

Do Corporate Managers Trade Against Short Sellers?

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Abstract: Motivated by the significant capital allocated to repurchasing stock and its potential affect on price discovery, we develop an empirical model of changes in corporate stock repurchases. We find that share price, capital availability, dividend policy, firm size, and operating profitability significantly influence quarterly stock repurchases, but our novel discovery is that managers trade against shorts by increasing (decreasing) repurchases in response to an increase (decrease) in short sales. This practice appears to violate SEC regulations that stock price be set by “independent market forces without undue influence by the issuer.” We also empirically model insider trading, finding that insiders buy and sell with the shorts, with little attention to the amount of shares being repurchased. Managers therefore trade with shorts when using their personal capital, but against them with corporate capital.

Keywords: *short interest; share repurchases; insider trading; arbitrage.*

Data Availability: *Data are available from the sources identified in the study.*

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1. Introduction

Disputes between corporate managers and short sellers periodically capture the attention of the business community (Drummond 2006; O'Mahony 2008; Trotta 2008). A notable example is the epic short-side battle between Allied Capital and hedge fund manager, David Einhorn of Greenlight Capital (Einhorn 2008). While such disputes illustrate the often contentious relationship between short sellers and corporate managers, research on how managers respond to short sellers is very limited. To our knowledge, the only academic study is by Lamont (2004) who identified a sample of 266 companies who took a variety of actions to constrain short sellers (e.g., belligerent statements refuting or denouncing shorts for improper actions, lawsuits, appeals to authorities to investigate the shorts, stock splits or distributions, requests to shareholders to withdraw their shares from the lending market). Lamont found these firms experienced negative abnormal returns averaging about two percent a month over the subsequent year. He observes that this price decline is consistent with the hypothesis that short sale constraints allow stocks to be substantially overpriced, and any overpricing gets corrected only slowly.¹

An increase in short sales can cause a stock's price to decline in two ways: (1) by signaling overvaluation to long-side investors who then sell (increasing supply) or do not buy (decreasing demand), and (2) by directly increasing the number of shares in circulation (increasing supply). The latter occurs because stock is usually borrowed from (later returned to) owners who do not actively trade those shares (e.g., index funds, selected mutual funds). In addition, short sellers sometimes sell stock without locating shares to borrow (i.e., naked short selling). In this study, we investigate whether managers trade against short sellers to prevent, or

¹ Miller (1977) provides theory that stocks become overvalued when short selling is constrained, as pessimists are underrepresented in price formation. He identifies a second condition, a difference of opinion among investors, which is also required in order to explain why some investors hold overvalued stocks (i.e., the optimists).

at least delay, a decline in stock price. Specifically, we examine whether managers increase the amount of capital allocated to repurchasing stock in order to counteract an increase in short interest. Increasing corporate repurchases can support a stock's price by signaling undervaluation to long-side investors (increasing demand) and by removing shares from circulation (decreasing supply). An increase in corporate repurchases is therefore well-suited to offset the price decline that would otherwise occur following an increase in short selling.² Managers can also respond to short sellers by trading against them with their personal capital. Although the dollar amounts are small compared to corporate repurchases, outside investors often regard insider buying (or reduced selling) as a signal of undervaluation and some respond by purchasing shares. We investigate both corporate repurchases and insider trades to provide a comprehensive study of whether managers trade against short sellers. Our primary focus, however, is on corporate repurchases because the potential price effect is much larger.³

Managers can easily monitor the aggregate short position in their company's stock since it is publicly reported by the stock exchanges twice monthly (at mid-month and month-end). If naked short selling is substantial and persistent, that amount is reported more frequently.⁴ Using these sources of information, managers' could adjust share repurchases to counteract changes in short sales. While timing repurchases in this manner would put corporate capital at risk, prior

² To simplify the exposition, we discuss only the offsetting price effects of increases in short selling and repurchases, but decreases offset in a similar manner.

³ During the July 23, 2010 episode of the CNBC show *Mad Money*, Jim Cramer commented that insider buying and corporate repurchases are two ways that managers of heavily shorted companies can draw a "line in the sand that says that our stock goes this low and no lower." However, few companies publicly admit to such practices -- possibly due to concerns over legality. An exception is International Bancshares Corporation, a financial institution that needed Treasury permission to repurchase its shares. In a press release on March 25, 2009, IBC stated that it "is particularly vulnerable to the harmful practices of short-traders because under CPP, the Company is prohibited from repurchasing its common stock." (CCP refers to the U.S. Treasury Department's Capital Purchase Program.) The Treasury, which held stock warrants as part of TARP funding, did grant IBC permission to repurchase stock.

⁴ Since 2004, the SEC has required that stock exchanges provide a daily list of companies with substantial and persistent "fails to deliver" by short sellers (SEC 2004). For our sample period, "substantial" is at least 10,000 shares and one-half of one percent of outstanding shares. "Persistent" is five consecutive trading days. The list is reported with a lag of about seven business days. In addition, a web-based service, BUYINS.net, collects this and other data daily "to help companies identify when they are becoming a target of abusive short selling."

research indicates that managers are able to identify when their stock is misvalued. Baker and Wurgler (2002) provide empirical evidence that companies issue shares at high prices and repurchase them at low prices. Their evidence supports the “market timing theory” of capital structure, which posits that corporate trading is substantial and frequent enough so that the current mix of debt and equity is influenced by managers’ historical market “timing” activities. Studying a more recent time period (2004 to 2006), De Cesari et al. (2011) similarly find that managers of 265 large firms time their repurchases to buy at relatively low prices. And Christa Davies, AON Corp CFO states (Katz, March 2011): “For us to spend cash on anything else, it has to beat share buyback, which sets the bar for all other capital investments.”

Even managers who are antagonistic toward short sellers, however, may be reluctant to trade against them for at least two reasons: First, using corporate share repurchases to counteract short sales could constitute price manipulation under the 1933 and 1934 Securities Acts. To provide a “safe harbor” from prosecution, the SEC (1982, 2003) issued Rule 10b-18 and its amendment, which identify four conditions to be met each day stock is repurchased. Those conditions are designed to allow “the market to establish a security’s price based on independent market forces without undue influence by the issuer.” (SEC 2003, p. 64953). If managers raise the bid price for their company’s stock to hurt (possibly squeeze) short sellers, they would violate the “price condition” of Rule 10b-18, which caps a company’s offer price at the last independent transaction or bid price. However, the SEC states that price manipulation can occur even without offering a higher price by constantly offering the last price, thereby forcing others to raise the price (SEC 2003, p. 64954, fn. 19). Safe harbor protection would usually be lost by actively trading against short sellers, thereby making the company vulnerable to charges of price

manipulation.⁵ A second reason that managers may be reluctant to trade against shorts is the possibility of overpaying, or even losing money, on a stock that shorts sellers believe to be overvalued. While Baker and Wurgler (2002) and De Cesari et al. (2011) provide evidence that managers repurchase shares at favorable prices, their results are not conditioned on the level of short selling. Short sellers are widely viewed by financial economists as especially sophisticated investors, largely because the high costs and risks of short selling drive out uninformed traders (Diamond and Verrecchia 1987). And recent research shows that abnormal returns can be earned by trading with the shorts (Boehmer et al. 2010), especially when their positions conflict with the consensus analyst recommendation (Drake et al. 2011).

Reasonable arguments therefore exist for changes in corporate share repurchases to be positively, negatively, or unrelated to short selling activity. We provide empirical evidence on this relation by regressing the change in quarterly share repurchases on the concurrent change in short interest (a difference-in-differences research design). One advantage of this design is that actions by managers and shorts that occur within a relatively narrow time period (i.e., a quarter) are more likely to be causally related. To include other factors that may influence corporate repurchases, we modify a model by Blouin and Krull (2009), which extends earlier work by Dittmar (2000), Core et al. (2006), and Hribar et al. (2006). We use quarterly data from 2003 to 2009 and include all firms with data available, except for utilities and financial institutions.

