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When and How Are Rule 10b5-1 Plans Used for Insider Stock Sales?*

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Abstract

SEC Rule 10b5-1 plans are intended to limit the ability of insiders to trade opportunistically. We study insider stock sales by CEOs both under and outside of these plans. While both groups exhibit opportunism, this behavior is more limited in plan sales and non-plan sales in well-governed firms. Furthermore, opportunism in plan sales is greater for transactions representing a larger fraction of the CEO's firm-related wealth. CEOs can circumvent the intent of Rule 10b5-1 by exercising their discretion over financial reporting and real earnings management and appear to benefit from material nonpublic information by selectively cancelling plans or using limit orders.

Keywords: Insider trading, 10b5-1 plan, Corporate governance

JEL classification: G14, G34, G38, K22

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Abstract

SEC Rule 10b5-1 plans are intended to limit the ability of insiders to trade opportunistically. We study insider stock sales by CEOs both under and outside of these plans. While both groups exhibit opportunism, this behavior is more limited in plan sales and non-plan sales in well-governed firms. Furthermore, opportunism in plan sales is greater for transactions representing a larger fraction of the CEO's firm-related wealth. CEOs can circumvent the intent of Rule 10b5-1 by exercising their discretion over financial reporting and real earnings management and appear to benefit from material nonpublic information by selectively cancelling plans or using limit orders.

When and How Are Rule 10b5-1 Plans Used for Insider Stock Sales?

“[Securities and Exchange Commission Chairman Jay Clayton] called for a “cooling-off period” for so-called 10b5-1 plans, which allow company executives to sell stock at a predetermined time—even if they are in possession of important nonpublic information—without exposing themselves to insider-trading charges.

The system has come under scrutiny in recent weeks as executives at Pfizer Inc., Moderna Inc. and other drug companies have sold millions of dollars in shares around the same time their firms have announced key results of Covid-19 vaccine trials.”

Source: *The Wall Street Journal*, November 17, 2020¹

1. Introduction

In October 2000, the Securities and Exchange Commission (SEC) enacted Rule 10b5-1, which provides corporate insiders at public firms with an affirmative defense against allegations of trading on material non-public (inside) information when they buy or sell their firm’s shares. Under Rule 10b5-1, insiders establish trading plans through which they schedule the purchase or sale of a predetermined number of shares through one or more trades with an independent third-party broker up to two years in advance. Insiders are presumed less likely to be acting on inside information regarding the value of their firms’ shares when they schedule trades in advance than when they do not.

The cooling-off period proposal by SEC Chairman Jay Clayton in November 2020 reflects a concern by the SEC, including Chairman Clayton’s successor, Chairman Gary Gensler,² that some insiders are trading shares opportunistically even within the Rule 10b5-1 framework.

¹ See “SEC Chairman Urges Corporate Insiders to Avoid Quick Stock Sales,” Wall Street Journal, November 17, 2020 (<https://www.wsj.com/articles/sec-chairman-urges-corporate-insiders-to-avoid-quick-stock-sales-11605637892?mod=djemCFO>).

² See “SEC Floats Rules to Shore Up Money Markets, Curb Insider Trading,” Wall Street Journal, December 15, 2021 (<https://wsj.com/articles/sec-floats-money-market-fund-rules-to-deter-investor-runs-11639579017>), for an example of Chairman Gensler’s perspective on Rule 10b5-1 plans.

Jagolinzer (2009), Hugon and Lee (2016), Mavruk and Seyhun (2016), and Mitts (2020), among others, report evidence of such opportunistic behavior. However, the extent to which insiders trade opportunistically within Rule 10b5-1 plans, the mechanisms that facilitate opportunistic trading, and the cost of such trading to other stockholders are important issues not yet well understood.

This study provides new insights on the impact of Rule 10b5-1 plans for a sample of 13,930 stock sales by 1,629 CEOs at 1,322 different public firms during the 2013 to 2020 period. Of these stock sales, 8,554 are identified in SEC Form 4 filings as executed through Rule 10b5-1 plans.

Executing a stock sale through a Rule 10b5-1 plan is endogenous because the selling CEO chooses whether to sell through a plan. To better understand the nature of this choice, we first investigate predictors of Rule 10b5-1 plan usage and find that firm, transaction, and CEO characteristics differ between Rule 10b5-1 plan sales and non-plan sales. Firms whose CEO sells through a Rule 10b5-1 plan exhibit greater litigation risk, higher growth opportunities (as reflected in Tobin's q), and higher recent return volatility than firms whose CEOs do not sell through plans.

Plan sales are also more likely when a firm has a higher Bebchuk, Cohen, and Ferrell (2009) entrenchment index, when 50 percent or more of the directors join the board after the current CEO takes office, and when the board has a larger proportion of independent directors.

Furthermore, plan sales tend to involve a smaller percentage of the firm's outstanding shares than non-plan sales, tend to have a transaction value that represents a smaller fraction of the CEO's firm-related wealth, and tend to occur when the CEO is less than 62 years of age.

Consistent with Hugon and Lee (2016), we also find that the decision to sell shares through a Rule 10b5-1 plan is influenced by the timing of the transaction relative to the release of value-relevant financial information. A plan sale is more likely to occur during the 40 trading days *before* a quarterly earnings announcement and less likely during the 40 days *after* such an announcement.

This pattern is consistent with CEOs choosing to trade under plans when the likelihood of being accused of trading on material non-public information is greater. It is also consistent with CEOs using plans to sell their shares during corporate trading blackout periods, which typically prohibit trading before earnings announcements.

We also examine whether the profitability of CEO stock sales varies with plan use. In this analysis, we first compare the average cumulative abnormal return (CAR) during the 40 trading days leading up to a stock sale and the average CAR during the following 40 trading days for both plan and non-plan sales. As illustrated in Figure 1, and consistent with Mitts (2020), the average CAR plots for both plan and non-plan sales exhibit an inverted “V” shape that is associated with opportunistically timed stock sales in other contexts (see, for example, Yermack; 2009).

While both plan and non-plan sales exhibit the inverted “V” shape, we find that non-plan sales are, on average, preceded by a larger average price run-up (3.40 percent versus 1.12 percent average CAR) and followed by a larger average price decline (-2.28 percent versus -1.02 percent average CAR) than plan sales. These differences are consistent with greater opportunistic behavior by CEOs who sell outside of Rule 10b5-1 plans and inconsistent with evidence reported by Mavruk and Seyhun (2016) that the profitability of plan sales is similar to that of non-plan sales. These differences persist when we use propensity score matching methods to account for potential under-reporting of plan sales that might arise because the SEC does not require that all insiders disclose whether they trade through a Rule 10b5-1 plan, and when we limit the analysis to restricted stock sales, for which disclosure of a Rule 10b5-1 plan is required.

Although the level of opportunistic behavior we observe for plan trades is less than that for non-plan trades, it is still significant. The 1.12 percent average CAR over the 40 days leading up to plan sales and the -1.02 percent average CAR over the 40 days following plan sales are both

statistically different from zero at the 1 percent level. Also, examination of the timing of plan sales suggests that transaction dates are deliberately chosen to increase the absolute value of the gains from the trades.

While the overall level of opportunistic behavior is smaller for plan sales than for non-plan sales, the level of opportunism associated with plan sales is relatively large when we focus on sales in which the CEO has a lot of money at stake. In this analysis, we define high *CEO incentive* stock sales as the 25 percent of sales with the largest transaction value relative to the CEO's firm-related wealth, where firm-related wealth is the total value of the CEO's equity and option portfolios measured as in Coles, Daniel, and Naveen (2006, 2013).

When we consider only high *CEO incentive* stock sales, both plan and non-plan sales exhibit larger increases in pre-sale and larger decreases in post-sale average CARs. The average CAR during the 40 trading days *before* a high *CEO incentive* sale is 4.03 percent for non-plan sales and 1.98 percent for plan sales. For this same sub-sample of high *CEO incentive* stock sales, the average CAR during the 40 trading days *after* the sale is -2.92 percent for non-plan sales and -2.94 percent for plan sales. Regression analyses also indicate that CEOs who have a lot of money at stake can trade opportunistically even if the transaction is executed under a Rule 10b5-1 plan.

We next investigate ways in which CEOs can circumvent the intent of Rule 10b5-1. Skaife, Veenman, and Wangerin (2013) show that ineffective internal control over financial reporting is related to the profitability of insider trading. Our analyses of accounting reporting reveal that disclosure quality at the selling CEO's firm tends to improve more during the fiscal year in which a Rule 10b5-1 plan sale takes place than during the fiscal year in which a non-plan sale occurs. However, consistent with the average CAR evidence, the improvement in disclosure quality for plan sales is smaller and more like that for non-plan sales if *CEO incentive* is high. Our results also

show that both non-plan sales and high *CEO incentive* plan sales are more likely to be timed to benefit the CEO or associated with opportunistic transaction-based earnings management.

We also report novel evidence on the elimination of planned Rule 10b5-1 sales. The elimination of a sale can be accomplished by cancelling the plan or by using a limit order within the plan. Both of these actions are permitted, but rarely disclosed, so we identify instances where a sale is likely to have been eliminated by using an approach similar to the one Cohen, Malloy, and Pomorski (2012) implement to detect routine insider trading. In contrast to the inverted “V” shape illustrated in Figure 1, the average CARs for sales we identify as likely to have been eliminated exhibit a normal “V” shape. The average CAR declines 1.32 percent during the 20 trading days leading up to the date of a likely eliminated sale and the average CAR increases 1.61 percent in the following 20 trading days. This pattern suggests that by cancelling a 10b5-1 plan or using limit orders, some CEOs benefit from inside information and avoid losses associated with stock price declines.

Finally, additional tests reveal less, but still significant, opportunism among Rule 10b5-1 plan sales and among non-plan sales in well-governed firms. Notably, however, the same tests also indicate that the governance mechanisms that we consider are not effective at limiting opportunistic behavior associated with high *CEO incentive* sales within plans.

This study contributes to the broad literature on the use of private information by insiders to personally benefit from trading their firms’ stock.³ It provides large sample empirical evidence

³ For example, Lorie and Niederhoffer (1968) report that corporate insiders often earn abnormal returns when trading their firms’ shares. Research on this area shows that insider trades predict both abnormal stock returns (Jaffe, 1974; Finnerty, 1976b; Seyhun, 1986; and Lin and Howe, 1990) and operating performance (Finnerty, 1976a). More recently, Usman and Hirshleifer (2017) find that a value-weighted trading strategy based on trades of opportunistic insiders earns monthly four-factor alphas of more than 1 percent. Other studies report evidence on, or model insider trading around specific corporate events, including bankruptcy (Gosnell, Keown, and Pinkerton, 1992), takeovers (Agrawal and Nasser, 2012), corporate sell-offs (Hirschey and Zaima, 1989), and capital expenditures (John and Mishra, 1990). Within this literature there is evidence consistent with the views of Maine (1966) and Carlton and Fischel (1983) that stockholders benefit from insider trading because such trading helps improve the accuracy of stock

on predictors of Rule 10b5-1 plan use and on the differences between insider stock sales executed under such plans and those not executed under such plans.

We advance the literature on the effectiveness of external control mechanisms, specifically regulatory procedures, in limiting opportunistic trading by insiders.⁴ Moreover, we add to the literature on the effectiveness of internal governance mechanisms by providing evidence on the relations between governance characteristics and returns from insiders' stock sales.⁵ We also report evidence on how top managers use their discretion over financial reporting and real earnings management, as well as their ability to cancel plans and use of limit orders, to sidestep the intent of Rule 10b5-1.

Our findings complement recent studies of Rule 10b5-1 plans by Hugon and Lee (2016), Mavruk and Seyhun (2016), Bonaimé, Harford, and Moore (2020), and Mitts (2020), as well as recent work by Kallunki, Kallunki, Nilsson, and Puhakka (2020) who show that managerial wealth is correlated with the decision to engage in opportunistic insider trading. Also, the evidence we report on the cancellation of plans and the use of limit orders is consistent with the theoretical prediction by Lenkey (2019) that eliminating the cancellation of pre-planned trades in Rule 10b5-1 plans would increase the welfare of uninformed outside investors.

The rest of this paper proceeds as follows. Section 2 describes the data, Section 3 presents

prices. For example, Meulbroek (1992) finds that market participants detect the possibility of informed trading and reflect this information in the prices at which they trade shares. Rozeff and Zaman (1998) find that insider buying also is greater after low stock returns. In a study of the 1982 Anheuser-Busch acquisition of Campbell Taggart, Cornell and Sirri (1992) find that private information was incorporated into Campbell's stock through insider trading. Marin and Olivier (2008) show that, while insiders' share sales peak many months before a large drop in the stock price, insiders' share purchases peak only the month before a large increase.

⁴ See, for example, Jaffe (1974), Seyhun (1992), Bettis, Coles, and Lemmon (2000), Bhattacharya and Daouk (2002), Roulstone (2003), Bushman, Piotroski, and Smith (2005), Jagolinzer (2009), Jagolinzer, Lareker, and Taylor (2011), Thevenot (2012), Billings and Cedergren (2015), Dai, Parwada, and Zhang (2015), Henderson, Jagolinzer, and Muller (2015), Kepler, Lareker, Tayan, and Taylor (2020), and Lareker, Lynch, Quinn, Tayan, and Taylor (2021).

⁵ See, for example, Fama (1980), Jensen and Meckling (1976), Hermalin and Weisbach (1998), and Harris and Raviv (2008) on internal governance mechanisms.

the empirical analyses, and Section 4 concludes.

2. Data

We collect data on stock sales by CEOs during the 2013 through 2020 period from the Thomson Financial Insider Filing database (hereafter, TFN). Our sample period begins in 2013 because TFN's coverage of trades executed under Rule 10b5-1 plans begins in that year. TFN reports the existence of Rule 10b5-1 plans that corporate insiders disclose with ownership changes in SEC Form 4 and Form 144 filings. We use disclosures in Form 4 filings to construct our main sample and use those in Form 144 filings to augment the sub-sample of restricted share sales used in robustness tests. The TFN database is organized into two distinct sections. Section 1 includes stock trades and Section 2 contains derivative transactions. Our sample is drawn from Section 1.

To identify stock sales by CEOs, we use the following procedure. First, in Section 1 of TFN we require "trancode", "acqdisp", and "rolecode" to be "S" (for sales), "D" (for disposition), and "CEO" (for Chief Executive Officer), respectively. To ensure data quality, we only retain transactions that have a "cleanse" code of "R" (data verified through the cleansing process) or "H" (cleansed with a very high level of confidence). We then aggregate all sales by a CEO on the same day at the same selling price into a single transaction. We exclude trades in which, at the time of the stock sale, the firm has already received an acquisition bid (covered by Thomson's SDC Platinum Merger and Acquisition database) that is subject to completion. We further require data on CEO compensation and corporate governance to be available from Execucomp and Institutional Shareholder Services (ISS, formerly RiskMetrics), respectively. This procedure results in a sample of 13,930 stock sales by 1,629 CEOs at 1,322 different firms.

We obtain stock price data from the Center for Research in Security Prices (CRSP) and accounting information from the Standard and Poors' Compustat (Compustat) databases.

