0058	-5.86	-0.0016	-0.0252	-16.20	-0.0070	-0.0116	-13.67	-0.0032
Size decile	0.0070	30.26	0.0203	0.0054	19.44	0.0155	0.0002	1.37	0.0004
Cash	-0.0017	-0.63	-0.0004	-0.0086	-2.60	-0.0018	-0.0053	-3.87	-0.0011
Leverage	-0.0091	-3.29	-0.0019	-0.0284	-7.35	-0.0058	-0.0066	-4.96	-0.0014

Table 6: Net insider buying regressions

This table presents results from OLS and fixed-effects regressions explaining insider trading activity. The dependent variable equals the dollar value of open market insider purchases minus the dollar value of insider sales, scaled by market cap. This measure is expressed as a percentage and is winsorized at the 1% and 99% levels. Insider trading categories are based on open market trades by all insiders or top executives, as noted. *Lagged repurchases*, *repurchases*, and *lead repurchases* represent repurchases as a percent of share outstanding in the lagged, contemporaneous, or lead quarter. *Lagged repurchase dummy*, *repurchase dummy* and *lead repurchase dummy* refer to whether the firm is classified as having a one percent repurchase in the lagged, contemporaneous, or lead quarter. *Ln(Illiquidity)* is the natural log of illiquidity, defined as the average daily percentage stock price change per dollar of daily trading volume, measured 250 trading days prior to the quarter. *Options* is the total dollar value of options exercised (the number of shares times the stock price on the day of exercise) divided by the stock's market capitalization at the start of the period. *Net B/M* is the ratio of book value of common equity to market capitalization minus the industry median book to market ratio for that calendar quarter. *Lagged returns* are the buy-and-hold stock returns for the prior quarter minus the value-weighted returns on the market during the same time period. *Size decile* is the size decile of the firm, based on market cap and calculated each calendar quarter with 10 being the largest firms and 1 the smallest. Year dummies are included in all models, and standard errors are clustered at the firm level in the OLS regressions. All variables are winsorized at the 1% and 99% level. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
Lagged repurchases	0.016***	0.017***		
	(7.501)	(8.239)		
Repurchases	-0.054***	-0.053***		
	(-13.804)	(-25.753)		
Lead repurchases	0.018***	0.020***		
	(8.461)	(10.264)		
Lagged repurchase dummy			0.030***	0.031***
			(4.616)	(4.793)
Repurchase dummy			-0.095***	-0.091***
			(-10.348)	(-13.612)
Lead repurchase dummy			0.041***	0.049***
			(6.487)	(7.561)
Ln(Illiquidity)	3.386***	0.726	3.317***	0.666
	(2.919)	(0.663)	(2.874)	(0.607)
Options	-74.281***	-70.617***	-74.313***	-70.579***
	(-49.642)	(-132.756)	(-49.626)	(-132.513)
Net B/M	0.085***	0.090***	0.084***	0.088***
	(16.999)	(15.714)	(16.632)	(15.334)
Lagged returns	-0.206***	-0.181***	-0.204***	-0.180***
	(-25.202)	(-29.509)	(-25.001)	(-29.204)
Size decile	-0.001	-0.016***	-0.001	-0.017***
	(-0.887)	(-8.752)	(-1.370)	(-9.058)
Year dummies	Yes	Yes	Yes	Yes
Firm fixed effects	No	Yes	No	Yes
Number of observations	223,927	223,927	223,927	223,927
Adjusted R^2	0.107	0.061	0.105	0.058