Our most important finding is that changes in corporate share repurchases are strongly positively associated with contemporaneous changes in short interest. A positive association is

⁵ The safe harbor conditions are voluntary in the sense that a violation does not by itself constitute price manipulation. Trading against short sellers could also cause a company to violate one (or more) of the other three conditions, but we believe the price condition is the main constraint. To illustrate, the other three conditions could be met : 1) by using a single broker, 2) by not trading at the market opening or near the closing (last 30 minutes, reduced to 10 minutes for highly liquid stocks), and 3) by limiting daily purchases to 25 percent of average daily trading volume. For a more detailed discussion of each condition, see SEC (2003).

consistent with managers trading against short sellers; that is, managers increase (decrease) share repurchases in response to an increase (decrease) in short sales during the quarter. We estimate that quarterly share repurchases increase by \$1,140,000 for each one percent increase in short interest. This trading is unlikely to result from reverse causation whereby short sellers react to corporate repurchases (i.e., endogeneity) because (1) short sellers have no incentive to increase their position when a company is buying back its shares, and (2) information about corporate share repurchases is reported quarterly, so it is not available to shorts in a timely manner.

We find that several other factors also influence corporate buybacks. Our model includes two variables to capture capital market incentives, and each shows that managers increase share repurchases when share valuations are low (i.e., when the book-to-market ratio at the beginning of a quarter is high, and/or the return during the current quarter is low). Larger companies also buy back more shares. And several accounting-based measures of capital availability affect repurchases. Specifically, companies acquire more shares when cash and short-term investments are high or free cash flow increases; they acquire fewer shares when debt is high or the company has a large dividend payout. In addition, companies with a high return-on-assets and a positive change in return-on-assets repurchase more shares. A likely reason is that those companies can increase earnings per share by acquiring shares (Hribar et al. 2006). Consistent with Blouin and Krull (2009), we find that the prior quarter's change in repurchases is negatively related to the current quarter's change (which is consistent with regression to the mean).

The strong positive association between increases in repurchases and short interest leads us to examine the resultant returns. We calculate average returns as if the shares are repurchased at the beginning of the quarter, since we do not have actual purchase dates. Firms are first sorted into quintiles based on the beginning-of-the-quarter level of short interest, since prior research

shows that the level of short interest is predictive of future returns (Boehmer et al. 2010, Drake et al. 2011). We find that returns during the current quarter decline monotonically from the lower to higher short interest quintiles, but the returns are positive for each quintile with one exception: For the highest short interest quintile, returns are negative and statistically significant:⁶ This quintile is of particular interest because shorts have an especially strong expectation that these shares will decline in value (i.e., short interest is high and increasing), yet managers are increasing share repurchases. To determine if returns turn negative as expected by shorts, we calculate one-quarter-ahead returns. We find they are positive and sufficiently large to offset the negative returns during the current quarter, so the price decline expected by the shorts does not occur. Two-quarter returns are also positive in the other four short interest quintiles. Our analyses indicate that managers do not lose money when they increase corporate share repurchases to fight the short sellers. But these positive returns have an important downside by making the company vulnerable to charges of price manipulation under the 1933 and 1934 Securities Acts (see our earlier discussion).

Next, we examine managers' personal trades. We are interested in whether their trades are consistent with corporate repurchases and whether insiders trade with, against, or with no relation to changes in short selling. As would be expected, insiders trade somewhat infrequently, with a buy or sell transaction occurring in about 25 percent of the sample quarters. For this subsample, we discover that net insider selling during the quarter is significantly positively associated with an increase in short selling. Interestingly, insider selling is not significantly related to corporate share repurchases. Several control variables are also significant: Insider selling is greater at larger firms and when abnormal returns during the quarter are higher, and

⁶ We report raw returns, rather than market-adjusted returns, because the research question is whether the company loses (gains) capital when repurchasing its own stock, not whether the company is successful in managing a stock portfolio with a certain level of riskiness.

their selling is less when the book-to-market is high (i.e., at value firms). Insider selling is also somewhat greater when the following year's return is negative. Based on this evidence, we conclude that managers do not use their personal capital to trade against short sellers.

Our paper contributes to several areas of contemporary finance and accounting research. First, we add to research on the determinants of corporate share repurchases. Our new contribution is showing that short selling activity influences the timing of corporate share repurchases. We also extend prior research on repurchases by testing a more complete set of accounting and market variables and finding several to be highly influential. Second, we advance the literature on insider trading by showing that managers' decisions have little relation to corporate repurchases but do correspond to trading by short sellers. Third, our finding of positive returns for corporate repurchases suggests that managers play an influential role in price discovery for their company's stock. Managers' influence on price has implications for short sellers, since it suggests that corporate share repurchases may increase the riskiness of a short position.⁷ Lastly, we hope to revive a line of research that considers how managers respond to short sellers. This research has been largely dormant since a widely cited working paper by Lamont (2004), but the increase in short selling in recent years justifies further inquiry.⁸

The remainder of the paper proceeds as follows. Section 2 describes the models we use to investigate changes in corporate share repurchases and insider trading. Section 3 describes the

⁷ Researchers have not previously considered this possibility, although they have studied idiosyncratic risk and repurchases would seem to add to this risk. For a discussion of the importance of idiosyncratic risk, see Pontiff (2006). In addition, Mashruwala et al. (2006) shows that idiosyncratic risk is important in explaining why the accrual anomaly had not been arbitrated away several years after the publication of Sloan (1996). (Note that the authors are working on a separate study to determine whether short sellers can significantly improve their trading returns by avoiding stocks that have an active repurchase program.)

⁸ The only other research we know of is by de Jong et al. (2011). They study companies issuing convertible debt who enter into a "combined offering" with the underwriter, whereby the company uses a portion of the debt proceeds to repurchase shares that arbitrageurs short sell to the underwriter in a prearranged transaction. The company is willing to cater to the needs of arbitrageurs to increase the proceeds received from issuing the convertible debt.

data collection and presents descriptive statistics. Empirical results and robustness tests are reported in Section 4. The final section discusses an interesting implication of our results.

2. Models of Trading by Managers

2.1 Corporate Share Repurchases

To investigate the relation between changes in corporate share repurchases and short selling, we extend models of corporate repurchases used by Dittmar (2000), Stephens and Weisbach (1998), Hribar et al. (2006), and Blouin and Krull (2009). Our model is most similar to equation (5) in Blouin and Krull (2009).⁹

$$\begin{aligned} \Delta Repurchase_{i,t} = & \beta_0 + \beta_1 \Delta ShoIntQ_{i,t} + \beta_2 BTM_{i,t-1} + \beta_3 Return_{i,t} + \beta_4 Cash_{i,t-1} + \beta_5 Debt_{i,t-1} \\ & + \beta_6 \Delta FCF_{i,t} + \beta_7 ROA_{i,t-1} + \beta_8 \Delta ROA_{i,t} + \beta_9 Size_{i,t-1} + \beta_{10} DivYld_{i,t-1} + \beta_{11} QOpGnt_{i,t} \\ & + \beta_{12} \Delta Repurchase_{i,t-1} + \Sigma \beta_m Industry_m + \Sigma \beta_n Year-Qtr_n + e_{i,t} \quad (1) \end{aligned}$$

The dependent variable, $\Delta Repurchase_{i,t}$, is the change in a company's repurchases of common stock from quarter t-1 to quarter t. Following Blouin and Krull (2009), we calculate $Repurchase_{i,t}$ as purchases of common and preferred stock from the Statement of Cash Flows less any decrease in preferred stock from the balance sheet, scaled by total assets at the beginning of the quarter (and multiplied by 100).