Consistent with other Rule 10b5-1 plan studies, our sample includes only open market stock sales.⁶ We do not include open market purchases of shares by CEOs because purchases are less common, less likely to be executed through a Rule 10b5-1 plan, and are likely to involve a much smaller dollar amount. Indeed, in contrast to the 13,930 sales in our final sample, there are only 1,864 open market purchase transactions by CEOs that satisfy our data requirements in the 2013 through 2020 sample period. Furthermore, while we identify 61.4 percent (8,554 of 13,930) of the sales as Rule 10b5-1 plan transactions, only 6.9 percent (128 of 1,864) of the purchases are identified as plan transactions. Also, among the Rule 10b5-1 plan transactions, the median dollar value of a sale is approximately 16 times the median value of a purchase (\$811 thousand vs. \$50 thousand). The small dollar amounts involved with typical stock purchases provide considerably less incentive for CEOs to engage in opportunistic behavior.

Table 1 reports descriptive statistics for our sample. It shows that the selling CEOs work at firms that tend to be relatively large, profitable, and have moderate leverage (although there is considerable cross-sectional variation in these characteristics). Also, the typical transaction involves the sale of 15 thousand shares, representing 0.019 percent of the firm's total outstanding shares and an aggregate value of \$0.930 million.

---- Insert Table 1 here ----

CEO stock sales tend to follow a recent increase and precede a decline in the market value of the firm's shares. The average CAR during the 40 trading days before (after) the stock sale is 1.971 percent (-1.527 percent). We calculate all CARs using a market model with a one-year estimation period that ends 41 trading days before the reported stock sale date using the CRSP

⁶ See, for example, Jagolinzer (2009), Henderson, Jagolinzer, and Muller (2015), Hugon and Lee (2016), Mitts (2020), and Larcker, Lynch, Quinn, Tayan, and Taylor (2021).

value weighted return as the benchmark.

The percentage of plan sales in our sample, 61.4 percent, is consistent with that reported by Gibson (2019), who states that more than 50 percent of S&P 500 companies now have executives who use Rule 10b5-1 plans. However, it is worth emphasizing that because disclosure of the existence of a Rule 10b5-1 plan is voluntary in SEC Form 4 filings, the 61.4 percent value represents a lower bound on the percentage of plan sales in our sample. We investigate the importance of the absence of mandatory Rule 10b5-1 disclosure in Section 3.⁷

Our sample CEOs own a median (mean) of 0.448 percent (2.018 percent) of their firm's common stock at the end of the fiscal year immediately before the stock sale. The mean ownership is comparable the corresponding CEO equity ownership levels of 2.8 percent and 3.3 percent reported by Kim and Lu (2011) and Coles, Lemmon, and Meschke (2012), respectively.

The size of the typical transaction is relatively small compared with the CEO's compensation and firm-related wealth.⁸ The median dollar value, \$0.930 million, represents approximately 15 percent of the typical CEO's most recent annual compensation of \$6.027. Furthermore, the median (mean) percentage of shares owned by the CEO that are sold, 0.043 percent (1.425 percent), represents only a modest fraction of the CEO's holdings. Finally, the typical transaction value also equals only a modest fraction of the CEO's total firm-related wealth. This fraction, labeled *CEO incentive* in Table 1, has a median (mean) value of 0.026 (0.104).

Our estimates of firm-related wealth are consistent with those reported by Chu, Faasse, and Rau (2018). For the 2006 through 2012 period, they report that the mean natural logarithm of the

⁷ Insiders are required to report on Form 144 whether the sale of restricted stock is executed under a Rule 10b5-1 plan, but these sales represent only 20.2 percent of our total sample. Within our sample, 55.8 percent of the sales involving restricted shares (1,572 of 2,818 restricted share sales) are identified as Rule 10b5-1 sales.

⁸ Following Coles, Daniel, and Naveen (2006, 2013), we calculate the CEO's firm-related wealth as the sum of the value of her stock portfolio and the value of all her outstanding options.

CEO's firm-related wealth (in thousands of dollars) is 9.768 at firms with compensation consultants and 10.033 at firms without such consultants. By comparison, the corresponding value for our sample is 10.664 over the 2013 through 2020 period.

Table 1 also presents statistics on corporate governance characteristics. It shows that 44.0 percent of the CEOs also chair their respective boards, and that 35.8 percent of the sample firms have a classified board in which director service terms are staggered. Bernile, Bhagwat, and Yonker (2018) find that, on some dimensions, higher board diversity is associated with lower stock price volatility and better firm performance. Motivated by this finding, we construct a board diversity measure and find that 61.2 percent of the boards in our sample have at least one female director and at least one ethnic minority director. Also, following Coles, Daniel, and Naveen (2014), we label 70.9 percent of the boards as coopted because at least 50 percent of their directors are appointed after the incumbent CEO takes office. We classify directors who are not current or former employees or consultants to the company, or related to a senior company executive, as independent. The median (mean) percentage of independent directors is 81.8 percent (80.2 percent). Finally, the median (mean) Bebchuk et al. (2009) entrenchment index value for the firms in our sample is 4.000 (4.090).

3. Empirical analyses

3.1. Predictors of Rule 10b5-1 plan adoptions for CEO stock sales

3.1.1. Evidence for all sales

While a Rule 10b5-1 plan can provide an “affirmative defense” against allegations of trading on inside information, as many as 38.6 percent of the sales in our sample (the complement of the 61.4 percent identified as plan sales in Table 1) are executed outside of a plan. This suggests that there are costs associated with using a plan that can offset the benefits. We first investigate

predictors of Rule 10b5-1 plan sales by estimating the logit and ordinary least squares (OLS) models reported in Table 2. The key dependent variable in these models is an indicator that equals one for Rule 10b5-1 plan sales and zero otherwise.

---- Insert Table 2 here ----

A primary reason a CEO would choose to sell shares through a Rule 10b5-1 plan is to reduce litigation risk. To account for such risk, we estimate the firm-level litigation risk for each observation in our sample as the probability that a class action suit will be filed against the firm in the year of the stock sale. We do this by first using data from all the observations in our sample to estimate the logit model proposed by Kim and Skinner (2012) for assessing firm litigation risk (Model 3 in their Table 7). We then use the coefficients from this model to obtain a probability estimate for each observation. These probability estimates, which have a value between 0 and 1, enable us to control for each firm's litigation risk in the models we report in Table 2.

As expected, the results in Table 2 indicate that firm litigation risk is positively related to the likelihood that a stock sale is executed through a Rule 10b5-1 plan. Other firm financial, stock, and governance characteristics also differ significantly between firms in which CEO stock sales are executed under a Rule 10b5-1 plan and firms in which they are not. Specifically, firms with plan sales tend to have more growth opportunities, as reflected in a higher *Tobin's q*. To the extent that higher growth opportunities reflect higher uncertainty regarding future cash flows, this might indicate that plan protections are more important when there is more uncertainty about the value of the firm's shares. The significant positive coefficient for *stock return volatility* in Models 1 and 2 suggest a similar interpretation related to uncertainty. Moreover, if greater uncertainty about share value signals a higher likelihood of a lawsuit, the coefficients for *Tobin's q* and *stock return volatility* might be capturing elements of litigation risk that the litigation risk measure is not.

With regards to firm governance characteristics, a larger entrenchment index (excluding the board classification indicator), the presence of a coopted board, and a larger fraction of independent directors are also associated with a higher likelihood of plan use.

Table 2 also shows that plan sales tend to represent a smaller proportion of the firm's outstanding shares and have a lower aggregate value, relative to the CEOs' firm-related wealth (*CEO incentive*). This suggests that a Rule 10b5-1 plan is more likely to be used when the CEO sells shares on a regular basis and has less value at stake from the outcome of any given sale.

The CEOs that report plan sales are less likely to chair their boards or to be close to retirement age. The higher likelihood of plan use by younger CEOs might reflect greater career concerns among those executives if the value of the protection afforded by trading under a plan is positively related to the CEO's horizon. As Brickley, Linck, and Coles (1999) note, career concerns, both internal and external, are greater for younger managers.

In Models 3 and 4 of Table 2, we also examine whether the timing of earnings announcements and changes in the quality of accounting disclosures and accruals affect the choice between plan and non-plan sales. If a Rule 10b5-1 plan provides protection from insider trading accusations, CEOs who can choose whether to use a plan should be more likely to do so when they sell shares shortly before new value-relevant information is revealed to the market. One indicator of the release of such information is whether the quarterly earnings deviate from analyst expectations. In Models 3 and 4 of Table 2 we include indicator variables for positive and negative earnings surprises, where the surprises are computed as the difference between the quarterly earnings announced by the firm and the security analyst consensus estimate from the IBES database. We distinguish between positive and negative surprises both before and after the stock sale by the CEO.

The estimates for the earnings surprise indicators in Models 3 and 4 indicate that a CEO is more likely to sell shares through a Rule 10b5-1 plan if the trade is executed prior to an earnings surprise, whether that surprise is positive or negative. This is consistent with CEOs selling under plans during blackout periods and when the likelihood of being accused of trading on material non-public information is greater. In contrast, Models 3 and 4 indicate that a Rule 10b5-1 plan sale is less likely if it follows a positive or negative earnings surprise. These results add to the findings by Hugon and Lee (2016) that plan sales are more likely before disappointing earnings.

We also estimate Models 3 and 4 in Table 2 using indicator variables based on the two-day CAR around the earnings announcement instead of the earnings surprise indicators. The results from these models, which are not tabulated in the interest of brevity, are consistent with those for the earnings surprise indicators. Plan sales are more likely before and less likely after earnings announcements that produce statistically significant CARs (both positive and negative).

We include the *change in accounting disclosure quality* in the year of the sale in Models 3 and 4 in Table 2 to investigate whether the decision to trade within a plan is related to such changes. Veliotis (2010) discusses incentives that insiders have to misrepresent financial statements or other aspects of a business shortly before Rule 10b5-1 plan sales. Here we use the method in Chen, Miao, and Shevlin (2015) to estimate disclosure quality as the number of non-missing Compustat items, with a smaller number representing lower disclosure quality. We expect that a decline in accounting disclosure quality might reflect efforts by the CEO to reduce transparency and that such efforts are more likely when the CEO sells shares outside of a Rule 10b5-1 plan. The estimates in Models 3 and 4 weakly support this conjecture, with both coefficients for the *change in accounting disclosure quality* having a positive sign, but with only one having statistical significance at the 10 percent level.

Finally, Models 3 and 4 in Table 2 include the *change in accounting accruals* in the year of the sale. This measure is computed using the modified Jones (1991) method proposed by Dechow, Sloan, and Sweeney (1995), from the fiscal year prior to the stock sale to the fiscal year in which the sale takes place. We include it to investigate whether a decline in accruals, which can signal a decline in firm performance, might prompt a CEO to trade under a plan. The coefficients for the *change in accounting accruals* variable are insignificantly different from zero.

3.1.2. Evidence for restricted stock sales

CEOs are not required to disclose on SEC Form 4 whether they sell under a Rule 10b5-1 plan. Consequently, the number of plan sales in our full sample represents a lower bound on the actual number of such trades. To evaluate the possible impact that plan misclassification might have on our findings, we replicate our analyses using only the restricted stock sales in our sample. Because CEOs are required to disclose on SEC Form 144 whether they sell restricted stock under a Rule 10b5-1 plan, we can more confidently classify plan sales within the sub-sample of restricted shares.

To construct this sub-sample, we first obtain data for all Form 144 filings during the 2013 through 2020 period from TFN. We then match these filings with our full sample to identify which of the 13,930 CEO stock sales involve restricted shares. This matching process reveals that CEOs sell restricted shares in 2,818 (20.2 percent) of the sample transactions and that 1,572 (55.8 percent) of these sales occur under a Rule 10b5-1 plan.

In untabulated analyses, we use the restricted share sub-sample to replicate the analyses reported in Table 2 for the full sample of 13,930 sales. These replications yield results that are qualitatively similar to those in Table 2. For example, the coefficients for *firm litigation risk* and *Tobin's q* are positive and significant at the 5 percent level or higher in all four models, as are the

estimates for *stock return volatility*. It is worth noting that the coefficients for *stock return volatility* exhibit even greater statistical significance with the restricted share sub-sample than with the full sample in that these coefficients are only statistically significant in Models 1 and 2 of Table 2 for the full sample. For the restricted share sub-sample, the results for the firm governance, transaction, and CEO characteristics, as well as those for the announcements/disclosure variables, are also consistent with those in Table 2.⁹

3.2. Stock performance around CEO stock sales

3.2.1. Stock performance for Rule 10b5-1 plan sales vs. non-plan sales

The plots for sub-samples of plan and non-plan sales in Figure 1 show that both the average increase in CAR over the 40 days leading up to the sale and the average decrease in CAR during the 40 days following the sale are greater for non-plan sales than for plan sales.

---- Insert Figure 1 here ----

For non-plan sales there is an average abnormal stock price increase of 3.40 percent before the sale and an average decline of 2.28 percent after the sale. In contrast, the plot for plan sales shows an average abnormal stock price increase of 1.12 percent before the sale and a 1.02 percent decline after the sale. The relative magnitudes of the changes in the two plots suggest that, on average, there is less opportunistic behavior around Rule 10b5-1 plan stock sales.

While the differences in average CARs are informative, it is also worth noting that, across our entire sample, the average unadjusted market capitalization for the selling CEO's firm increases from \$24.57 billion on day -40 to \$25.06 billion on day -1, relative to the stock sale. It

⁹ Full details of the restricted share sample estimates are not presented in the interest of brevity but are available from the authors upon request.

then declines over the following 40 days, to \$24.75 billion.

Panel A of Table 3 presents multivariate evidence that the differences in average CARs illustrated in Figure 1 are statistically significant. The significant negative coefficient for the *10b5-1 plan* indicator variable in Model 1 indicates that the CAR over the 40 days prior to the stock sale still tends to be significantly lower for plan sales than for non-plan sales when we control for firm and transaction characteristics and year and industry fixed effects. Likewise, the significant positive coefficient for *10b5-1 plan* in Model 2 indicates that the CAR over the 40 days after the stock sale declines less for plan sales than for non-plan sales. Both coefficients are consistent with the univariate evidence in Figure 1, that non-plan sales are associated with a larger run-up in CAR prior to the sale and a larger decline in CAR following the sale than plan sales.

---- Insert Table 3 here ----

3.2.1.1. Are the firms and CEOs with Rule 10b5-1 plans different?

One potential concern with the CAR evidence is that both the firms and the CEOs for which we observe share sales under Rule 10b5-1 plans are inherently different from other firms and their CEOs. The evidence in Table 2, that several firm and CEO characteristics differ significantly according to plan usage, suggests this possibility.

To investigate whether a selection problem might be driving the evidence in Figure 1 and Panel A of Table 3, we use propensity score matching tests to estimate an average treatment effect (ATE) of Rule 10b5-1 plans on the returns that occur around stock sales. For each sale in the treatment group (those executed under a Rule 10b5-1 plan), we first identify a control sale based on a propensity score we estimate using Model 3 in Table 2. This provides us with a control group of sales that exhibit firm and CEO characteristics similar to those in the treatment group.

Next, we use the control group to obtain propensity scores following Abadie and Imbens (2008) and estimate confidence intervals with a matching estimator that uses a Gaussian kernel with 500 bootstrap repetitions. Because the matching occurs jointly on multiple variables, the treatment and control samples do not exhibit the same size for all matched characteristics. Thus, in this analysis we also use nearest-neighbor one-to-one matching without replacement, and nearest-neighbor one-to-three matching with replacement.