The explanatory variable of primary interest, $\Delta ShoIntQ_{i,t}$, is the change in short interest from quarter t-1 to quarter t, where short interest is the number of shares sold short divided by common shares outstanding. Short interest is compiled in the middle of the last month of the quarter.¹⁰ If managers use repurchases to trade against short sellers, the coefficient on $\Delta ShoIntQ$

⁹ Blouin and Krull (2009) investigate whether firms distribute cash from repatriated foreign earnings (due to the tax holiday provided by the 2004 American Jobs Creation Act) to their shareholders via share repurchases. Equation (5) of Blouin and Krull (2009) therefore includes some variables that are not relevant to our study, such as a tax penalty.

¹⁰ The stock exchanges compile firm-level short interest at mid-month and release it before month-end throughout our test period. In 2007, they added a second measure compiled at month-end. We use the mid-month measure as it is the most current measure of short interest available to managers before the end of the fiscal quarter.

would be positive, indicating that firms increase their share repurchases contemporaneously with an increase in short interest (i.e., in the same quarter). If managers instead trade with the shorts, the coefficient on $\Delta ShoIntQ$ would be negative. This would indicate that managers increase share repurchases when short interest decreases (i.e., when shorts are buying to reduce or close positions), and managers reduce share repurchases when short sales increase. Managers and short sellers might trade together because each has superior information (possibly from different sources) that causes them to reach a similar opinion about whether the stock is under- or over-valued. Ex ante, it is unclear whether corporate managers trade with, against, or with no relation to the shorts, so we do not propose a sign for the coefficient on $\Delta ShoIntQ$.

By calculating our two variables of primary interest, repurchases and short interest, as changes, our research design controls for firm-specific factors affecting these variables that are stable over time (without our needing to identify them). To control for cross-sectional factors, we include several variables from prior research on corporate share repurchases. Below, we describe the calculation of each variable before discussing the underlying rationale. $BTM_{i,t-1}$ equals the ratio of book value of equity to the market value of equity at the end of quarter t-1. $Return_{i,t}$ is the raw stock return during quarter t. $Cash_{i,t-1}$ is calculated as cash and short term-investments at the end of quarter t-1, deflated by total assets at that time. $Debt_{i,t-1}$ is calculated as the ratio of current plus long term debt to total assets at the end of quarter t-1. $\Delta FCF_{i,t}$ is the change in free cash flow (operating cash flow minus capital expenditure) deflated by total assets at the end of the quarter from quarter t-1 to quarter t. $ROA_{i,t-1}$ is the ratio of net income for quarter t-1, divided by total assets at the end of that quarter. $\Delta ROA_{i,t}$ is the change from quarter t-1 to quarter t. $Size_{i,t-1}$ equals the natural log of total assets at the end of quarter t-1. $DivYld_{i,t-1}$ is dividends per share for quarter

$t-1$ divided by stock price at the end of that quarter. $QOpGnt_t$ is the total number of stock options granted to managers in quarter t , scaled by common shares outstanding

The book-to-market ratio has been used in the share repurchase literature to indicate whether the firm's stock is undervalued (Ikenberry et al. 1995; Dittmar 2000), so following prior research we expect a positive coefficient. A positive coefficient would also occur if growth firms prefer to direct capital to promising investment opportunities, rather than to repurchases shares. Following Stephens and Weisbach (1998), we include a recent (current quarter) stock return and expect a negative coefficient, on the assumption that companies increase repurchases in response to a decline in price. The coefficient on cash and short-term investments is expected to be positive because firms with more resources on hand can more easily increase share repurchases. Consistent with Dittmar (2000) and Core et al. (2006), we expect a negative coefficient on debt. Debt servicing requires that firms keep cash on hand, and some debt covenants have strict limitations on payouts to shareholders. Firms with increasing free cash flow are more able to increase share repurchases, so we expect a positive coefficient on ΔFCF (Stephens and Weisbach 1998).

We expect positive signs on return-on-assets and changes in ROA because profitable firms can increase earnings per share by reducing outstanding shares; further, they can generate more resources to repurchase shares. Firm size is expected to be positively related to repurchases based on studies by Dittmar (2000), Core et al. (2006), and Blouin and Krull (2009). Dividend yield would have a negative coefficient assuming that share repurchases and dividends are substitutes in returning capital to shareholders (Grullon and Michaely 2004). Companies that use stock options as compensation often repurchase shares in order to minimize dilution of ownership by existing stockholders, so we expect a positive sign on option grants.

2.2 Insider Trading

We examine managers' personal trades to determine (1) whether they are consistent with corporate share repurchases and (2) whether managers trade with, against, or with no relation to changes in short selling. We use the following model:

$$\begin{aligned} QInsNetSell_{i,t} = & \beta_0 + \beta_1 \Delta ShoIntQ_{i,t} + \beta_2 \Delta Repurchase_{i,t} + \beta_3 BTM_{i,t-1} + \beta_4 AbReturn_{i,t} + \\ & \beta_5 AbReturn_{i,(t+1,t+4)} + \beta_6 \Delta ROA_{i,t} + \beta_7 QOpGnt_{i,t} + \beta_8 Size_{i,t-1} \\ & + \beta_9 PctOperAccrual_{i,t-1} + \Sigma \beta_m Industry_m + \Sigma \beta_n Year-Qtr_n + e_{i,t} \end{aligned} \quad (2)$$

$QInsNetSell_{i,t}$ is the ratio of insider sales less insider purchases during quarter t, divided by the sum of those two amounts. We include only quarters with at least one open market sale or purchase by registered insiders. We choose the sell version of the trading ratio because sales of stock by insiders are much more frequent than purchases. Other studies that use variations of a trading ratio as the dependent variable and use only periods with insider activity include Rozeff and Zaman (1998), Lakonishok and Lee (2001), Frankel and Li (2002), Piotroski and Roulstone (2005), Rogers and Stockton (2005), and Core et al. (2006).

Short interest is a ratio (short interest/ common shares outstanding) with the amount of short interest collected in the middle of the last month of the quarter. $\Delta ShoIntQ$ is the change between consecutive quarters. We do not predict a sign for $\Delta ShoIntQ$, as short interest could be positively related, negatively related, or unrelated to insider net selling. The sign would be negative if managers trade against short sellers, possibly to influence trading by those outside investors who use insider trades to guide their trading. Otherwise, insider trades are too small in dollar amount to be effective in trading against shorts. A positive sign would be observed if managers trade consistently with shorts. Research shows that abnormal returns can generally be earned by trading with the short sellers (Boehmer et al. 2010, Drake et al. 2011).

To our knowledge, we are the first to investigate if insider trading is related to short selling, but we are not the first to investigate whether insider trading is related to corporate stock repurchases. Core et al. (2006) find that when accruals are high, firms decrease repurchases and managers sell more shares. Griffin and Zhu (2010) find that CEO stock options influence the choice, amount, and timing of funds distributed to repurchase stock. Ex ante, we expect that managers trade in a similar manner with corporate and personal capital, so we test whether the coefficient on $\Delta Repurchase_{i,t}$ is negatively related to net insider selling.

Our model includes several other variables that have been shown by prior research to influence insider trades. Rozeff and Zaman (1998) and Piotroski and Roulstone (2005) find that insider selling increases (declines) in response to recent stock price increases (decreases). We extend their research by using quarterly, rather than annual, returns and expect a positive association between insider net sales and $AbReturn_{i,t}$. Those studies also show insiders tend to purchase value stocks, possibly because they are often undervalued based on fundamental information (Piotroski 2000). We therefore expect less selling of firms with a high BTM , resulting in a negative coefficient. Consistent with Piotroski and Roulstone (2005), we also include the one-year-ahead buy-and-hold return, $AbReturn_{t+1 to t+4}$, since insiders may have better information for predicting future returns than the market. We expect a negative sign because insiders would reduce current selling when they expect positive future returns. All abnormal returns are characteristic-based and benchmark-adjusted¹¹ as in Daniel et al. (1997) and Warmers (2004).

We include ΔROA for the current quarter and expect a negative sign because insiders are likely to hold their shares for a longer period when operating performance is improving. We

¹¹ The DGTW benchmarks are available via <http://www.smith.umd.edu/faculty/rwermers/ftpsite/Dgtw/coverpage.htm>

include stock option grants (*QOpGnt*) and expect a positive sign, reasoning that insiders receiving large option grants would sell shares to diversify their investment portfolio. We include *Size* and expect the coefficient to be positive, as prior research indicates that insiders of larger firms sell more stock than those at smaller firms (Seyhun 1986, Rozeff and Zaman 1988). Finally, Core et al. (2006) suggest that insiders sell more shares when accruals are high, which supports a positive sign on *PctOperAccrual_{i,t-1}*. Based on the recent study by Hafzalla et al. (2011) that shows accruals better predict future returns when deflated by earnings, we use the percent operating accrual (i.e., scaling accruals by the absolute value of net income).

3. Data and Descriptive Statistics

3.1 Data

We obtain monthly short interest, quarterly share repurchases, and quarterly financial data from Compustat; share prices, common shares outstanding, and cumulative adjustment factors from CRSP; insider trades from the Thomson Reuters TFN database; and option grants from ExecuComp. Our test period begins with 2003, the first year with short interest data on Compustat, and extends through 2009. We merge data from the four databases, including only firms with ordinary common shares (CRSP share codes of 10 or 11). As summarized in Table 1, the final sample consists of 4081 firms and 67,109 firm-quarters. We exclude firms in financial services or in regulated industries because they may need regulator permission to repurchase shares. We drop observations with stock prices less than or equal to \$1.00.

The Thomson Reuters TFN database obtains insider trading data from SEC Forms 3, 4, and 5. We aggregate daily data from TFN to calculate a quarterly measure and keep only records with a cleanse indicator (assigned by Thomson) of R, H, C, L, or I. Codes R, H, and C indicate that the data are accurate with a very high degree of confidence. Codes L and I indicate that

Thomson either cleaned or improved the data, but they could not verify the data from secondary sources. Roughly a third of the data have an indicator of either L or I. Following Kahle (2002) and Jategaonkar (2010), we collect acquisitions and dispositions of shares by company executives, officers, directors, and controlling persons.¹² We consider them to be “managers” due to their likely participation in the decision to buy back shares. They would also be updated about capital expended in repurchasing shares.

3.2 Descriptive Statistics

Table 2 presents descriptive statistics. The mean for *Repurchases* of 0.506 indicates that corporate share repurchases constitute about half of one percent of total assets in an average quarter. However, most quarters do not have a share repurchase (median is zero). The average share repurchase increases to 1.8 percent of total assets when only non-zero quarters are included (not tabulated). The mean for $\Delta Repurchase$ is -0.002, which is low for two reasons: (1) a non-zero change occurs for only 35.1 percent of the quarters and (2) a large increase in repurchases tends to be followed by a decrease (mean reversion). This results in changes at the 90th and 10th percentile that are sizable at 0.379 percent and -0.399 percent of total assets, respectively.

Short interest averages 4.8 percent (median 2.9 percent) over the sample period. The quarterly change, $\Delta ShoIntQ$, has a mean (median) of 0.001 (0.000), which is small because short interest for most companies doesn't change very much between consecutive quarters. The changes at the 90th and 10th percentile, however, are sizable at 0.02 and -0.018. Insider net stock sales, *QInsNetSell*, has a mean of 0.601, with positive (negative) cell values of one indicating all transactions in the quarter are sells (buys). In untabulated results, we find the mean for sells is 0.664, compared to 0.04 for buys, so insiders sell about 15 times more shares than they buy.

¹² We collected insiders' trades with TFN role codes 'CB', 'CEO', 'CO', 'GC', 'P', 'CFO', 'CI', 'CT', 'D', 'DO', 'H', 'OB', 'OD', 'OT', 'TR', 'VC', 'AV', 'C', 'EVP', 'SVP', 'VP', 'CP', and 'F'.

Quarterly raw returns tend to be positive over our sample period, with a mean (median) of 0.037 (0.017). Abnormal returns are characteristic-based, benchmark adjusted based on Daniel et al. (1997) and Wermers (2004). The mean (median) is 0.011 (-0.010). Accruals are deflated by the absolute value of earnings because a recent study by Hafzalla et al. (2011) shows this accrual measure has the most power than other measures in predicting future returns. The accruals mean and median are both negative at -1.649 and -0.610, respectively. More than ninety percent of the quarters do not have any option grants, resulting in a small mean (median) grant of 0.002 (0.000). The remaining values are similar to other studies.

Table 3 reports correlations among the variables used to explain the change in corporate share repurchases (Model 1). The first column (first row) presents Spearman (Pearson) univariate correlations between the quarterly change in repurchases and individual explanatory variables. The correlations are generally statistically significant in the direction expected: Using either correlation statistic, changes in repurchases are significantly positively associated with five variables: changes in short interest, cash and short-term investments, changes in free cash flow, changes in return on assets, and option grants. Repurchase changes are significantly negatively correlated with four variables: quarterly stock returns, debt, dividend yield, and changes in repurchases during the preceding quarter. The two highest correlations are with the change in short interest and with the lagged change in repurchases. Next, we examine whether these univariate associations are statistically significant in a multivariate model.

4. Multivariate Analyses

4.1 Changes in Short Interest and in Corporate Share Repurchases

Table 4 reports on factors expected to influence the amount of capital allocated to repurchase stock during a quarter (Model 1). Version 1 includes only the change in short interest.

Version 2 includes all the explanatory variables, except for the change in repurchases during the prior quarter. Versions 3 and 4 add this variable. In versions 1, 2, and 3 of the model, we correct for the possibility of biased standard errors by clustering on the firm and by using indicator variables to control for industry (two-digit SIC codes) and time (quarter-year) fixed effects (Petersen 2009). In version 4, we cluster on both time and firm (Gow et al. 2010).

Our most important finding is that the coefficient on $\Delta ShoIntQ$ is always positive and statistically significant. The coefficient size and statistical significance of $\Delta ShoIntQ$ increase as we add control variables (i.e., from Version 1 to 3). Clustering on time and firm (Version 4) has very little effect on the coefficient and statistical significance. Firms experiencing an increase (decrease) in short interest during a quarter therefore respond by significantly increasing (decreasing) share repurchases. Reverse causation, which would arise if short sellers react to changes in corporate repurchases, is very unlikely because (1) short sellers have no incentive to increase their position during a quarter when the company is buying back shares, and (2) information about corporate share repurchases is reported only quarterly, so it is not readily available in a timely manner.

Our multivariate model extends prior research by including a more extensive set of explanatory variables. We include two variables to capture capital market incentives, and each shows that managers increase share repurchases when stock prices are relatively low. Specifically, repurchases increase when the book-to-market ratio at the beginning of a quarter is high and/or the return during the current quarter is low. Several accounting-based measures of capital availability also affect repurchases. Managers acquire more shares when cash and short-term investments at the beginning of the quarter are high. They repurchase fewer shares when debt is high at the beginning of a quarter, possibly due to debt covenant restrictions (Dittmar

2000, Core et al. 2006). Changes in free cash flows have a positive effect, with companies that experience an increase (decrease) in free cash flow during the quarter increasing (decreasing) their share repurchases (but the statistical significance is low compared to other variables). Companies with a high return-on-assets in the preceding quarter and those with a positive change in return-on-assets in the current quarter repurchase more shares (Blouin and Krull, 2009). Prior research shows that larger firms repurchase more stock (Dittmar 2000, Core et al. 2006, and Blouin and Krull 2009), and we find that the log of size is positive and highly significant. The coefficient on *DivYld* is negative and statistically significant, providing support for the proposition that dividend distributions and repurchases are substitutes. *QOpGnt* (executive stock option grants) is the only variable that is not statistically significant. Lastly, we find that the prior quarter's change in repurchases is strongly negatively related to changes in repurchases during the current quarter, which is consistent with regression to the mean. Despite the high level of statistical significance for this variable, it has little affect on the statistical significance of the other variables (see Version 2).