Panel B in Table 3 reports the results from the propensity score matching tests evaluating differences in the average CAR accruing during both the 40 days before and the 40 days after a CEO stock sale. The ATE estimates from all three matching procedures indicate that, on average, CARs are significantly lower before and higher after a stock sale in the Rule 10b5-1 treatment group. These patterns, which are consistent with those in Panel A, alleviate the concern that selection might be driving our findings.

3.2.1.2. Evidence from restricted stock sales

In Panel C of Table 3, we use only the sub-sample of restricted stock sales to estimate the two regressions similar to those in Panel A. The coefficients from these estimates are very much like those for the full sample, with similar magnitudes and significance levels. For example, the results in Panel C show that with the restricted share sub-sample, the coefficients for the *10b5-1 plan* indicator in Models 1 and 2 have the same sign and are close in magnitude and significance to those in Panel A (-0.0168 versus -0.0176 for Model 1 and 0.0091 versus 0.0081 for Model 2).

To conserve space, Panel C does not report the coefficient estimates for our control variables in the restricted share regressions. However, we note that the coefficients for *ln(Transaction value)*, *ln(Market value of the firm's equity)*, and *Prior 40-day abnormal return*, are all significant with identical signs and similar magnitudes to those in Panel A in both models.

As in Panel A, the coefficient for *Tobin's q* is also positive in both models, but only significant in Model 2. The strong similarity of the results from the restricted share models adds to our confidence that plan misclassification does not materially affect the findings in Panel A.

3.2.1.3. Addressing possible trade misclassification with propensity score matching

Our reliance on voluntary disclosures by the selling CEOs to identify plan usage in the full sample implies that we might identify a stock sale as a non-plan sale either because there is no plan or because a plan exists, but the CEO does not disclose it. To investigate the robustness of our findings to under-reporting of plan usage, we perform a second propensity score matching analysis. In this analysis we use the specification in Model 3 of Table 2 to identify CEO stock sales not reported as executed within a plan, but that have characteristics similar to those disclosed as implemented within a plan. To obtain a high-quality matching result, with limited bias and close matches, we use the one-to-one matching method without replacement and set a narrow caliper of 0.00001. Through this process, we identify 557 non-plan trades that, according to Model 3 in Table 2, have characteristics similar to those of plan trades.

In Figure 2 we plot the average CAR over the 40 trading days leading up to every sale and the average CAR over the 40 trading days following every sale for the sample of 8,554 plan sales (the solid line), for the 557 sales identified through the matching process (the dotted line), and for the remaining 4,819 ($13,930 - 8,554 - 557 = 4,819$) non-plan sales (the dashed line). The similarity of the lines for the 557 matched sales and the other 4,819 non-plan sales suggests that misclassification of sales is unlikely to explain the evidence in Figure 1 and Panel A of Table 3. In fact, even if we treat all of the 557 matched sales as plan sales, the pre-sale and post-sale differences in average CARs for the 9,111 ($8,554 + 557 = 9,111$) plan sales and the 4,819 non-plan sales are both significantly different at the 1 percent level. The *t*-statistics for tests of the

differences are 11.40 for $CAR[t_{-40}, t_{-1}]$ and -6.57 for $CAR[t_{+1}, t_{+40}]$, respectively.

---- Insert Figure 2 here ----

3.2.2. The absolute level of abnormal profits from Rule 10b5-1 plan sales

The evidence to this point indicates that the abnormal profits from Rule 10b5-1 plan sales are smaller than those from non-plan sales, but it does not inform us about the significance of the profits from plan sales in an absolute sense. To investigate this issue, we first analyze the significance of the mean and median changes in CARs over the 40 trading days leading up to and the 40 trading days following the plan sales in our sample. Both the mean and median increases leading up to the sales (1.12 percent and 1.25 percent, respectively) and the mean and median decreases following the sales (-1.02 percent and -0.741 percent, respectively) are significantly different from zero with p -values of less than 0.001.

We also examine abnormal returns around falsified trading dates to obtain further evidence on the significance of the abnormal returns earned by CEOs who trade within Rule 10b5-1 plans. In this analysis, for each of the 8,554 plan trades in our sample, we first estimate the $CAR[t_{-40}, t_{-1}]$ and $CAR[t_{+1}, t_{+40}]$ for each of the 126 trading days (6 months) *before* and each of the 126 trading days (6 months) *after* the actual stock sale date. We then use these returns to calculate the total average CAR that the CEOs would have earned from selling their shares after $[t_{-40}, t_{-1}]$ but before $[t_{+1}, t_{+40}]$ (i.e., $CAR[t_{-40}, t_{-1}]$ minus $CAR[t_{+1}, t_{+40}]$). Finally, we plot the cumulative distribution function corresponding to the average total CAR for each of the 252 falsified trading dates.

Figure 3, which presents the distribution function plot, overlays a solid vertical line denoting the actual average CAR of 2.15% (which is close to the average actual $CAR[t_{-40}, t_{-1}]$ of 1.12 percent minus the average actual $CAR[t_{+1}, t_{+40}]$ of -1.02 percent). Among the falsified trading days during the year surrounding the actual date, only two dates exhibit an average total CAR that

is greater than the actual average total CAR. This 0.8 percent ($2/252 = 0.008$) incidence is like a pseudo p -value that rejects the hypothesis that the actual transaction date is random. This finding further indicates that CEOs are able to time stock sales to their benefit within Rule 10b5-1 plans.

---- Insert Figure 3 here ----

3.3. CEO incentives and stock price reactions around sales

We next investigate whether opportunistic selling by the CEOs in our sample varies with their financial incentives to engage in such behavior. Kallunki, Kallunki, Nilsson, and Puhakka (2020) find that less wealthy Swedish insiders are likely to behave more opportunistically when selling shares. Since we cannot directly observe the total wealth of the CEOs in our sample, we measure *CEO incentive* as the ratio of the *transaction value* to the CEO's firm-related wealth at the end of the fiscal year immediately preceding the sale. As shown in Table 1, the median (mean) value of *CEO incentive* is 0.026 (0.104) and there is quite a bit of cross-sectional variation in this measure, as indicated by the standard deviation of 0.310.

After computing *CEO incentive*, we partition our sample based on whether the sale is executed under a Rule 10b5-1 plan and find that *CEO incentive* is significantly greater for non-plan sales than for plan sales. The CEOs who trade outside of a plan have lower firm-related wealth relative to the value of the shares sold. Indeed, the mean *CEO incentive* values are 0.146 and 0.078 for non-plan and plan sales, respectively, with a t -statistic for a test of the difference equal to 11.69.

We next sort our total sample based on *CEO incentive* and create a sub-sample comprising the top quartile (3,483 observations) with the highest *CEO incentive*. This sub-sample contains 19.3 percent (1,648/8,554) of the plan trades and 34.1 percent (1,835/5,376) of the non-plan trades. The higher percentage in the non-plan sub-sample reflects the relatively high mean value for *CEO incentive* among the non-plan sales.

To assess whether high *CEO incentives*, as we measure them, prompt executives to behave opportunistically, in Figure 4 we plot average CARs around the stock sales in the top *CEO incentive* quartile for plan and non-plan transactions, respectively.

---- Insert Figure 4 here ----

While sales under Rule 10b5-1 plans exhibit less opportunism on average (as shown in Figure 1 and Panel A of Table 3), Chart 1 in Figure 4 indicates that this is not true when the CEO has a lot to gain from such behavior. The plots in this chart show that CEO stock sales under Rule 10b5-1 plans are preceded by a larger average increase in CAR and followed by a larger average decrease in CAR when *CEO incentive* is larger.

Chart 2 in Figure 4 indicates that high *CEO incentive* is also associated with greater opportunistic behavior in non-plan sales. However, the difference between the top-quartile and non-top-quartile *CEO incentive* sales is not as pronounced for non-plan sales as it is for plan sales.

Further examination of the charts in Figure 4 reveals that, even with high *CEO incentive*, the pre-sale increase in average CAR for plan trades (1.98 percent) is smaller than that for high *CEO incentive* non-plan trades (4.03 percent).¹⁰ However, the post-sale decline is approximately the same for high *CEO incentive* plan (-2.94 percent) and non-plan sales (-2.92 percent).

Overall, Figure 4 suggests that Rule 10b5-1 plans are associated with smaller gains from sales following stock price run-ups. However, for CEOs who have a lot at stake, the financial impact of opportunistic plan sales before stock price declines is comparable to that for non-plan sales. While strategic timing of sales might be more difficult under Rule 10b5-1 plans, CEOs who sell their shares under these plans are still able to behave opportunistically.

¹⁰ The pre-sale CAR for days -40 to -1 equals 1.98 percent for high *CEO incentive* sales in Chart 1. The maximum for this plot is greater than 2 percent because the day 0 average CAR is 2.35 percent.

Panel A in Table 4 reports multivariate tests of differences in average CARs around all CEO stock sales in our sample and around only Rule 10b5-1 plan sales. The results indicate that the average CAR before (after) high *CEO incentive* sales is significantly larger (smaller) than that for other plan sales. This further supports the conclusion that CEOs behave opportunistically even with plan sales, when they have a lot of money at stake.

---- Insert Table 4 here ----

The magnitudes of the coefficients in Models 3, 4, 7, and 8 in Panel A of Table 4 suggest that the impact of opportunism within plans is economically important when *CEO incentive* is high. For example, the coefficient of -0.0142 for the high *CEO incentive* indicator variable in Model 8 indicates that the mean dollar value of the decline in firm value is \$425.53 million (\$29,967 million mean market capitalization on day 0 for the sub-sample of plan sales \times -0.0142 = \$425.53 million) and the mean gain to the CEO from selling before the decline is \$39.4 thousand (\$2.776 million mean transaction value for the sub-sample of plan sales \times -0.0142 = \$0.0394 million). While the \$39.4 thousand loss avoidance equals only about 0.65 percent of the total pay for the median CEO in our sample, it is worth noting that in addition to the loss avoidance, CEOs also secure the gain accruing to the shares while they were held by the executive. As a result, the loss avoidance represents just a fraction of the monetary benefits that high incentive CEOs realize when they sell shares using a Rule 10b5-1 plan.

3.3.1. Omitted variable bias

To investigate the influence of potentially omitted unobservable correlated variables in Models 3, 4, 7, and 8 in Panel A in Table 4, we use the Impact Threshold of a Confounding Variable (hereafter ITCV) method from Frank (2000) and Larcker and Rusticus (2010). Panel B

of Table 4 reports the results from these analyses.

The ITCV method enables us to estimate the magnitude of the potential bias from an omitted variable that would invalidate the statistical inference for a variable of interest in an OLS model. This estimated bias depends on the partial correlation between the unobservable confounding variable and both the (i) dependent variable and (ii) independent variable of interest. The ITCV is the lowest product of the two partial correlations that causes the coefficient for the independent variable of interest to lose statistical significance. Therefore, the larger the ITCV the less vulnerable OLS results are to an omitted variable bias.

We also estimate impact scores for independent variables other than the variable of interest. The impact score is the product of the partial correlation between the variable of interest and the control variable and the correlation between the dependent variable and the control variable (partialling out the effect of the other control variables).

Consider, for example, the effect of the *CEO incentive* variable in Model 3 on $CAR[t-40, t-1]$ in the sub-sample of plan sales. The first column in Panel B reports the coefficients we obtain in Model 3. The second column reports the ITCV for the *CEO incentive* variable and the third column reports the impact score associated with the addition of each control variable on the coefficient for *CEO incentive*. A negative impact score implies that including the control variable makes the coefficient for *CEO incentive* more negative (less positive) while a positive impact score has the opposite effect.

To investigate whether the ITCV value suggests that the OLS results are weak, we use the control variables as a benchmark to estimate the size of the correlations necessary for an unobserved confounding variable to overturn the statistical significance of *CEO incentive*. In doing this, we note that the absolute value of the ITCV for *CEO incentive* in Model 3 is considerably

larger than the absolute value of the impact score for all control variables other than $\ln(\text{Transaction value})$. This suggests that a confounding omitted variable would have to exhibit a stronger impact score than those of all of the control variables, with the exception of $\ln(\text{Transaction value})$, in order to invalidate the results. The ITCV for High *CEO incentive* in Model 4 suggests a similar level of confidence in the significance of that variable as a predictor of $\text{CAR}[t_{-40}, t_{-1}]$. At the same time, the ITCV for *CEO incentive* and high *CEO incentive* in Models 7 and 8, respectively, would have to have an impact score that is greater than any of the control variables to invalidate the results for the $\text{CAR}[t_{+1}, t_{+40}]$.

Assuming that we have a good set of control variables and fixed effects, the ITCV analysis provides some assurance that the relation between *CEO incentive* and high *CEO incentive* and both $\text{CAR}[t_{-40}, t_{-1}]$ and $\text{CAR}[t_{+1}, t_{+40}]$ for plan sales is robust to an omitted variable bias.¹¹

The ITCV estimate for Model 4 in Panel B in Table 4 provides a similar level of assurance with regard to the effect of high *CEO incentive* on the $\text{CAR}[t_{+1}, t_{+40}]$ accruing to the sub-sample of Rule 10b5-1 plan stock sales.

3.3.2. Restricted share sales

Panel C of Table 4 presents regression estimates for the sub-sample of restricted stock sales. The results in Panel C are consistent with those in Panel A.

3.3.3. Self-selection in Rule 10b5-1 plan use

We next investigate whether low *CEO incentive* sales under Rule 10b5-1 plans exhibit less opportunism because the selling CEOs never intended to trade opportunistically, because they face

¹¹ It is important to note that, because the ITCV is negative for all models in Panel B of Table 4, in order to lower the statistical significance of the *CEO incentive* or high *CEO incentive* variable, the Impact score of any missing control variable must be positive. For this to happen, both partial correlations associated with the missing control must have the same sign, otherwise, the inclusion of such an omitted correlated variable would further improve the statistical significance of *CEO incentive* or high *CEO incentive*.

other restrictions that limit opportunistic trading, or because they choose to not behave opportunistically with small trades for other reasons. While we cannot directly observe CEO intentions, there is other evidence that informs us about them.

One possible explanation for the evidence that we observe among Rule 10b5-1 plan trades is that some high *CEO incentive* sales are executed within plans to obtain an affirmative defense, but that these sales are bundled with smaller, less consequential sales, to mask opportunistic behavior. We investigate this possibility as follows.

We first count the number of sales by each CEO in our sample and identify the CEOs who have at least one high *CEO incentive* trade. We then compare the mean (median) number of sales by these CEOs with the mean (median) number of sales by all other CEOs, depending on whether the CEO has at least one trade under a Rule 10b5-1 plan. As Figure 5 shows, CEOs with at least one high *CEO incentive* sale under a Rule 10b5-1 plan tend to trade more than those with at least one high *CEO incentive* sale not under a Rule 10b5-1 plan. Moreover, CEOs with at least one high *CEO incentive* sale not under a Rule 10b5-1 plan tend to trade more than those without any high *CEO incentive* sale not under a Rule 10b5-1 plan. Notably, CEOs with at least one high *CEO incentive* sale under a Rule 10b5-1 plan trade just as much as those without any high *CEO incentive* sales under a Rule 10b5-1 plan. The last result suggests that CEOs with high *CEO incentive* plan sales might be masking opportunistic behavior by trading at a similar frequency as CEOs who also use Rule 10b5-1 plans to sell their shares.