The results presented are consistent with prior research by including all quarters within the sample time period, even though the majority of quarters have zero repurchases. In most cases, the companies with zero repurchases do not have a stock buyback program, so they would not be expected to trade against shorts by repurchasing their stock. Table 5 reports model results corresponding to Table 4, but the sample now includes only quarters in which some stock is repurchased. The number of observations is reduced from 67,109 to 18,708 firm-quarters. We refer to these firms as “active repurchasers.”

In Table 5, the coefficient on $\Delta ShoIntQ$ is again positive and statistically significant, but it is now about three times larger (12 vs. 4). Using a coefficient of 4, the estimated increase in

quarterly repurchases for each 1% increase in short interest is around \$150,000 ($(0.01 * 4 * \exp(5.936))$). This estimate is based on all 67,109 quarters, even though most firms do not have a program to repurchase their shares. Including numerous quarters with zero repurchases understates how companies with an active program respond to shorts. For active repurchasers, quarterly share repurchases increase about \$1,140,000 ($(0.01 * 12.433 * \exp(6.8554))$) for each one percent increase in short interest. This amount is clearly economically meaningful. (Note that estimate for active repurchasers is higher because the estimated coefficient is higher and the sample consists of larger firms).

Examining the other explanatory variables on Table 5, the coefficients are generally much larger than on Table 4. Only size completely loses statistical significance, although book-to-market is insignificant with clustering on both firm and time. The full-sample finding that companies adjust share repurchases in a manner consistent with fighting their short sellers is driven by the subsample of firms that actively repurchase shares. The next question we address is whether these companies lose capital by fighting short sellers.

4.2 Returns to Fighting the Shorts

Average returns when repurchases and short interest both increase during the quarter (i.e., managers are fighting the shorts) are reported in Table 6. We use raw returns because we are interested in whether the company loses (gains) capital when increasing share repurchases to fight short sellers (see footnote 6). We calculate average returns *as if* the shares are repurchased at the beginning of the quarter because we do not have purchase dates during the quarter. We show returns for the current quarter and for the subsequent quarter, plus we report the value at the end of the subsequent quarter of a dollar invested at the beginning of the current quarter. Calculating these “as if” returns allows us to provide some evidence (albeit imperfect) on

whether companies lose money when they trade against short sellers. In calculating as if returns, firms are first sorted into quintiles based on the beginning-of-the-quarter level of short interest, since prior research shows that the level of short interest is predictive of future returns (Boehmer et al. 2010, Drake et al. 2011).

Table 6 shows that returns during the current quarter decline monotonically from the lowest to the highest short interest quintile, but the returns are positive except for the highest short interest quintile, where the return is -1.49 percent (statistically significant at the 0.05 level in a two-tail test). This quintile is of particular interest: A high level of short interest at the beginning of the quarter, combined with a further increase during the quarter, indicates that shorts have an especially strong expectation that these shares will decline in value, yet managers increase share repurchases during the quarter. To determine if returns for the highest short interest quintile turn negative as expected by shorts, we calculate one-quarter-ahead returns, finding they are positive and sufficiently large, at 2.95 percent, to offset the negative returns in the current quarter. The value of a dollar invested at the beginning of the current quarter would increase to \$1.014 at the end of the second quarter. Also note that the one-quarter-ahead returns for the other four quintiles are above two percent, and the compounded two-quarter value of an invested dollar increases monotonically, ranging from \$1.073 to \$1.014, from the 1st to the 5th quintile. While the monotonic pattern indicates managers would earn higher returns if they restricted share repurchases to when the level of short interest is low, short interest tends to be sticky over time so managers at a given company may never have that opportunity.

In summary, our analyses indicate that managers do not lose money when they increase corporate share repurchases to fight short sellers. But these positive returns have an important downside by making the company vulnerable to charges of price manipulation under the 1933

and 1934 Securities Acts (see introduction). Ideally, we would like to know how much returns would differ if the company did not use repurchases to fight their short sellers, but this return cannot be determined.

4.3 Robustness Tests

Recall that the sample excludes firms in regulated industries and financial service industries. When we include those industries, the main results do not change. The 2008 ban on short selling of “financial stocks” caused a sizable decline in short sales across a wide range of companies, while the need to preserve capital during the crisis considerably reduced corporate share repurchases. The results therefore include some quarters with highly unusual market conditions. As a robustness test, we reran the model including only quarters ending before September 2008. The overall model is somewhat stronger, and the only noteworthy change is a greater weight on the current quarter’s return and less weight on the book-to-market ratio. We also reran the change in repurchases model using two alternative specifications of the change in short interest. First, we converted our short interest change variable, $\Delta\text{ShoIntQ}$, into deciles and used the resulting ranks. For the second specification, short interest for each quarter is the average for the three months, rather than the amount reported for the last month of the quarter. We find the change in short interest is positively related to the change in repurchases and highly significant in both specifications.

Prior studies estimate share repurchases in several ways. For instance, Stephens and Weisbach (1998) use quarterly decreases in shares outstanding, quarterly purchases of common and preferred stock from the cash flow statement, and quarterly changes in treasury stock. They conclude that none of those proxies measure share repurchases without error. More recently, Blouin and Krull (2009) show that purchases of common stock can be calculated fairly

accurately based on data from the Statement of Cash Flows, and we use their estimation method in our models. As a robustness test, we reran Model 1 using each of the other quarterly measures in Stephens and Weisbach (1998). In addition, we used a measure of abnormal change in share repurchases (AbRepur8), calculated as the difference between repurchases in the current quarter and the average repurchases for the preceding eight quarters. The association between changes in repurchases and changes in short selling is always positive and statistically significant (untabulated).

Stephens and Weisbach (1998) also use monthly decreases in shares outstanding to approximate repurchases. Using monthly data reduces the time period over which we compare changes in repurchases and short interest, which helps to establish a causal relation. However, measurement error in estimating repurchases increases because the number of shares outstanding changes whenever stock is issued, not only when stock is repurchased. As a robustness test, we ran regressions similar to Model 1 using monthly data collected from CRSP and Compustat. The repurchases dependent variable is measured as the change in common shares outstanding (SHROUT) from month $m-1$ to month m , scaled by common shares outstanding at the end of month $m-1$. The change in short interest is also calculated monthly. The other variables are quarterly measures, which results in an identical amount being used for each month in the quarter. We expect that the coefficient on the monthly change in short interest to be *negative*, since the dependent variable is the change in shares outstanding. That is, a reduction in shares outstanding indicates share repurchases. Using this model, we find that the coefficient on the change in short interest is negative and highly significant (-0.1456 , $t\text{-value} = -27.68$, using 204,739 observations, not tabulated), supporting our finding that firms increase share repurchases when short interest increases.

Using monthly data, we also calculate two alternative measures of abnormal changes in share repurchases (AbShrOut12 and AbShrOut24) and changes in short interest (AbShoInt12 and AbShoInt24). AbShrOut12 is abnormal common shares outstanding, calculated as the difference between the current month's common shares outstanding and the average amount for the preceding 12 months. AbShrOut24 is defined similarly but based on the average number of common shares outstanding over 24 months. AbShoInt12 (AbShoInt24) is defined as the difference between the current month's short interest and average short interest for the past 12 (24) consecutive months. Using these measures, we find that the coefficients on the monthly change in short interest are always negative and statistically significant.

We conducted numerous robustness tests because our study is the first to test and find a relation between changes in share repurchases and changes in short interest. Those tests show that this relation is very robust.

4.4 Insider Trading

Next, we examine managers' personal trades. Our empirical tests are limited in comparison to our analyses of corporate share repurchases because we view insider trades as much less effective in fighting shorts. We are primarily interested in (1) whether insider trades are consistent with corporate repurchases and (2) whether insiders trade with, against, or with no relation to changes in short selling. An insider trade occurs in 26 percent of the sample quarters.

If insider trades are consistent with corporate repurchases, insider net stock sales during a quarter, *QInsNetSell*, would be negatively associated with the change in corporate repurchases. As reported on Table 7, the sign is negative but the coefficient falls slightly short of statistical significance. In contrast, the coefficient for the change in short interest is statistically significant in all four versions of the model, with the positive sign indicating that insiders trade with short

sellers. Insiders therefore tend to sell when shorts sell and to buy when shorts buy (i.e., to reduce their short position).

These results hold with the inclusion of three highly significant control variables. Following prior research, we use ranks for each of the three variables. We find that net insider selling is greater when (1) the book-to-market rank is lower (glamour firms), (2) the rank of abnormal returns is higher, and (3) the rank of size is greater. The evidence is mixed for the other two variables: Versions 2 and 3 of the model find that managers' trades are predictive of future (four-quarter-ahead) abnormal returns, but the coefficient is no longer statistically significant in Version 4, which clusters on both firm and time. In contrast, the rank of percent operating accruals is statistically significant in Version 4 but insignificant in Versions 2 and 3.

An executive who has been responsible for corporate stock buybacks for more than a decade at a well-known company posited that the timing of corporate share repurchases is private information, so managers may avoid trading on this information due to insider trading laws. We believe this is a reasonable explanation for the insignificant association with repurchases, but it does not explain why insider trades are positively correlated with short selling activity. To better understand this result, we examine returns when insiders and shorts trade consistently. Table 8, Panel A, reports returns when they both buy, and Panel B reports returns when they sell. We again report returns by short interest quintile based on the beginning-of-the-quarter level of short interest. When they buy, we find that current-quarter raw returns are negative and very sizable (averaging -9.78 percent). When they sell, current quarter returns are positive and very sizable (averaging 8.04 percent). The subsequent one-quarter and two-quarter returns are small in comparison and insider trades in the current quarter are not very predictive of those returns.

Shorts and insiders therefore trade as contrarians, buying during sharp price declines and selling during rapid price appreciation. A shared perception about when recent returns cause a company's shares to be temporarily misvalued likely explains why we observe the positive association between insider trading and short selling activity.¹³ This shared perception could occur because the shorts use trades by insiders in deciding on their short positions. Regardless of the explanation for this positive association, the evidence shows that managers do not trade against short sellers with their personal capital.

5. Conclusion

Lamont (2004, 30) concludes that anti-shortening actions show that “firms are not just passively responding to market signals, but are in fact actively trying to prop up their stock prices.” We provide evidence of a new type of anti-shortening activity: managers time corporate share repurchases to counteract changes in short interest. Of course, not all managers do so, but it happens often enough to significantly affect the overall association between changes in share repurchases and changes in short selling. This finding provides a new explanation for why trading by short sellers is under-weighted in price discovery, and thereby for why investors can earn substantial abnormal returns by mimicking the trades of short sellers (Boehmer et al. 2010, Drakes et al. 2011).

¹³ This result provides indirect evidence that the positive association observed between corporate repurchases and short selling results from managers timing corporate repurchases to trade against short sellers, rather than a perception the company's shares are undervalued.

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TABLE 1
Sample Selection

	<u>Number of Firms</u>	<u>Number of Observations</u>
Firm-quarters with data from Compustat/CRSP/TFN/ExecuComp (2003 - 2009)	7,948	136,484
Delete: Missing short interest	(371)	(9,310)
Delete: Missing data for main variables	(1,887)	(32,799)
Delete: Financial services or regulated industries	(1,529)	(24,347)
Delete: Observations with stock prices lower or equal to \$1.00	<u>(80)</u>	<u>(2,919)</u>
Final quarterly sample	4,081	67,109

TABLE 2
Descriptive Statistics

	<u>Obs.</u>	<u>Mean</u>	<u>P90</u>	<u>Q3</u>	<u>Median</u>	<u>Q1</u>	<u>P10</u>
Repurchase _t	67,109	0.506	1.529	0.017	0	0	0
ΔRepurchase _t	67,109	-0.002	0.379	0	0	0	-0.399
ShoIntQ _t	67,109	0.048	0.119	0.068	0.029	0.008	0.001
ΔShoIntQ _t	67,109	0.001	0.020	0.006	0.000	-0.005	-0.018
QInsNetSell _t	21,030	0.601	1	1	1	1	-1
Cash _{t-1}	67,109	0.219	0.595	0.335	0.125	0.035	0.012
BTM _{t-1}	67,109	0.568	1.095	0.718	0.450	0.272	0.157
DivYld _{t-1}	67,109	0.001	0.005	0.001	0	0	0
Size _{t-1}	67,109	5.936	8.492	7.257	5.857	4.523	3.462
ΔFCF _t	67,109	0.000	0.060	0.024	0.000	-0.025	-0.063
ROA _{t-1}	67,109	-0.004	0.035	0.022	0.010	-0.007	-0.061
ΔROA _t	67,109	-0.001	0.028	0.008	0.000	-0.009	-0.031
Debt _{t-1}	67,109	0.174	0.426	0.287	0.135	0.002	0
Return _t	67,109	0.037	0.332	0.155	0.017	-0.115	-0.257
AbReturn _t	67,109	0.011	0.274	0.115	-0.010	-0.128	-0.248
PctOperAccrual _{t-1}	67,109	-1.649	1.695	0.206	-0.610	-1.869	-4.868
QOpGt _t	67,109	0.002	0	0	0	0	0

‡ indicates two-tailed statistical significance at the 1% level. In Panel B, the number of observations are in parentheses and italics. Repurchase_t is purchase of common and preferred stock from the Statement of Cash Flows (PRSTKCY) minus decreases in preferred stock (PSTKQ and PSTKRQ), scaled by total assets (ATQ) at the beginning of quarter t, and multiplied by 100. ΔRepurchase_t is the change in shares repurchased from quarter t-1 to quarter t. ShoIntQ_t is the short interest ratio (short interest/ common shares outstanding), using mid-month short interest (SHORTINT) for the last month of quarter t. ΔShoIntQ is the change in short interest ratio from quarter t-1 to quarter t. QInsNetSell_t is net stock sales by insiders during quarter t, calculated as insider stock sales less purchases during quarter t, scaled by the sum of those two amounts. Cash_{t-1} is the ratio of cash and short term-investment (CHEQ) to total assets (ATQ) at the beginning of quarter t. BTM_{t-1} equals the ratio of book value of equity (CEQQ) to market value of equity (PRCCM*SHROUT) at the end of quarter t-1. DivYld_{t-1} equals dividends per share (DVPSXQ) for quarter t-1, divided by stock price (PRCCM) at the beginning of quarter t. Size_{t-1} equals the natural log of total assets (ATQ) at the beginning of quarter t. ΔFCF_t equals the change in free cash flow [operating cash flow less capital expenditure] from quarter t-1 to quarter t, scaled by total assets at the beginning of quarter t. ROA_{t-1} equals the ratio of net income (NIQ) to total assets at the beginning of quarter t. ΔROA_t equals the change in ROA from quarter t-1 to quarter t. Debt_{t-1} equals the ratio of current plus long term debt (DLCQ+DLTTQ) to total assets at the beginning of quarter t. Return_t is the quarterly raw stock return. QOpGt_t is the total number of stock options granted to top executives (GRNTNUM) during quarter t scaled by number of shares outstanding. PctOperAccrual_{t-1} is the percent of operating accruals of quarter t-1, and is calculated as the difference between net income (NIQ) and operating cash flow (from cash flow statement, OANCFY) of quarter t-1, scaled by the absolute value of net income (NIQ). AbReturn_t is the characteristic-based, benchmark-adjusted returns for quarter t, and it is calculated based on Daniel et al. (1997) and Warmers (2004). Year to-date variables, such as PRSTKCY and OANCFY are adjusted to reflect the quarterly change.