---- Insert Figure 5 here ----

3.4. Mechanisms that facilitate opportunistic behavior by CEOs

The evidence that we present to this point is not very specific regarding the nature of the opportunistic behavior that CEOs might engage in within a Rule 10b5-1 plan. There are a number

of actions that a CEO can take. For example, the CEO can manipulate the firm's share price through investment, operating, financing, and reporting choices, or through the timing of the release of value-relevant information. Even in the absence of such choices or releases, a CEO can profit if she has sufficient foresight regarding the resolution of existing uncertainty about the value of a firm's shares.

Many of the above actions are inherently difficult to observe, so we are limited in our ability to provide direct evidence on them. However, we can provide evidence on whether the quality of financial disclosures, earnings management choices, the timing of sales relative to earnings announcements, and the cancellation of plans or the use of limit orders facilitate the opportunistic behavior we document in Table 4. Moreover, we can also investigate the role of corporate governance in limiting opportunistic behavior associated with CEO stock sales.

3.4.1. Quality of accounting information disclosure around CEO stock sales

Table 5 reports tests on changes in the quality of financial statement disclosures from the fiscal year before the CEO stock sale to the fiscal year that includes that sale. As in Table 2, we use the method in Chen, Miao, and Shevlin (2015) to estimate *disclosure quality*.

---- Insert Table 5 here ----

The evidence in Panel A of Table 5, consistent with that in Table 2, indicates that disclosure quality improves more around Rule 10b5-1 plan sales than around non-plan sales. However, consistent with the CAR evidence in Figure 4 and Table 4, the improvement in disclosure quality among plan sales is also negatively related to *CEO incentive*. These findings are robust to whether we estimate the models in Table 5 using the full sample (Panel A) or the sub-sample of restricted stock sales (Panel B).

3.4.2. Timing of sales, accruals, and real earnings management

We also examine accounting accruals and real earnings management around the stock sales. Figure 6 illustrates the average year-to-year change in accruals in each of the four quarters before the quarter in which the stock sale takes place, in the quarter of the sale, and in each of the following four quarters. Quarterly accounting accruals are calculated, following Murphy and Zimmerman (1993), as quarterly net income minus cash flow. The x-axis of each chart indicates the quarter in which the accruals are measured, with the number 0 denoting the quarter in which the stock sale occurs, -1 denoting the quarter prior to quarter in which the sale occurs, and so on.

---- Insert Figure 6 here ----

Figure 6 shows the change in accruals for Rule 10b5-1 plan stock sales (Chart 1) and for non-plan stock sales (Chart 2). The shading of the bars in Charts 1 and 2 indicate whether, in each event-quarter, the year-to-year change in accruals around plan sales is significantly different from the changes in accruals around non-plan sales. According to the charts, the average year-to-year changes in accruals for quarters -3, -2, -1 and 0 are significantly larger for plan sales than for non-plan sales. This pattern is consistent with more aggressive accrual management by CEOs who sell through plans and have less flexibility to time their trades.

Charts 3 and 4 in Figure 6 illustrate the differences in changes in accruals for plan sales where *CEO incentive* is in the top quartile (Chart 3) and where *CEO incentive* is in the other three quartiles (Chart 4). The significant differences for quarters -3, -2, -1 and 0, suggest that CEOs who have a lot at stake with plan sales are likely to be even more aggressive in the management of their firms' accruals prior to the sale than other CEOs with plan sales.

Models 1 and 2 in Panel A of Table 6 present evidence from OLS regressions on differences in annual changes in accounting accruals between Rule 10b5-1 plan and non-plan stock sales. The

dependent variable in Model 1 is the change in discretionary accruals, computed using the modified Jones (1991) method, from the fiscal year prior to the stock sale to the fiscal year in which the sale takes place. The dependent variable in Model 2 is the one-year change in accruals computed using the method by Dechow and Dichev (2002).

---- Insert Table 6 here ----

From the fiscal year before the trade until the fiscal year in which the trade takes place, the coefficients for Models 1 and 2 show that discretionary accruals decline more for plan sales than for non-plan sales. In other words, accruals earnings management is higher during the year before the trade for plan sales.

In the same tests, the negative coefficients for the $10b5-1plan \times \ln(1 + CEO\ incentive)$ interaction term indicates that the decline in accruals-based earnings management is even greater when a CEO who trades under a plan has more money at stake. The latter result is consistent with the graphical evidence in Chart 3 of Figure 6. Specifically, that accruals tend to increase during the quarters before higher *CEO incentive* plan sales are executed.

Models 3, 4, and 5 in Panel A of Table 6 are OLS regressions similar to Models 1 and 2, but where the dependent variable is the change in a measure of real transaction-based earnings management, such as operating cash flow, production costs, and discretionary expenses, rather than accounting accruals. Consistent with the evidence in Models 1 and 2, the results in Models 3, 4, and 5 suggest that Rule 10b5-1 plan sales are associated with a larger decline in real activity management from the fiscal year before the sale to the fiscal year in which the sale takes place. This indicates that real transaction-based earnings management increases before plan sales. Furthermore, while real transaction-based earnings management is higher during the year before plan sales than before non-plan sales, it is even higher when *CEO incentive* is greater.

Estimating the models in Table 6 using only the restricted share sub-sample (reported in Panel B) yields results for the *10b5-1 plan* variable and the interaction of that variable with *CEO incentive* that are qualitatively similar to those for the full sample. However, the estimates for *CEO incentive* alone are all insignificantly different from zero.

Collectively, the evidence in Figure 6 and Table 6 suggests that some CEOs, particularly those with high incentives, exercise their discretion over financial reporting by influencing accruals and real activity-related disclosures in ways that weaken the impact of Rule 10b5-1 plan restrictions on the profitability of their stock sales.

3.4.3. Timing of sales and earnings announcements

Usman and Hirshleifer (2017) note that opportunistic insiders can be identified through the profitability of their trades *prior* to quarterly earnings announcements and Hugon and Lee (2016) consider the use of Rule 10b5-1 plans prior to disappointing earnings announcements.¹² Based on these studies, we investigate the extent to which CEO stock sales follow or precede positive or negative earnings surprises.

Table 7 reports statistics for earnings surprises and two-day CARs during the window (0,+1) around earnings announcements (i) that take place during the 40 trading days before the CEO stock sale and (ii) that take place during the 40 trading days after the CEO stock sale. Panel A reports evidence for the entire sample, partitioned based on whether the sale is executed under

¹² These studies suggest that we might expect CEO stock sales to occur more frequently immediately before negative earnings announcements. However, as Bettis, Coles, and Lemmon (2000) note, executives do not have complete discretion with regards to the timing of such sales. Insider trading policies developed by many public companies forbid trading by corporate officers during the period leading up to earnings announcements. In fact, Bettis, Coles, and Lemmon (2000) observe that these policies commonly disallow trading by insiders at all times except for period 3 to 12 trading days after a quarterly earnings announcement. Such policies would seem to limit the ability of CEOs to strategically time their sales. Moreover, a well-crafted insider trading policy that ensures that all insider trades comply with existing securities laws would limit the insiders' liability. Nevertheless, according to Kepler, Larcker, Tayan, and Taylor (2020), current SEC rules do not mandate disclosure of the insider trading policy, the existence of a Rule 10b5-1 plan, or whether an insider's trade conforms with such a plan.

a Rule 10b5-1 plan. The results show that both plan and non-plan sales are more likely to follow positive earnings surprises and to precede negative earnings surprises. While this implies that sales are timed both within and outside of plans, the results also suggest that opportunistically timed sales occur more frequently outside of plans. For example, while 56.30 percent of plan sales follow positive announcements, 62.91 percent of non-plan sales follow such announcements. This difference is statistically significant at the 1 percent level.

---- Insert Table 7 here ----

The announcement returns in Panel A in Table 7 show that the average two-day CAR for earnings announcements before both Rule 10b5-1 plan and non-plan sales is significantly greater than the corresponding average CAR for announcements after the sale. This finding further suggests that CEOs are selling opportunistically both within and outside of plans.

Panel B in Table 7 reports evidence from tests like those in Panel A for sub-samples of plan sales partitioned on *CEO incentive*. The results show that 56.22 percent of high *CEO incentive* sales precede negative earnings surprises while 48.58 percent of other plan sales precede negative earnings surprises. This finding is consistent with the earlier evidence that, even within Rule 10b5-1 plans, some CEOs behave opportunistically when they have a lot of money at stake by trading ahead of bad news. This interpretation is further supported by the significant negative average post-trade announcement return for top quartile *CEO incentive* sales in Panel B.

In Panels C and D we analyze all restricted stock sales and restricted stock sales executed under Rule 10b5-1 plans, respectively. The results in Panels C and D are consistent with their counterparts in Panels A and B in Table 7.

In un-tabulated analyses, we replicate the earnings surprise analyses in Table 7 using two-day CARs around the earnings announcements instead of the earnings surprise based on analyst

expectations. We separately use the full sample and the restricted share sub-sample to investigate the differences in the proportion of sales with positive and negative CARs both before and after the CEO stock sales. The evidence from these analyses is consistent with that for earnings surprise in Table 7.

Overall, the evidence in Figure 6 and in Tables 6 and 7 suggest that access to inside information about accounting and operating performance, combined with the ability to exercise discretion over the timing of stock sales, enable some CEOs to bypass the intent of Rule 10b5-1 plans. This appears to be particularly true with high *CEO incentive* sales.

3.4.4. The cancellation of plans and the use of limit orders with plan trades

Among the interesting features of Rule 10b5-1 plans are the ability of insiders to cancel plans or use limit orders. The cancellation of a plan and the existence of limit orders is very rarely disclosed even when the plan itself is disclosed (Henderson, Jagolinzer, and Muller, 2015). This makes it difficult to estimate the economic importance of rescinded trades within Rule 10b5-1 plans.¹³ However, the trading patterns in our sample provide some insights regarding their importance. We obtain these insights by first identifying the CEOs in our sample who sell shares at regular intervals. We then examine the timing of the individual trades of those CEOs to detect sales which appear to be missing from their regular trading sequences. Our strategy for identifying missing sales is conceptually similar to the process Cohen, Malloy, and Pomorski (2012) use to identify routine insider trading. Once we identify missing sales, we examine stock returns around the time of those missing sales for evidence on their economic importance.

¹³ Insiders also have flexibility regarding the length of time between when the plan is established and when the first trade is scheduled. See Larecker et al. (2021) and McGinty (2022) for discussions of the importance of these “cooling-off periods” in limiting opportunistic trading. We do not examine cooling-off periods because few firms in our sample report sufficient details for their plans.

We begin this analysis with all trades in our sample that are reported as Rule 10b5-1 plan stock sales. Within this sample, we identify all CEOs who have at least four consecutive stock sales during our sample period and determine whether a sequence of sales by each of these CEOs reflects a predictable pattern. We consider several possible trading frequencies when searching for trading patterns to allow for the flexible nature of the Rule 10b5-1 plans. For example, regular trades might occur weekly, fortnightly, monthly, bimonthly, or quarterly.

For those CEOs whose sales exhibit a regular trading pattern, we examine the plan trades to see if the pattern changes in frequency (for example from monthly to weekly). We classify any observed change in frequency as reflecting the start of a new trading plan sequence. For each trading plan sequence with at least four sales, we then examine the plan sales in chronological order to identify any missing sale that falls between three consecutive sales before and three consecutive sales after using the same frequency. From this analysis, we identify 85 sales that appear to be missing from a predictable trading pattern. These represent a sample of sales likely to have been eliminated through plan cancellation or limit orders.

Next, we set the date of the missing sale to equal the most frequently used calendar date in the series of consecutive sales and plot the CAR over the 20 trading days leading up to every missing (presumed) sale date and the CAR over the subsequent 20 trading days. In Figure 7, which presents this plot, we observe a “V” shaped pattern in which the average CAR declines 1.32 percent over the 20 trading days prior to the presumed sale date and increases 1.61 percent over the ensuing 20 trading days. Both the decline during the 20 days before the missing sale and the increase over the 20 days after the missing sale are statistically significantly different from zero (*p*-values of 0.0607 and 0.0182, respectively).

---- Insert Figure 7 here ----

While it is possible that this test omits eliminated sales that fall outside the trading patterns we identify, the evidence that we observe is consistent with the cancellation of Rule 10b5-1 plans and the use of limit orders within plans to eliminate sales for the benefit of the selling CEOs.

3.4.5. Opportunistic trading and corporate governance

We next investigate whether the opportunistic trading we observe varies with the quality of corporate governance. In this analysis we estimate the OLS models in Panel A of Table 8 to assess the relations between five different corporate governance measures and the CAR on the firm's shares over the 40 trading days following the CEO stock sale. We define all governance measures so that a larger value reflects what is conventionally considered to be better governance in the literature.¹⁴ These measures include an indicator variable that equals one if all directors stand for election at the same point in time (i.e., *non-classified board*) and a second indicator variable that equals one if fewer than 50 percent of the directors are appointed after the CEO takes office (i.e., *non-coopted board*). The other three governance measures are a *no entrenchment index* that is computed as six minus the Bebchuk et al. (2009) entrenchment index, a *board diversity* indicator that equals one if the board has at least one female director and one ethnic minority director, and the *proportion of independent directors* on the board. In every model in Panel A, we interact the governance measure with an indicator variable that equals one if the sale is not executed within a Rule 10b5-1 plan (i.e., *No 10b5-1 plan*).

---- Insert Table 8 here ----

¹⁴ While the governance measures that we use in our analysis are common in the literature, we recognize that the relations between individual measures and governance quality vary across firms. One-size-fits-all models of effective governance do not fully accommodate the notion that optimal organization design varies with factors such as differentiating firm characteristics or the nature of the firm's input or product markets. As such, a low value for any of the governance measures might be observed at a firm that is well-governed. For example, the presence of a classified (or staggered) board does not necessarily imply that a firm is not well-governed.

The negative and significant coefficients for the *No 10b5-1 plan* indicator in all models in Panel A are consistent with the evidence in Table 3 that the decline in post-sale CAR tends to be smaller when the CEO trades through a plan. Furthermore, the positive and significant estimates for *No 10b5-1 plan* \times *Governance measure* in all models in Panel A suggest that a strong governance structure can help limit opportunism outside of a plan.¹⁵ The results in Panel B of Table 8, based on the sample of restricted stock sales, generate inferences like those in Panel A.

One question that arises in light of the results in Table 8 is what happens when *CEO incentive* is large. We address this question in Table 9 where we analyze the full sample (Panel A) and the restricted stock sub-sample (Panel B). The estimates in both panels of Table 9 indicate that, consistent with the evidence in Table 4, high *CEO incentive* is significantly negatively related to the post-sale CAR when the trade is executed pursuant to a plan. The fact that all of the joint estimates for high *CEO incentive* + high *CEO incentive* \times *Governance measure* are negative and significant suggests that the governance mechanisms that we consider may not be enough to limit opportunism within plan sales—particularly when the *CEO incentive* is high.

---- Insert Table 9 here ----

Overall, the evidence from the restricted stock sub-sample, together with our baseline tests and other analyses aimed at alleviating identification and selection issues, help us achieve triangulation in the spirit of DeFond (2010, p. 407). Defond argues that “when ... proxies are simply noisy measures of the same underlying theoretical construct, triangulation may rule out the possibility that the observed association is driven by the noise component of a given measure.” In

¹⁵ For example, in Model 1, the absolute value of the estimate for the *No 10b5-1 plan* indicator variable of -0.0128 is barely larger than the positive estimate of 0.0107 for the *No 10b5-1 plan* \times *Governance measure* interaction term. Since a non-classified board is often associated with good governance, and a larger post-sale CAR indicates less opportunistic behavior, the positive estimate for *No 10b5-1 plan* \times *Governance measure* suggests that good governance, as proxied by a lack of board classification, might mitigate opportunistic behavior outside of plans.

our study, it is unlikely that plan usage misclassification is either driving or distorting our findings.

4. Conclusions

We find that stock sales executed by CEOs within Rule 10b5-1 plans tend to be associated with less opportunism than non-plan sales, but that opportunistic behavior among plan sales is significant in an absolute sense. Among plan sales, the level of opportunism varies with the financial importance of the transaction to the CEO. When the CEO has more money at stake, there is a higher probability of opportunistic behavior within a Rule 10b5-1 trading plan.

We investigate mechanisms CEOs might use to engage in opportunistic trading. Examination of disclosure quality, accounting accruals, real transaction-based earnings management measures, and earnings announcements around Rule 10b5-1 plan trades suggest that CEOs can circumvent the intent of Rule 10b5-1 by exerting discretion over financial reporting and real earnings management. We also find evidence consistent with CEOs benefitting from plan cancellations and the use of limit orders within Rule 10b5-1 plans. This raises the question of whether the cancellation of plans and the use of limit orders should be permitted. Finally, we report evidence suggesting that the presence of a plan in controlling opportunism is probably less critical when the firm's corporate governance is strong. However, this appears to only be true when CEOs do not have strong financial incentives to trade opportunistically.

This study should be of interest to corporate governance policy groups and regulators who are focused on limiting the ability of managers of public corporations to enrich themselves at the expense of their firm's stockholders. Our results suggest that some CEOs are exploiting weaknesses in the Rule 10b5-1 framework for personal gain. Fortunately, some of those loopholes are identifiable and can be addressed by the SEC.

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Table 1: Firm and transaction characteristics

Sample statistics for 13,930 stock sales by 1,629 CEOs at 1,322 firms from 2013 to 2020 for which the Thompson Financial Insider Filing database (TFN) indicates whether the sale is executed under an SEC Rule 10b5-1 plan and in which firm, transaction, and CEO data are available from the CRSP/Compustat, Execucomp, and Institutional Shareholder Services (ISS). All variables are reported at the transaction level. Firm financial characteristics are computed as of the end of the quarter in which the sale took place. *Tobin's q* is computed as the market value of equity plus the book value of debt, divided by the book value of assets. *Leverage* is the book value of debt divided by total assets. *Transaction value* is the dollar value of the shares sold. $CAR[t_{-40}, t_{-1}]$ is the average cumulative abnormal return (CAR) over the 40 trading days leading up to the sale and $CAR[t_{+1}, t_{+40}]$ is the average CAR over the 40 days following the sale. CARs are estimated using a market model with a one-year estimation period that ends 41 trading days before the stock sale date using the CRSP value weighted return as the benchmark. *Total CEO compensation* is obtained from Execucomp for the fiscal year ending immediately before the stock sale. *CEO firm-related wealth* is as defined in Coles, Daniel, and Naveen (2006, 2013) and measured at the fiscal year end immediately before the stock sale. *CEO incentive* is the *transaction value* divided by the CEO's firm-related wealth. *CEO-chairman duality* is an indicator variable that equals one if the CEO also chairs the board. *Classified board* is an indicator variable that equals one if not all directors of the firm stand for election at the same time. *Board diversity* is an indicator variable that equals one if there are at least one female director and at least one ethnic minority director. *Coopted board* is an indicator variable that equals one if at least 50 percent of the directors were appointed after the CEO took office. *Proportion of independent directors* is the number of directors who are not current or former employees of the firm or a subsidiary, and who are not affiliated with the company, divided by the total number of directors. *Entrenchment index* is the sum of indicator values for the six anti-takeover provisions tracked by ISS and described in Bebchuk, Cohen, and Ferrell (2009). All continuous variables are winsorized at the 1st and 99th percentile.

	Mean	Median	Q1	Q3	Std
Firm financial characteristics:					
Market value of the firm's equity (\$ billions)	29.157	4.824	1.778	18.304	81.827
Tobin's <i>q</i>	2.790	2.209	1.458	3.588	1.822
Leverage	0.223	0.192	0.062	0.343	0.191
Transaction characteristics:					
Number of shares sold (millions)	0.038	0.015	0.006	0.04	0.062
Percent of outstanding shares sold	0.040	0.019	0.006	0.049	0.058
Transaction value (\$ millions)	2.949	0.930	0.329	2.686	5.459
$CAR[t_{-40}, t_{-1}]$ (percent)	1.971	1.885	-4.420	8.484	12.038
$CAR[t_{+1}, t_{+40}]$ (percent)	-1.527	-0.978	-7.296	4.591	11.52
Proportion of sales under a 10b5-1 plan	0.614	1	0	1	0.487
CEO ownership and incentives:					
Percent of outstanding shares owned by CEO	2.018	0.448	0.126	1.576	3.942
Percent of shares owned by CEO that are sold	1.425	0.043	0.011	0.145	10.891
Total CEO compensation (\$ millions)	8.554	6.027	3.403	11.276	7.655
CEO firm-related wealth (\$ billions)	1.143	0.035	0.013	0.106	6.132
CEO incentive	0.104	0.026	0.007	0.074	0.310
CEO age	56.897	57	53	61	7.031
Firm governance characteristics:					
CEO-chairman duality	0.440	0	0	1	0.496
Classified board	0.358	0	0	1	0.479
Board diversity	0.612	0	0	0	0.487
Coopted board	0.709	1	0	1	0.454
Proportion of independent directors	0.802	0.818	0.750	0.889	0.097
Entrenchment index	4.090	4	4	5	0.808

Table 2: Predictors of Rule 10b5-1 plan adoption

Logit and OLS model estimates for whether a stock sale by a CEO is executed pursuant to an SEC Rule 10b5-1 plan. The data are for 13,930 CEO stock sales during the 2013 to 2020 period. The dependent variable in all models, *10b5-1 plan*, is an indicator variable that equals one if the stock sale is executed under a Rule 10b5-1 plan and zero otherwise. *Firm litigation risk* is the predicted probability of a security class action suit being filed against the firm in the year of the stock sale, as estimated using litigation risk Model (3) proposed by Kim and Skinner (2012). *Excess stock return* is the buy and hold abnormal return over the 12-month period ending in the month before the sale, computed using the monthly CRSP value weighted return as the benchmark. *Stock return volatility* is the standard deviation of monthly stock returns over the 12-month period ending in the month before the sale. *Entrenchment index excluding classified board* is the *Entrenchment index* described in Table 1, excluding an indicator for whether the board is classified. *Percent of outstanding shares sold* is the number of shares sold as a percentage of the total outstanding shares. *CEO equity-based compensation* is the ratio of stock- plus option-based compensation received by the CEO during the fiscal year of the sale as a percentage of total compensation. *CEO near retirement* is an indicator variable that equals one if the CEO is at least 62 years old and zero otherwise. The announcements/disclosures around the sale are quarterly earnings surprises (relative to analyst forecasts), changes in accounting *disclosure quality* (estimated as the change in the number of non-missing Compustat items (Chen, Miao, and Shevlin, 2015)), and changes in *accounting accruals* (estimated using the modification of the Jones method (Jones, 1991) that was proposed by Dechow, Sloan, and Sweeney, 1995). All other variables are defined in Table 1. *P*-values are in parentheses. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable = 1 if plan, 0 otherwise	Logit Model 1	OLS Model 2	Logit Model 3	OLS Model 4
Intercept	-3.6651*** (0.0001)	-0.7803*** (0.0007)	-4.2600*** (0.0000)	-0.7987*** (0.0003)
Firm litigation risk	22.0430*** (0.0003)	2.9731*** (0.0055)	23.3608*** (0.0003)	2.8252*** (0.0056)
Firm size, growth options, and leverage:				
ln(Market value of the firm's equity)	-0.0439 (0.4801)	-0.0019 (0.8748)	0.0092 (0.8833)	0.0050 (0.6494)
Tobin's <i>q</i>	0.1321*** (0.0017)	0.0225*** (0.0038)	0.1133*** (0.0047)	0.0180** (0.0115)
Leverage	0.1704 (0.6474)	0.0394 (0.6075)	0.1862 (0.6051)	0.0428 (0.5413)
Firm stock characteristics:				
Excess stock return	-0.1698 (0.2674)	-0.0397 (0.1739)	-0.1633 (0.3266)	-0.0344 (0.2445)
Stock return volatility	4.3902** (0.0154)	1.0071*** (0.0046)	2.4103 (0.2153)	0.5521 (0.1161)

Continued on Next Page

Table 2 Continued: Predictors of Rule 10b5-1 plan adoption

Dependent variable = 1 if plan, 0 otherwise	Logit Model 1	OLS Model 2	Logit Model 3	OLS Model 4
Firm governance characteristics:				
Classified board	0.1193 (0.4369)	0.0305 (0.3275)	0.1406 (0.3800)	0.0365 (0.2327)
Entrenchment index excluding classified board	0.2636** (0.0392)	0.0584** (0.0323)	0.2607** (0.0455)	0.0531** (0.0432)
Board diversity	0.2132 (0.1232)	0.0400 (0.1614)	0.1338 (0.3575)	0.0218 (0.4405)
Coopted board	0.3346** (0.0137)	0.0653** (0.0271)	0.3433** (0.0117)	0.0629** (0.0228)
Proportion of independent directors	2.3764*** (0.0012)	0.4997*** (0.0009)	2.5862*** (0.0005)	0.5142*** (0.0004)
Transaction and CEO characteristics:				
Percent of outstanding shares sold (%)	-6.0086*** (0.0000)	-1.2174*** (0.0000)	-5.6882*** (0.0000)	-1.1257*** (0.0000)
Percent of outstanding shares owned by CEO (%)	0.0434* (0.0942)	0.0090* (0.0863)	0.0368 (0.1415)	0.0074 (0.1249)
ln(1 + CEO incentive)	-0.7897*** (0.0023)	-0.1642*** (0.0014)	-0.8127*** (0.0010)	-0.1564*** (0.0014)
CEO equity-based compensation	0.1330 (0.2367)	0.0255 (0.2279)	0.0692 (0.3837)	0.0126 (0.3893)
CEO-chairman duality	-0.2081 (0.1142)	-0.0458* (0.0875)	-0.2639* (0.0551)	-0.0578** (0.0253)
CEO near retirement	-0.4400*** (0.0010)	-0.0916*** (0.0016)	-0.3549** (0.0149)	-0.0668** (0.0243)
Announcements/disclosures around sale:				
Positive earnings surprise indicator during the 40 days before sale			-0.9211*** (0.0000)	-0.1764*** (0.0000)
Negative earnings surprise indicator during the 40 days before sale			-0.5540*** (0.0000)	-0.0985*** (0.0000)
Positive earnings surprise indicator during the 40 days after sale			1.3097*** (0.0000)	0.2442*** (0.0000)
Negative earnings surprise indicator during the 40 days after sale			1.0649*** (0.0000)	0.2061*** (0.0000)
Change in accounting disclosure quality in the year of the sale			1.6501* (0.0516)	0.2639 (0.1018)
Change in accounting accruals in the year of the sale			-0.0300 (0.1620)	-0.0051 (0.1856)
Year and industry fixed effects	Yes	Yes	Yes	Yes
Number of observations	13,930	13,930	12,234	12,234
Adjusted R ²	0.2299	0.1658	0.2730	0.1954
Regression's <i>p</i> -value	0.0001	0.0001	0.0000	0.0000

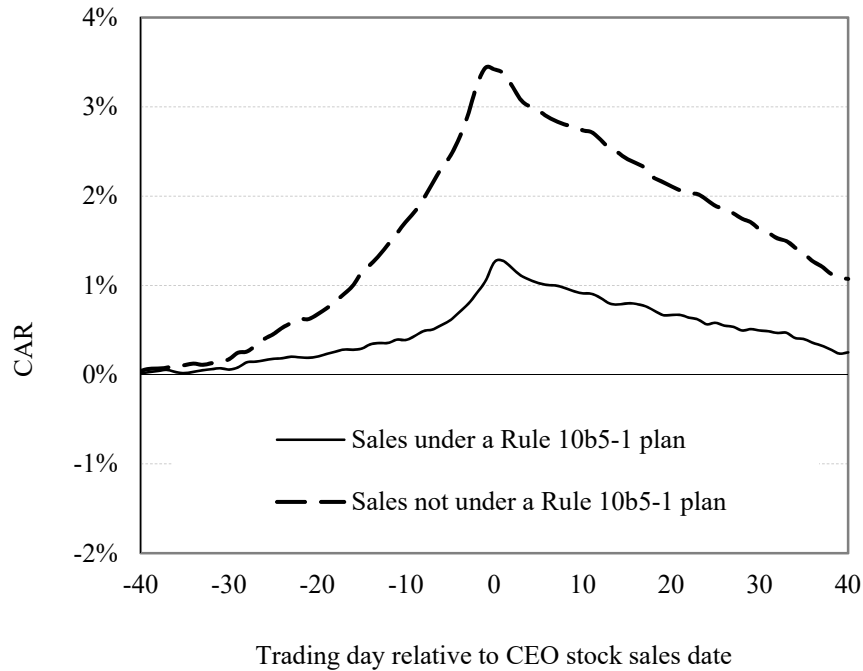


Figure 1: Average cumulative abnormal returns around CEO stock sales

The plots show average cumulative abnormal returns (CARs) from 40 trading days before to 40 trading days after 13,930 CEO stock sales during the 2013 to 2020 period. The Thomson Financial Insider Filing database (TFN) is used to identify whether the sale takes place under an SEC Rule 10b5-1 plan. Of the 13,930 sales, 8,554 are identified as executed under a plan and 5,376 are not. CARs are estimated using a market model with a one-year estimation period that ends 41 trading days before the stock sale date using the CRSP value weighted return as the benchmark.