TABLE 3
Correlation Matrix

	<u>(1)</u>	<u>(2)</u>	<u>(3)</u>	<u>(4)</u>	<u>(5)</u>	<u>(6)</u>	<u>(7)</u>	<u>(8)</u>	<u>(9)</u>	<u>(10)</u>	<u>(11)</u>	<u>(12)</u>	<u>(13)</u>
$\Delta\text{Repurchase}_t$ (1)		0.049	-0.002	-0.029	0.022	-0.031	0.012	0.003	0.013	0.003	-0.012	0.008	-0.390
$\Delta\text{ShoIntQ}_t$ (2)	0.029		-0.055	0.055	0.002	0.000	-0.002	0.024	0.023	0.003	-0.001	0.000	0.014
BTM_{t-1} (3)	-0.013	-0.057		0.144	-0.213	0.054	0.005	-0.019	-0.040	-0.023	0.047	-0.039	-0.009
Return_t (4)	-0.046	0.038	0.086		-0.025	0.021	-0.020	0.054	0.055	-0.016	-0.004	0.023	0.007
Cash_{t-1} (5)	0.020	-0.011	-0.261	-0.032		-0.420	-0.062	-0.329	-0.021	-0.364	-0.178	-0.009	0.007
Debt_{t-1} (6)	-0.019	0.002	0.055	0.024	-0.562		0.043	-0.001	0.028	0.333	0.087	0.003	-0.006
ΔFCF_t (7)	0.009	0.002	0.008	-0.019	-0.085	0.041		-0.010	0.097	0.009	-0.010	-0.018	-0.014
ROA_{t-1} (8)	0.002	0.037	-0.210	0.107	-0.125	-0.069	-0.036		-0.352	0.307	0.131	0.041	0.009
ΔROA_t (9)	0.015	0.008	-0.025	0.060	-0.030	0.031	0.150	-0.271		0.004	0.008	0.003	-0.007
Size_{t-1} (10)	-0.002	0.014	0.005	0.040	-0.336	0.394	0.016	0.266	0.014		0.256	0.070	-0.001
DivYld_{t-1} (11)	-0.017	0.015	0.012	0.024	-0.245	0.136	-0.001	0.241	0.004	0.393		-0.007	-0.011
OpGnt_t (12)	0.009	-0.004	-0.057	0.039	-0.008	0.025	-0.020	0.075	0.005	0.154	0.052		-0.003
$\Delta\text{Repurchase}_{t-1}$ (13)	-0.241	0.015	-0.013	0.005	0.010	-0.007	-0.016	0.012	-0.004	-0.003	-0.014	0.011	

Correlation coefficients on bold indicate two-tailed statistical significance at 5% or lower level. $\Delta\text{Repurchase}_{t-1}$ is the change in shares repurchased from quarter t-2 to quarter t-1. All other variables are constructed as described in Table 2. Pearson correlations are reported in the upper triangle and Spearman in the lower triangle.

TABLE 4
Multivariate Test of the Effect of Change in Short Interest on
Change in Corporate Share Repurchases

$$\Delta Repurchase_{i,t} = \beta_0 + \beta_1 \Delta ShoIntQ_{i,t} + \beta_2 BTM_{i,t-1} + \beta_3 Return_{i,t} + \beta_4 Cash_{i,t-1} + \beta_5 Debt_{i,t-1} + \beta_6 \Delta FCF_{i,t} + \beta_7 ROA_{i,t-1} + \beta_8 \Delta ROA_{i,t} + \beta_9 Size_{i,t-1} + \beta_{10} DivYld_{i,t-1} + \beta_{11} OpGnt_{i,t} + \beta_{12} \Delta Repurchase_{i,t-1} + \sum \beta_m Industry_m + \sum \beta_n Year-Qtr_n + e_{i,t} \quad (1)$$

	Predictions	(1)	(2)	(3)	(4)
Short Selling Activity					
$\Delta ShoIntQ_t$?	3.503‡ (8.14)	3.616‡ (8.41)	4.076‡ (9.87)	4.164‡ (10.1)
Market Valuation					
BTM_{t-1}	+		0.076‡ (12.77)	0.081‡ (12.01)	0.035‡ (2.48)
$Return_t$	-		-0.191‡ (8.61)	-0.162‡ (8.17)	-0.174‡ (5.16)
Accounting Variables					
$Cash_{t-1}$	+		0.162‡ (8.99)	0.187‡ (9.05)	0.180‡ (5.26)
$Debt_{t-1}$	-		-0.268‡ (9.71)	-0.276‡ (9.04)	-0.275‡ (4.87)
ΔFCF_t	+		0.309‡ (2.66)	0.158* (1.72)	0.167* (1.66)
ROA_{t-1}	+		0.224‡ (3.72)	0.301‡ (4.37)	0.454‡ (3.49)
ΔROA_t	+		0.558‡ (4.89)	0.548‡ (5.61)	0.546‡ (3.88)
$Size_{t-1}$	+		0.018‡ (10.73)	0.019‡ (10.21)	0.014‡ (2.28)
$DivYld_{t-1}$	-		-5.289‡ (4.21)	-7.039‡ (5.37)	-9.686‡ (4.58)
$OpGnt_t$	+		0.828 (1.22)	0.451 (0.74)	1.121 (1.6)
$\Delta Repurchase_{t-1}$?			-0.393‡ (54.17)	-0.391‡ (24.85)
Intercept		-0.086† (1.97)	-0.151‡ (2.93)	-0.138‡ (2.74)	-0.045 (0.86)
Industry Dummies		Yes	Yes	Yes	Yes
Time Dummies		Yes	Yes	Yes	No
Cluster on		Firm	Firm	Firm	Firm and Time
Number of Observations		67,109	67,109	67,109	67,109
Adj. R ²		0.0087	0.0117	0.1651	0.1651

† and ‡ indicate one-tailed statistical significance at 5% and 1% levels, respectively. The t-value for each coefficient is presented below the coefficient in parentheses. The variables are constructed as described in Table 2.

TABLE 5
Multivariate Test of the Effect of Change in Short Interest on Change in Corporate Share Repurchases, excluding Quarters with Zero Repurchases

$$\Delta Repurchase_{i,t} = \beta_0 + \beta_1 \Delta ShoIntQ_{i,t} + \beta_2 BTM_{i,t-1} + \beta_3 Return_{i,t} + \beta_4 Cash_{i,t-1} + \beta_5 Debt_{i,t-1} + \beta_6 \Delta FCF_{i,t} + \beta_7 ROA_{i,t-1} + \beta_8 \Delta ROA_{i,t} + \beta_9 Size_{i,t-1} + \beta_{10} DivYld_{i,t-1} + \beta_{11} QOpGnt_{i,t} + \beta_{12} \Delta Repurchase_{i,t-1} + \sum \beta_m Industry_m + \sum \beta_n Year-Qtr_n + e_{i,t} \quad (1)$$