Table 3: Cumulative abnormal returns before and after CEO stock sales

Panel A presents estimates for OLS models in which the dependent variable is the average cumulative abnormal return (CAR) over the 40 days before or the 40 days following stock sales by 13,930 CEOs from 2013 to 2020. *10b5-1 plan* is an indicator variable that equals one if the sale is executed under an SEC Rule 10b5-1 plan, and zero otherwise. *Reporting lag* is the number of days between the transaction date and the SEC filing date. *Prior 40-day abnormal return* is $CAR[t_{-80}, t_{-41}]$ for Model 1 and $CAR[t_{-40}, t_{-1}]$ for Model 2. All other variables are defined in Tables 1 and 2. Panel B presents propensity score matching estimates obtained using the specification in Model 3 of Table 2. Average treatment effects on the CARs during 40 days before and 40 days after a CEO stock sale are estimated for treatments that are defined as transactions executed under a Rule 10b5-1 plan. We use three matching methods: propensity-score kernel matching, nearest-neighbor one-to-one matching, and nearest-neighbor one-to-three matching. We report the p -value of the treatment effects using 500 bootstrap replications in parentheses. Panel C reports the results using the sub-sample of 2,818 restricted stock sales. In all panels, p -values are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Cumulative abnormal returns before and after CEO stock sales		
Dependent variable =	CAR[t_{-40}, t_{-1}] Model 1	CAR[t_{+1}, t_{+40}] Model 2
Intercept	0.1490*** (0.0000)	-0.1312*** (0.0000)
10b5-1 plan	-0.0176*** (0.0000)	0.0081*** (0.0000)
ln(Transaction value)	0.0052*** (0.0000)	-0.0070*** (0.0000)
Reporting lag	0.0244 (0.7199)	-0.0951 (0.1220)
ln(Market value of the firm's equity)	-0.0071*** (0.0000)	0.0082*** (0.0000)
Tobin's q	0.0008 (0.1998)	0.0034*** (0.0000)
Leverage	0.0049 (0.3511)	-0.0006 (0.8937)
Prior 40-day abnormal return	-0.0481*** (0.0001)	0.1322*** (0.0000)
Year and industry fixed effects	Yes	Yes
N	13,930	13,930
Adjusted R ²	0.0253	0.0404
Regression's p -value	0.0001	0.0001
Panel B: Propensity score matching		
Matching method	Average Treatment Effect (ATE) of Rule 10b5-1 plan vs non-Rule 10b5-1 plan	
	CAR[t_{-40}, t_{-1}]	CAR[t_{+1}, t_{+40}]
Propensity-score kernel matching (11,655 observations used)	-0.0188*** (0.0000)	0.0086*** (0.0001)
Nearest-neighbor (1:1) matching (3,564 observations used)	-0.0170*** (0.0000)	0.0071** (0.0260)
Nearest-neighbor (1:3) matching (6,578 observations used)	-0.0153*** (0.0000)	0.0091*** (0.0000)
Panel C: Cumulative abnormal returns before and after CEO restricted stock sales		
Dependent variable =	CAR[t_{-40}, t_{-1}] Model 1	CAR[t_{+1}, t_{+40}] Model 2
10b5-1 plan	-0.0168*** (0.0002)	0.0091** (0.0282)
Controls and fixed effects as in Panel A	Yes	Yes
N	2,818	2,818
Adjusted R ²	0.0246	0.0440
Regression's p -value	0.0001	0.0001

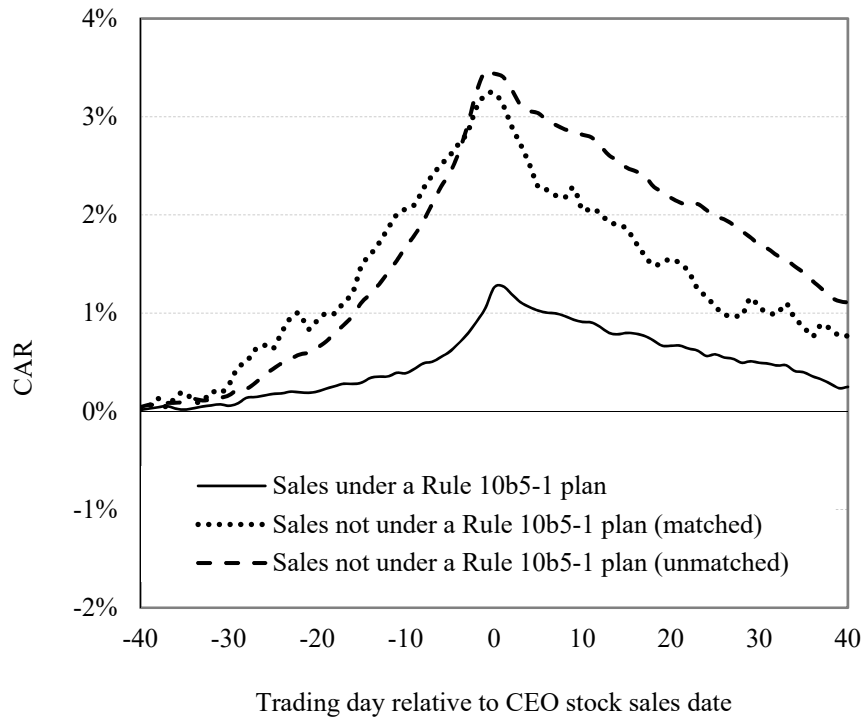


Figure 2: CARs around CEO stock sales partitioned based on Rule 10b5-1 plan identification

The plots show average cumulative abnormal returns (CARs) from 40 trading days before to 40 trading days after 13,930 CEO stock sales during the 2013 to 2020 period. The sales are partitioned into three sub-samples by classifying them (1) as having been reported as executed pursuant to a Rule 10b5-1 plan (8,554 sales), (2) as not having been reported as executed through a Rule 10b5-1 plan, but which are identified using propensity score matching as having characteristics similar to plan sales (557 sales), and (3) as not having been reported as plan sales and not having characteristics similar to plan sales (4,819 sales).

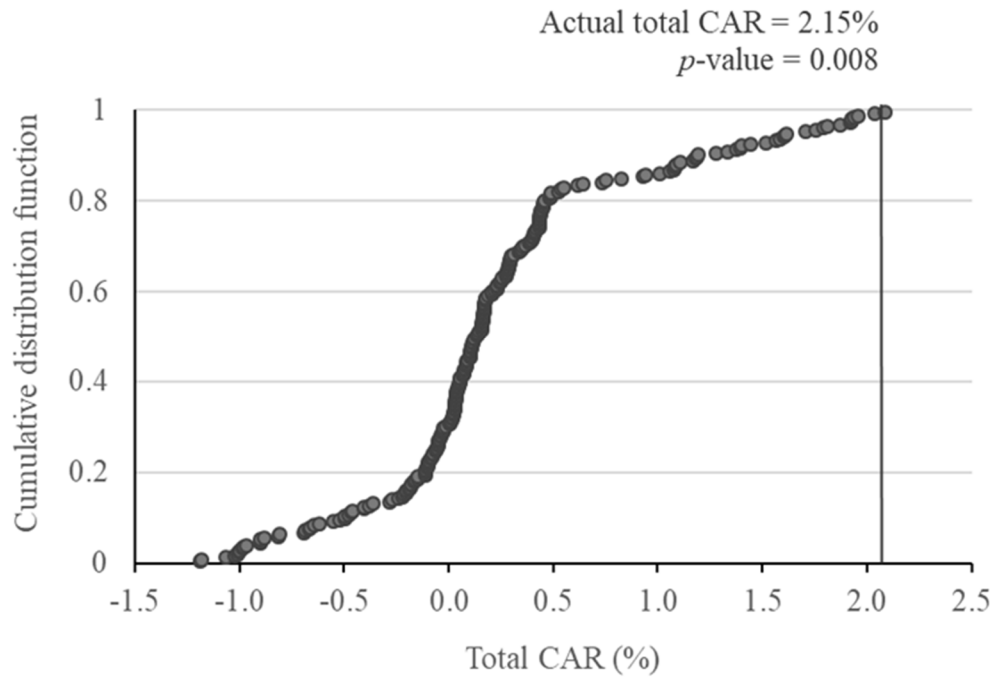


Figure 3: Cumulative distribution function for the average total CAR that would have been earned from falsified CEO stock sales on the 252 trading days around each of the actual dates that sales were executed under Rule 10b5-1 plans

The plot shows the cumulative distribution function for average cumulative abnormal returns (CARs) around falsified CEO stock sales on each of the 252 trading days around the actual sale date for 8,554 CEO stock sales under a Rule 10b5-1 plan during the 2013 to 2020 period. The average total CARs are for 40 trading days before to 40 trading days after the falsified trade date. For each of the 8,554 plan trades in our sample, we calculate $CAR_{[t-40, t-1]}$ and $CAR_{[t+1, t+40]}$ for a falsified date within 6 months (126 trading days) before and 6 months (126 trading days) after the actual date. We then calculate total CAR to represent the benefit to the CEO from selling the shares after $[t-40, t-1]$ but before $[t+1, t+40]$ as $CAR_{[t-40, t-1]} - CAR_{[t+1, t+40]}$.

Chart 1: Sales under a Rule 10b5-1 plan

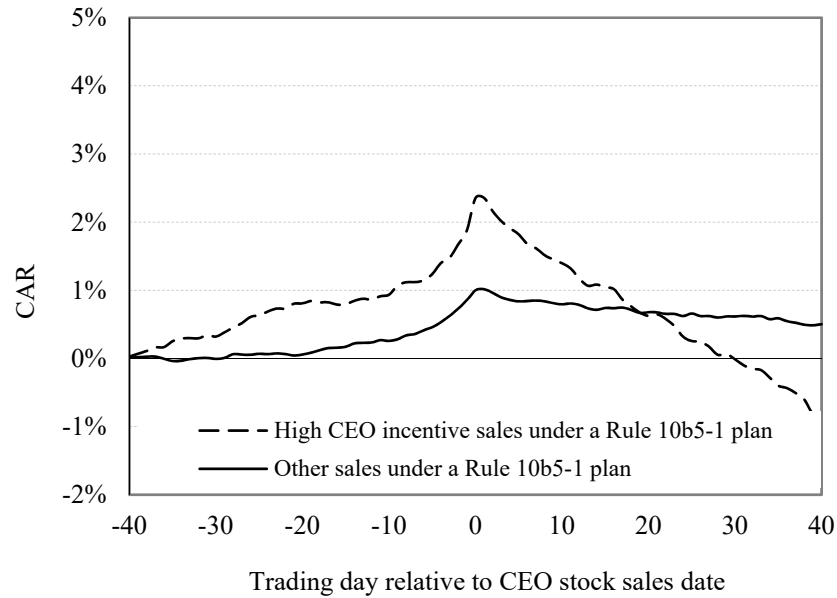


Chart 2: Sales not under a Rule 10b5-1 plan

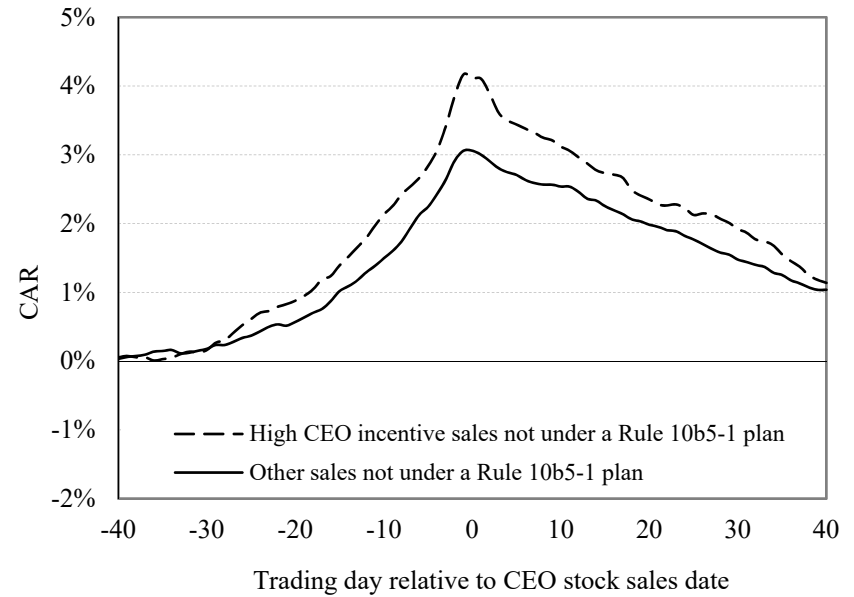


Figure 4: CEO incentives and CARs around CEO stock sales

These plots show average cumulative abnormal return (CAR) from 40 trading days before to 40 trading days after 13,930 CEO stock sales dates during the 2013 to 2020 period. CARs are estimated using a market model with a one-year estimation period that ends 41 trading days before the reported stock sales date. Chart 1 shows the CARs for stock sales completed under a Rule 10b5-1 plan while Chart 2 shows the CARs for stock sales not completed under a Rule 10b5-1 plan. The dashed line in each chart shows the CARs for plan or non-plan sales in which the *transaction value* as a proportion of total CEO firm-related wealth at the end of the fiscal year before the sale is in the top quartile for the total sample (high *CEO incentive*). The solid line shows the CARs for the remaining Rule 10b5-1 plan or non-plan transactions.

Table 4: Abnormal returns around CEO stock sales: The impact of Rule 10b5-1 plans and CEO incentives

Panel A reports OLS estimates for models in which the dependent variable is the cumulative abnormal return (CAR) over the 40 days before or 40 days after a CEO stock sale. The data are for 13,930 stock sales by CEOs from 2013 to 2020. Models 1, 2, 5, and 6 are estimated using the entire sample and Models 3, 4, 7, and 8 are estimated using only observations where the sale was completed as part of a Rule 10b5-1 plan. High *CEO incentive* is an indicator variable that equals one if *CEO incentive* is in the top quartile and zero otherwise. All other variables are defined in Tables 1, 2, and 3. *P*-values are reported in parentheses. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Panel B presents evidence on the possible effect of an omitted confounding variable on the statistical inferences for *CEO incentive* in Models 3 and 7 and high *CEO incentive* in Models 4 and 8. These estimates are obtained using the Impact Threshold of a Confounding Variable (ITCV) method from Frank (2000), which provides an estimate of the potential bias from an omitted variable that is needed to invalidate an OLS statistical inference. The 1st, 4th, 7th, and 10th columns in Panel B report the coefficients we obtain in Models 3, 4, 7, and 8 in Panel A. The 2nd, 5th, 8th, and 11th columns report the ITCV for *CEO incentive* and high *CEO incentive*, respectively. The 3rd, 6th, 9th, and 12th columns report the impact score associated with the addition of each control variable on the coefficient for *CEO incentive* and high *CEO incentive*. Panel C reports the results using the sub-sample of 2,818 restricted stock sales.