	Predictions	(1)	(2)	(3)	(4)
Short Selling Activity					
$\Delta ShoIntQ_t$?	11.709‡ (8.65)	11.658‡ (8.76)	12.433‡ (10.27)	12.139‡ (10.38)
Market Valuation					
BTM_{t-1}	+		0.116‡ (3.32)	0.105‡ (2.89)	-0.036 (.83)
$Return_t$	-		-0.795‡ (7.71)	-0.672‡ (7.11)	-0.658‡ (5.48)
Accounting Variables					
$Cash_{t-1}$	+		1.048‡ (9.41)	1.211‡ (10.00)	1.171‡ (7.98)
$Debt_{t-1}$	-		-0.902‡ (7.23)	-0.916‡ (6.97)	-0.951‡ (5.80)
ΔFCF_t	+		0.950‡ (2.30)	0.44 (1.28)	0.49 (1.51)
ROA_{t-1}	+		1.941‡ (3.86)	2.412‡ (4.72)	3.031‡ (4.60)
ΔROA_t	+		3.044‡ (4.91)	2.879‡ (5.35)	2.885‡ (3.21)
$Size_{t-1}$	+		0.004 (.50)	-0.003 (.37)	-0.006 (.54)
$DivYld_{t-1}$	-		-27.032‡ (5.63)	-30.087‡ (6.03)	-36.578‡ (6.87)
$OpGnt_t$	+		3.306 (1.63)	2.135 (1.21)	4.485‡ (2.13)
$\Delta Repurchase_{t-1}$?			-0.418‡ (42.08)	-0.415‡ (22.31)
Intercept		-0.151 (1.03)	0.099 (.57)	0.274 (1.47)	0.259* (1.70)
Industry Dummies		Yes	Yes	Yes	Yes
Time Dummies		Yes	Yes	Yes	No
Cluster on		Firm	Firm	Firm	Firm and Time
Number of Observations		18,708	18,708	18,708	18,708
Adj. R ²		0.0249	0.0421	0.1821	0.1821

‡ and † indicate one-tailed statistical significance at 5% and 1% levels, respectively. The t-value for each coefficient is presented below the coefficient in parentheses. The variables are constructed as described in Table 2.

TABLE 6
Current and One-Quarter-Ahead Returns when
Repurchases Increase and Short Interest Increases

Beginning of Quarter Short Interest Quintile	Current Quarter Raw Return	Value of a Dollar Invested at Beg. Of Current Quarter	One-Quarter- Ahead Raw Return	Value of a Dollar Invested at Beg. Of Current Quarter
1 (Low)	5.23% ‡ <i>(811)</i>	\$1.052	2.01% † <i>(811)</i>	\$1.073
2	2.30% ‡ <i>(1,596)</i>	\$1.023	3.50% ‡ <i>(1,596)</i>	\$1.059
3	0.47% <i>(1,598)</i>	\$1.005	2.84% ‡ <i>(1,598)</i>	\$1.033
4	-0.26% <i>(1,266)</i>	\$0.997	2.56% ‡ <i>(1,266)</i>	\$1.023
5 (High)	-1.49% † <i>(891)</i>	\$0.985	2.95% ‡ <i>(891)</i>	\$1.014
Average	1.14% ‡ <i>(6,162)</i>	\$1.011	2.86% ‡ <i>(6,162)</i>	\$1.040

†, and ‡ indicate two-tailed statistical significance at 5% and 1% levels, respectively. We report mean quarterly returns for the portfolios based on 67,109 firm-quarters. In parentheses and italics, we report the average number of firms per quarter in each portfolio.

TABLE 7
Multivariate Test of the Effect of Changes in Short Interest and Corporate Share Repurchases on Insider Trading

$$QInsNetSell_{i,t} = \beta_0 + \beta_1 \Delta ShoIntQ_{i,t} + \beta_2 \Delta Repurchase_{i,t} + \beta_3 BTM_{i,t-1} + \beta_4 AbReturn_{i,t} + \beta_5 AbReturn_{i,(t+1,t+4)} + \beta_6 \Delta ROA_{i,t} + \beta_7 QOpGnt_{i,t} + \beta_8 Size_{i,t-1} + \beta_9 PctOperAccrual_{i,t-1} + \sum \beta_m Industry_m + \sum \beta_n Year-Qtr_n + e_{i,t} \quad (2)$$

<u>Tobit Regression</u>	<u>Prediction</u>	<u>(1)</u>	<u>(2)</u>	<u>(3)</u>	<u>(4)</u>
Constant	?	0.820‡ (7.03)	0.531‡ (5.6)	0.530‡ (5.59)	0.441‡ (3.12)
$\Delta ShoIntQ_t$?	0.454‡ (2.58)	0.414† (2.50)	0.423† (2.55)	0.878† (2.03)
$\Delta Repurchase_t$	-			-0.002 (1.67)	-0.003 (1.55)
Rank of BTM_{t-1}	-		-0.078‡ (14.96)	-0.078‡ (14.96)	-0.090‡ (8.18)
Rank of $AbReturn_t$	+		0.046‡ (15.71)	0.046‡ (15.63)	0.047‡ (7.18)
$AbReturn_{t+1,t+4}$	-		-0.025† (2.00)	-0.025† (2.00)	-0.024 (1.25)
ΔROA_t	-		0.106 (0.99)	0.109 (1.01)	0.301† (2.01)
$QOpGnt_t$	+		-0.119 (0.41)	-0.117 (0.4)	0.830† (2.43)
Rank of $Size_{t-1}$	+		0.004‡ (16.86)	0.004‡ (16.86)	0.004‡ (12.45)
Rank of $PctOperAccrual_{t-1}$	+		0.000 (1.38)	0.000 (1.39)	0.000‡ (4.14)
Industry Dummies		Yes	Yes	Yes	Yes
Time Dummies		Yes	Yes	Yes	No
Cluster on		Firm	Firm	Firm	Firm and Time
Number of Observations		17,459	17,459	17,459	17,459
Cragg-Uhler(Nagelkerke) R^2		0.094	0.263	0.263	0.263
Log Likelihood		13066	11701	11700	11700
McFadden's Adj. R^2 :		0.039	0.138	0.138	0.138

† and ‡ indicate one-tailed statistical significance at 5% and 1% levels, respectively, with t-value below the coefficient in parentheses. The variables are constructed as described in Table 2.

TABLE 8
Current and Future Returns when
Insiders and Shorts Sellers Trade Together

Panel A. Insiders and Shorts Buy Stock

Beginning of Quarter Short Interest Quintile	Current Quarter Raw <u>Return</u>	One-Quarter- Ahead Raw <u>Return</u>	Two-Quarter- Ahead Raw <u>Return</u>
1 (Low)	-7.41% ‡ <i>(407)</i>	-2.26%* <i>(407)</i>	-1.28% <i>(407)</i>
2	-6.51% ‡ <i>(357)</i>	-0.40% <i>(357)</i>	3.71%* <i>(357)</i>
3	-13.41% ‡ <i>(298)</i>	-6.55% ‡ <i>(298)</i>	-0.03% <i>(298)</i>
4	-10.16% ‡ <i>(367)</i>	-2.30%* <i>(367)</i>	2.81% <i>(367)</i>
5 (High)	-12.07% ‡ <i>(395)</i>	-1.77% <i>(395)</i>	2.98% <i>(395)</i>
Average	-9.78% ‡ <i>(1,824)</i>	-2.50% ‡ <i>(1,824)</i>	1.65%* <i>(1,824)</i>

Panel B. Insiders and Shorts Sell Stock

Beginning of Quarter Short Interest Quintile	Current Quarter Raw <u>Return</u>	One-Quarter- Ahead Raw <u>Return</u>	Two-Quarter- Ahead Raw <u>Return</u>
1 (Low)	16.68% ‡ <i>(776)</i>	0.53% <i>(776)</i>	2.26%* <i>(776)</i>
2	8.28% ‡ <i>(1,849)</i>	0.98% † <i>(1,849)</i>	1.42% † <i>(1,849)</i>
3	6.93% ‡ <i>(2,054)</i>	0.45% <i>(2,054)</i>	1.54% † <i>(2,054)</i>
4	7.78% ‡ <i>(1,777)</i>	0.62% <i>(1,777)</i>	0.32% <i>(1,777)</i>
5 (High)	5.05% ‡ <i>(1,481)</i>	-0.26% <i>(1,481)</i>	-1.04% <i>(1,481)</i>
Average	8.04% ‡ <i>(7,937)</i>	0.49% † <i>(7,937)</i>	0.83% † <i>(7,937)</i>

† and ‡ indicate two-tailed statistical significance at 5% and 1% levels, respectively. In parentheses and italics, we report the average number of firms per quarter in each portfolio. The number of firms differs by short interest quintile because quintiles are based on the full sample.