Panel A: Impact of Rule 10b5-1 plans and CEO incentives								
Dependent variable =	CAR [<i>t</i> -40, <i>t</i> -1]				CAR [<i>t</i> +1, <i>t</i> +40]			
	All Sales		Rule 10b5-1 Sales		All Sales		Rule 10b5-1 Sales	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Intercept	0.1129*** (0.0006)	0.1102*** (0.0008)	0.1198*** (0.0017)	0.1208*** (0.0015)	-0.1151*** (0.0000)	-0.1144*** (0.0001)	-0.0039 (0.7938)	0.0055 (0.7151)
10b5-1 plan	-0.0178*** (0.0000)	-0.0189*** (0.0000)			0.0115*** (0.0000)	0.0110*** (0.0000)		
10b5-1 plan × ln(1 + CEO incentive)	-0.0009 (0.8791)				-0.0141*** (0.0000)			
ln(1 + CEO incentive)	0.0242*** (0.0004)		0.0243*** (0.0030)		-0.0111* (0.0532)		-0.0241*** (0.0086)	
10b5-1 plan × High CEO incentive		0.0000 (0.9913)				-0.0124*** (0.0017)		
High CEO incentive		0.0068** (0.0280)		0.0070** (0.0336)		-0.0042 (0.1292)		-0.0142*** (0.0000)
ln(Transaction value)	0.0033*** (0.0000)	0.0032*** (0.0000)	0.0037*** (0.0014)	0.0038*** (0.0016)	-0.0056*** (0.0000)	-0.0056*** (0.0000)	-0.0079*** (0.0000)	-0.0070*** (0.0000)
Reporting lag	0.0239 (0.7233)	0.0238 (0.7237)	0.0565 (0.4466)	0.0567 (0.4437)	-0.0945 (0.1267)	-0.0952 (0.1255)	-0.0460 (0.8066)	-0.0512 (0.7882)
ln(Market value of the firm's equity)	-0.0050*** (0.0000)	-0.0050*** (0.0000)	-0.0069*** (0.0000)	-0.0071*** (0.0000)	0.0075*** (0.0000)	0.0076*** (0.0000)	0.0080*** (0.0000)	0.0077*** (0.0000)
Tobin's <i>q</i>	0.0001 (0.4312)	0.0001 (0.3192)	-0.0002 (0.3724)	-0.0002 (0.3780)	0.0030*** (0.0000)	0.0030*** (0.0000)	0.0042*** (0.0000)	0.0040*** (0.0000)
Leverage	0.0063 (0.2289)	0.0057 (0.2755)	0.0017 (0.8342)	0.0019 (0.8168)	0.0000 (0.9965)	-0.0001 (0.9880)	-0.0020 (0.7645)	-0.0020 (0.7574)
Prior two-month abnormal return	-0.0477*** (0.0001)	-0.0472*** (0.0001)	-0.0629*** (0.0023)	-0.0622*** (0.0026)	0.1326*** (0.0000)	0.1327*** (0.0000)	0.1328*** (0.0000)	0.1340*** (0.0000)
Year and industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	13,930	13,930	8,554	8,554	13,930	13,930	8,554	8,554
Adjusted R ²	0.0253	0.0236	0.0142	0.0137	0.0425	0.0424	0.0470	0.0482
Regression's <i>p</i> -value	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Table 4 Continued: Abnormal returns around CEO stock sales: The impact of Rule 10b5-1 plans and CEO incentives

Panel B: ITCV												
Dependent variable =	CAR[$t-40, t-1$]						CAR[$t+1, t+40$]					
	Model 3			Model 4			Model 7			Model 8		
	Coefficient	ITCV	Impact	Coefficient	ITCV	Impact	Coefficient	ITCV	Impact	Coefficient	ITCV	Impact
CEO incentive	0.0243**	-0.0059					-0.0241***	-0.0094				
High CEO incentive				0.0070**	-0.0014					-0.0142***	-0.0261	
ln(Transaction value)	0.0037***		0.0141	0.0038***		0.0141	-0.0079***		-0.0070	-0.0070***		-0.0094
Reporting lag	0.0565		-0.0001	0.0567		-0.0001	-0.0460		0.0000	-0.0512		0.0000
ln(Market value of the firm's equity)	-0.0069***		-0.0085	-0.0071***		-0.0091	0.0080***		-0.0015	0.0077***		-0.0014
Tobin's q	-0.0002		-0.0001	-0.0002		-0.0001	0.0042***		-0.0073	0.0040***		-0.0090
Leverage	0.0017		0.0015	0.0019		0.0015	-0.0020		-0.0013	-0.0020		-0.0014
Prior two-month abnormal return	-0.0629***		-0.0011	-0.0622***		-0.0011	0.1328***		0.0010	0.1340***		0.0049

Panel C: Impact of Rule 10b5-1 plans and CEO incentives for restricted stock sales									
Dependent variable =	CAR [$t-40, t-1$]				CAR [$t+1, t+40$]				
	All Sales		Rule 10b5-1 Sales		All Sales		Rule 10b5-1 Sales		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	
10b5-1 plan	-0.0161*** (0.0005)	-0.0140** (0.0116)			0.0095** (0.0237)	0.0168*** (0.0008)			
10b5-1 plan × ln(1 + CEO incentive)	-0.0003 (0.9105)				-0.0031*** (0.0088)				
ln(1 + CEO incentive)	0.0376*** (0.0061)		0.0477*** (0.0055)		-0.0138 (0.1841)		-0.0381** (0.0337)		
10b5-1 plan × High CEO incentive		-0.0009 (0.9963)				-0.0239*** (0.0020)			
High CEO incentive		0.0115* (0.0725)		0.0119** (0.0847)		0.0027 (0.6360)		-0.0191*** (0.0042)	
Controls and fixed effects as in Panel A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
N	2,818	2,818	1,572	1,572	2,818	2,818	1,572	1,572	
Adjusted R ²	0.0279	0.0275	0.0380	0.0324	0.0446	0.0474	0.0374	0.0394	
Regression's p -value	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	

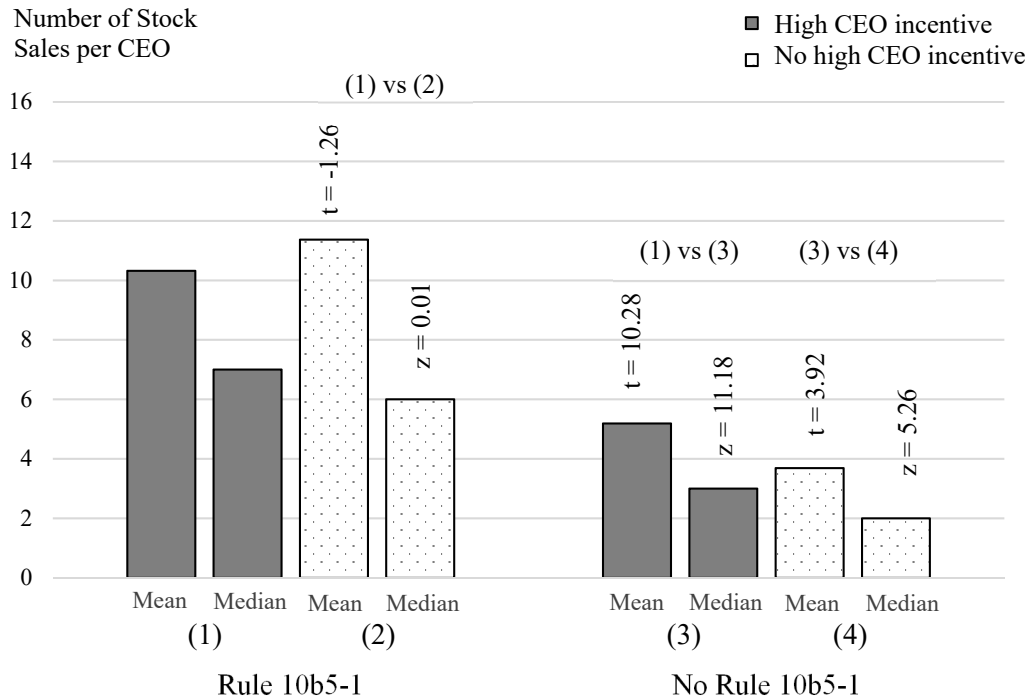


Figure 5: Comparisons of the number of sales for different CEO sub-samples

This figure presents mean (median) values for the number of stock sales that a sample of 1,629 CEOs executed during the 2013 to 2020 period. The first four bars on the left show the mean and median number of sales for CEOs with at least one sale within a Rule 10b5-1 plan while the next four bars on the right show the mean and median number of sales for CEOs without a sale within a Rule 10b5-1 plan. The solid shaded bars show the statistics for CEOs with at least one high *CEO incentive* trade while the dotted shaded bars show the statistics for CEOs without a high *CEO incentive* trade. Above the mean (median) of the dotted shaded bars, we report *t*-statistics (*z*-statistics) for differences in means (medians) with respect to the number of trades by CEOs with at least a high *CEO incentive* trade vs that by CEOs without a high *CEO incentive* trade (i.e. (1) vs (2) and (3) vs (4)). Above the mean (median) of the solid shaded bars for “No Rule 10b5-1”, we report *t*-statistics (*z*-statistics) for differences in means (medians) with respect to the number of trades by CEOs having at least one high *CEO incentive* trade under a Rule 10b5-1 plan vs. that by CEOs having no trades under a Rule 10b5-1 plan but having at least one high *CEO incentive* trade not under a Rule 10b5-1 plan (i.e. (1) vs (3)).

Table 5: Changes in disclosure quality around CEO stock sales

Panel A reports estimates from OLS models in which the dependent variable is the change in disclosure quality from the fiscal year before a firm's CEO sells stock to the fiscal year in which the sale takes place. The sample consists of 13,930 CEO stock sales executed during the 2013 to 2020 period. Disclosure quality is the degree of disaggregation in GAAP line items in the firm's annual report, which is estimated using the method in Chen, Miao, and Shevlin (2015), by counting the number of non-missing Compustat items. With this method, a larger number represents higher disclosure quality. Models 1, 2, and 3 are estimated using the change in disclosure quality for the balance sheet, the income statement, and the financial statements as a whole, respectively. Panel B reports results based on a sub-sample of 2,818 restricted stock sales. All variables are defined in previous tables. *P*-values are reported in parentheses. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable = Disclosure quality measure t – Disclosure quality measure $t-1$	Disclosure Quality Measure		
	Balance Sheet Disclosure Quality	Income Statement Disclosure Quality	Overall Disclosure Quality
	Model 1	Model 2	Model 3
Intercept	0.0368*** (0.0000)	0.2514*** (0.0000)	0.1019*** (0.0000)
10b5-1 plan	0.0025*** (0.0000)	0.0131*** (0.0000)	0.0058*** (0.0000)
10b5-1plan × ln(1 + CEO incentive)	-0.0006* (0.0904)	-0.0016* (0.0645)	-0.0012** (0.0296)
ln(1 + CEO incentive)	-0.0003 (0.8186)	0.0221*** (0.0000)	0.0093*** (0.0000)
Disclosure quality measure $t-1$	-0.0247*** (0.0000)	-0.3962*** (0.0000)	-0.1164*** (0.0000)
ln(Market value of the firm's equity)	-0.0014*** (0.0000)	0.0005 (0.2133)	-0.0003 (0.2237)
Tobin's <i>q</i>	0.0004** (0.0475)	-0.0003 (0.5516)	0.0009*** (0.0001)
Leverage	0.0037** (0.0233)	0.0023 (0.5356)	-0.0011 (0.6281)
Year and industry fixed effects	Yes	Yes	Yes
N	13,930	13,930	13,930
Adjusted R ²	0.0208	0.2666	0.1055
Regression's <i>p</i> -value	0.0001	0.0001	0.0001

Dependent variable = Disclosure quality measure t – Disclosure quality measure $t-1$	Disclosure Quality Measure		
	Balance Sheet Disclosure Quality	Income Statement Disclosure Quality	Overall Disclosure Quality
	Model 1	Model 2	Model 3
10b5-1 plan	0.0026** (0.0308)	0.0102*** (0.0005)	0.0048*** (0.0035)
10b5-1plan × ln(1 + CEO incentive)	-0.0010** (0.0346)	-0.0051*** (0.0000)	-0.0038*** (0.0000)
ln(1 + CEO incentive)	-0.0003 (0.9266)	0.0329*** (0.0000)	0.0147*** (0.0010)
Controls and fixed effects as in Panel A	Yes	Yes	Yes
N	2,818	2,818	2,818
Adjusted R ²	0.0394	0.2527	0.1131
Regression's <i>p</i> -value	0.0001	0.0001	0.0001

Chart 1: Sales under a Rule 10b5-1 plan

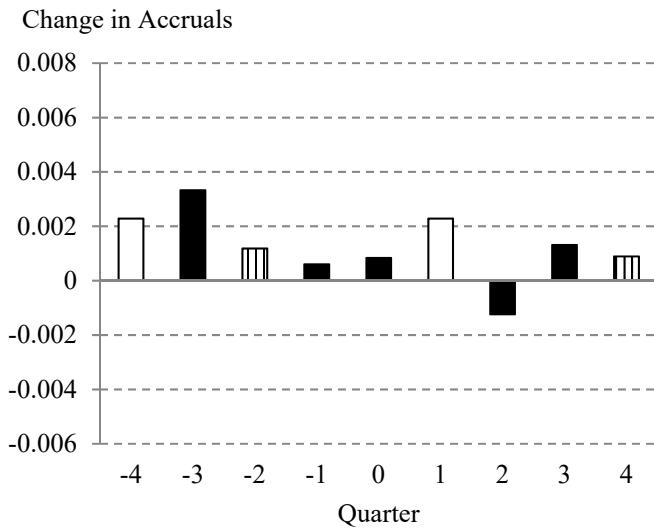


Chart 2: Sales not under a Rule 10b5-1 plan

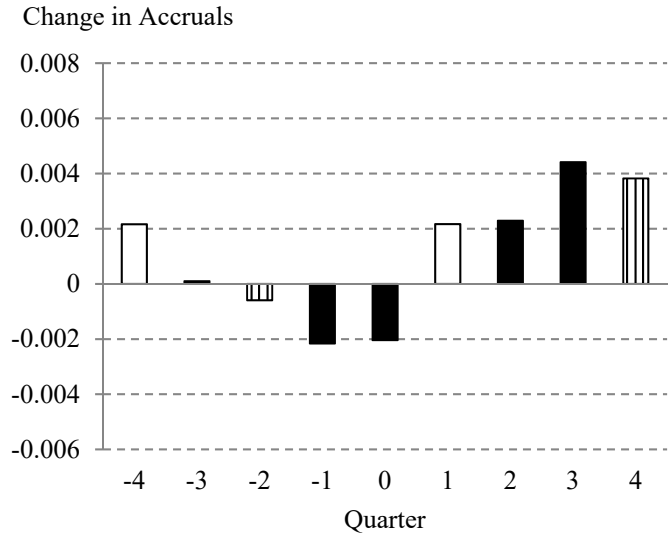


Chart 3: High CEO incentive sales under a Rule 10b5-1 plan

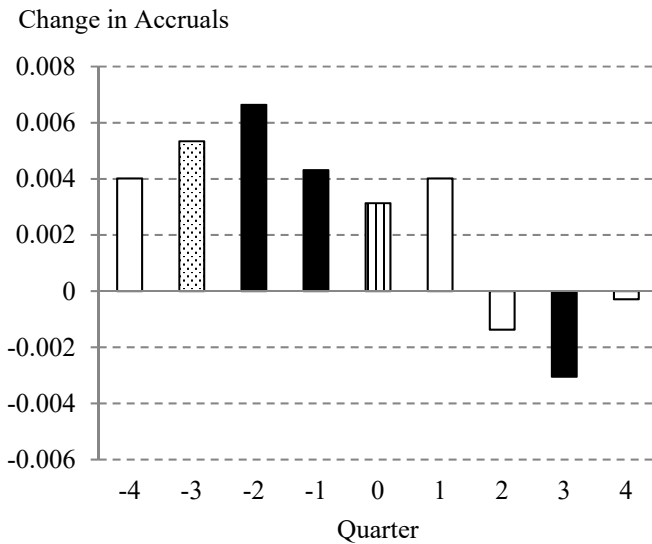


Chart 4: Other sales under a Rule 10b5-1 plan

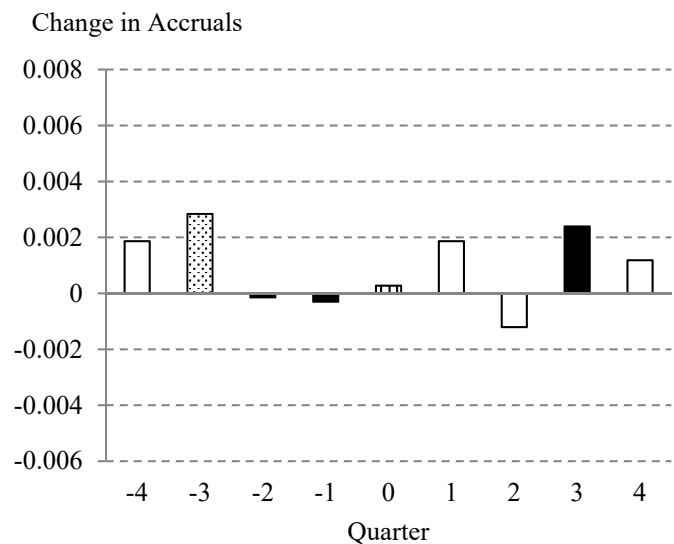


Figure 6: Average year-over-year growth rate in accounting accruals during quarters surrounding CEO stock sales

Quarterly accounting accruals are calculated as quarterly net income minus cash flow, as in Murphy and Zimmerman (1993) and adjusted by the median value in each industry-year. Each bar measures the change in industry-adjusted accruals between quarter t and quarter $t-4$. The x-axis represents the quarter relative to the CEO stock sale. In Charts 1 and 2, the shading indicates whether, in each quarter, accruals under a Rule 10b5-1 plan are significantly different from accruals not under a Rule 10b5-1 plan in the same quarter. In Charts 3 and 4, the shading indicates whether, in each quarter, accruals for high *CEO incentive* sales under a Rule 10b5-1 plan are significantly different from accruals for other sales under a Rule 10b5-1 plan in the same quarter. The solid, striped, and dotted shades denote statistical significance at the 1%, 5%, and 10% level, respectively.

Table 6: Earnings management around CEO stock sales

Panel A presents estimates for OLS models of year-to-year changes in accounting accruals and real activity measures. The data are for a sample of 13,930 CEO stock sales that took place between 2013 and 2020. Accruals are computed using the modification of the Jones method (Jones, 1991) proposed by Dechow, Sloan, and Sweeney (1995), and the method proposed by Dechow and Dichev (2002). Real activity measures of abnormal levels of operating cash flow, production costs, and discretionary expenses are calculated following Roychowdhury (2006). Following Cohen and Zarowin (2010), we multiply the abnormal levels of operating cash flow and discretionary expenses by -1 for ease of interpretation (a higher value implies that the firm is likely to have used real activity manipulations). Panel B reports results using the sub-sample of 2,818 restricted stock sales. All other variables are defined in the previous tables. We report p -values in parentheses. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Earnings management around CEO stock sales					
Dependent variable = Earnings management measure ϵ_t – Earnings management measure ϵ_{t-1}	Earnings Management Measure				
	Modified Jones Discretionary Accruals	Dechow-Dichev Discretionary Accruals	Roychowdhury Operating Cash Flow	Roychowdhury Production Costs	Roychowdhury Discretionary Expenses
	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	-0.4508 (0.8216)	2.1378** (0.0000)	-0.0166 (0.9081)	0.2375*** (0.0009)	1.4998** (0.0000)
10b5-1 plan	-0.0525*** (0.0070)	-0.1281** (0.0249)	-0.0169* (0.0641)	-0.0588*** (0.0000)	-0.0447** (0.0319)
10b5-1 plan \times ln(1 + CEO incentive)	-0.0154** (0.0172)	-0.0413* (0.0657)	-0.0117* (0.0798)	-0.0038* (0.0644)	-0.0182* (0.0561)
ln(1 + CEO incentive)	0.1219*** (0.0020)	0.3707*** (0.0001)	0.0634*** (0.0021)	0.0359*** (0.0081)	0.0562 (0.2498)
Earnings management measure ϵ_{t-1}	-1.0927*** (0.0000)	-1.1245*** (0.0000)	-0.8734*** (0.0000)	-0.8462*** (0.0000)	-0.8000*** (0.0000)
ln(Market value of the firm's equity)	0.0279*** (0.0000)	-0.0569*** (0.0000)	-0.0117*** (0.0000)	-0.0192*** (0.0000)	0.0168*** (0.0030)
Tobin's q	-0.0094 (0.1739)	-0.0557*** (0.0005)	-0.0315*** (0.0000)	-0.0433*** (0.0000)	-0.0253*** (0.0008)
Leverage	-0.2234*** (0.0000)	0.2790* (0.0925)	0.1067*** (0.0000)	0.1720*** (0.0000)	-0.0519 (0.3293)
Year and industry fixed effects	Yes	Yes	Yes	Yes	Yes
N	12,225	12,209	13,136	12,946	11,861
Adjusted R ²	0.6767	0.5887	0.5848	0.5138	0.4680
Regression's p -value	0.0001	0.0001	0.0001	0.0001	0.0001

Panel B: Earnings management around restricted CEO stock sales					
Dependent variable = Earnings management measure ϵ_t – Earnings management measure ϵ_{t-1}	Earnings Management Measure				
	Modified Jones Discretionary Accruals	Dechow-Dichev Discretionary Accruals	Roychowdhury Operating Cash Flow	Roychowdhury Production Costs	Roychowdhury Discretionary Expenses
	Model 1	Model 2	Model 3	Model 4	Model 5
10b5-1 plan	-0.0782** (0.0370)	-0.1360** (0.0271)	-0.0341* (0.0941)	-0.0402* (0.0773)	-0.0445** (0.0407)
10b5-1 plan \times ln(1 + CEO incentive)	-0.0133** (0.0216)	-0.0543*** (0.0066)	-0.0175 (0.2414)	-0.0169* (0.0778)	-0.0191** (0.0275)
ln(1 + CEO incentive)	-0.0190 (0.5995)	0.0128 (0.9371)	-0.0321 (0.5180)	0.0329 (0.3894)	0.1728 (0.2403)
Controls/fixed effects as in Panel A	Yes	Yes	Yes	Yes	Yes
N	2,253	2,198	2,577	2,535	2,256
Adjusted R ²	0.5714	0.4709	0.4647	0.4322	0.3232
Regression's p -value	0.0001	0.0001	0.0001	0.0001	0.0001

Table 7: Quarterly earnings surprise and abnormal announcement returns during the 40 days before and after CEO stock sales

The tests in Panels A and B, analyze measurable earnings surprises from a sample of 13,930 CEO stock sales during the 2013 to 2020 period. Earnings surprise is measured as the announced quarterly earnings less the analyst consensus from the IBES database. The announcement return is computed as the average two-day cumulative abnormal return (CAR) during the window (0,+1) around the quarterly earnings announcements for sub-samples of announcements that occur within 40 trading days before and 40 trading days after CEO stock sales. Panels C and D report results for tests like those in Panels A and B, respectively, using the sub-sample of 2,818 restricted stock sales.

Timing of announcement relative to sales date	Panel A: All stock sales						Panel B: All Rule 10b5-1 plan stock sales					
	Rule 10b5-1 Plan			Not Under a Rule 10b5-1 Plan			High CEO Incentive			Other CEO Incentive		
	[$t-40,t-1$]	[$t+1,t+40$]	z-statistic for diff. in	[$t-40,t-1$]	[$t+1,t+40$]	z-statistic for diff. in	[$t-40,t-1$]	[$t+1,t+40$]	z-statistic for diff. in	[$t-40,t-1$]	[$t+1,t+40$]	z-statistic for diff. in
	N=1,849	N=1,446	proportions	N=2,138	N=501	proportions	N=442	N=386	proportions	N=1,407	N=1,060	proportions
(1)	(2)	(1) – (2)	(3)	(4)	(3) – (4)	(1)	(2)	(1) – (2)	(3)	(4)	(3) – (4)	
Positive earnings surprise	56.30%	49.38%	3.95***	62.91%	49.90%	5.36***	57.47%	43.78%	3.93***	55.93%	51.42%	2.23**
Negative earnings surprise	43.70%	50.62%		37.09%	50.10%		42.53%	56.22%		44.07%	48.58%	
z-statistic for difference in proportions	(1) – (3)	(2) – (4)					(1) – (3)	(2) – (4)				
	-4.24***	-0.2					0.57	-2.57**				
Announcement return			Difference:			Difference:			Difference:			Difference:
	1.19%	-0.18%	1.37%	1.72%	-0.06%	1.78%	1.14%	-1.80%	-2.94%	1.21%	0.41%	0.80%
			t-stat: 5.30***			t-stat: 5.26***			t-stat: -5.87***			t-stat: 2.68***
	(1) – (3)	(2) – (4)					(1) – (3)	(2) – (4)				
Difference:	-0.52%	-0.12%					-0.08%	-2.21%				
t-stat	-2.61***	-0.31					-0.20	-4.96***				
Timing of announcement relative to sales date	Panel C: All restricted stock sales						Panel D: All Rule 10b5-1 restricted stock sales					
	Rule 10b5-1 Plan			Not Under a Rule 10b5-1 Plan			High CEO Incentive			Other CEO Incentive		
	[$t-40,t-1$]	[$t+1,t+40$]	z-statistic for diff. in	[$t-40,t-1$]	[$t+1,t+40$]	z-statistic for diff. in	[$t-40,t-1$]	[$t+1,t+40$]	z-statistic for diff. in	[$t-40,t-1$]	[$t+1,t+40$]	z-statistic for diff. in
	N=487	N=367	proportions	N=525	N=136	proportions	N=136	N=96	proportions	N=351	N=271	proportions
(1)	(2)	(1) – (2)	(3)	(4)	(3) – (4)	(1)	(2)	(1) – (2)	(3)	(4)	(3) – (4)	
Positive earnings surprise	54.00%	50.68%	0.96	63.43%	38.24%	5.31***	55.88%	42.71%	1.98**	53.28%	53.51%	-0.06
Negative earnings surprise	46.00%	49.32%		36.57%	61.76%		44.12%	57.29%		46.72%	46.49%	
z-statistic for difference in proportions	(1) – (3)	(2) – (4)					(1) – (3)	(2) – (4)				
	-3.04***	2.48**					0.52	-1.82*				
Announcement return			Difference:			Difference:			Difference:			Difference:
	0.83%	-0.15%	0.98%	1.58%	-1.94%	3.52%	1.16%	-1.73%	2.89%	0.71%	0.42%	0.29%
			t-stat: 2.34**			t-stat: 4.66***			t-stat: 4.08***			t-stat: 0.57
	(1) – (3)	(2) – (4)					(1) – (3)	(2) – (4)				
Difference:	-0.75%	1.79%					0.46%	-2.15%				
t-stat	-2.05**	2.29**					0.82	-2.96***				

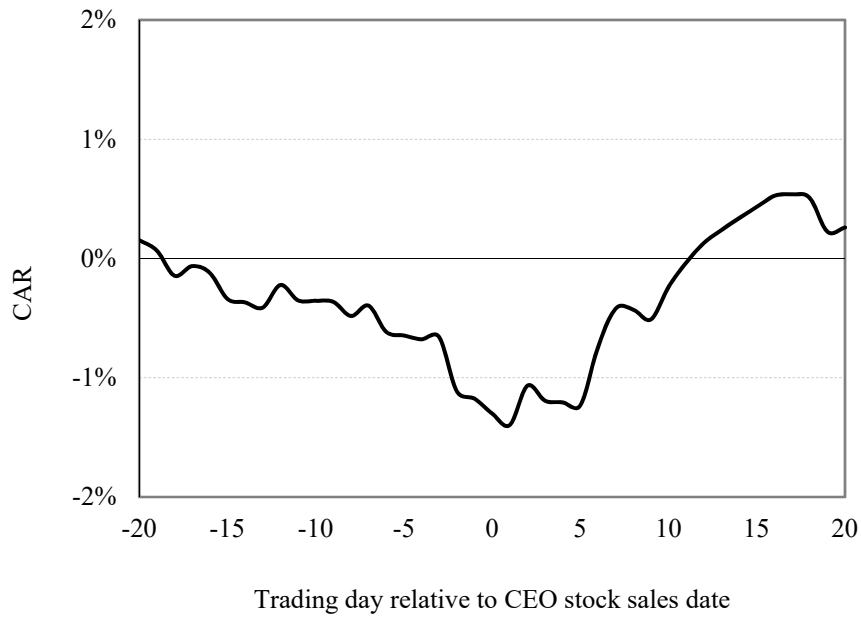


Figure 7: CARs around missing routine stock sales

The sample consists of sales by CEOs who routinely execute stock sales under Rule 10b5-1 plan trades over the 2013 to 2020 period. The plots show average cumulative abnormal returns (CARs) from 20 trading days before to 20 trading days after 85 dates on which routine stock sales are expected, but not observed.

Table 8: The impact of corporate governance on CEO stock sales

Panel A presents estimates from OLS models of cumulative abnormal returns (CARs) over the 40 days following CEO stock sales. The sample consists of 13,930 CEO stock sales during the 2013 to 2020 period. *No 10b5-1 plan* is an indicator variable that equals one if the sale is not executed under a Rule 10b5-1 plan and zero otherwise. *Non-classified board* is an indicator variable that equals one if all directors on the board stand for election at the same time. *Non-coopted board* is an indicator variable that equals one if fewer than 50 percent of the directors were appointed after the CEO took office. *No entrenchment index* equals six minus the *Entrenchment index* described in Table 1. All other variables are defined in the previous tables. Panel B reports results for the sub-sample of 2,818 restricted stock sales. *P*-values are in parentheses. The joint significance tests for *No 10b5-1 plan* + *No 10b5-1 plan* × *Governance measure* is evaluated at one standard deviation above the mean for continuous governance measures and at one for indicator governance measures. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: All stock sales					
Dependent variable = CAR _[t+1, t+40]	Governance Measure				
	Non-Classified Board	Non-Coopted Board	No Entrenchment Index	Board Diversity	Proportion of Independent Directors
	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	-0.1091*** (0.0004)	-0.1073*** (0.0005)	-0.1046*** (0.0006)	-0.1112*** (0.0003)	-0.0881*** (0.0070)
No 10b5-1 plan	-0.0128*** (0.0001)	-0.0078*** (0.0006)	-0.0161*** (0.0009)	-0.0114*** (0.0002)	-0.0356*** (0.0096)
No 10b5-1 plan × Governance measure	0.0107*** (0.0052)	0.0066* (0.0816)	0.0052** (0.0183)	0.0084** (0.0242)	0.0368** (0.0285)
Governance measure	-0.0040 (0.1504)	-0.0064** (0.0182)	-0.0025 (0.1375)	-0.0129*** (0.0000)	-0.0241* (0.0658)
ln(Transaction value)	-0.0065*** (0.0000)	-0.0066*** (0.0000)	-0.0064*** (0.0000)	-0.0066*** (0.0000)	-0.0064*** (0.0000)
Reporting lag	-0.0937 (0.1200)	-0.0927 (0.1269)	-0.0930 (0.1265)	-0.0909 (0.1366)	-0.0912 (0.1308)
ln(Market value of the firm's equity)	0.0076*** (0.0000)	0.0075*** (0.0000)	0.0076*** (0.0000)	0.0087*** (0.0000)	0.0074*** (0.0000)
Tobin's <i>q</i>	0.0034*** (0.0000)	0.0033*** (0.0000)	0.0033*** (0.0000)	0.0032*** (0.0000)	0.0034*** (0.0000)
Leverage	0.0000 (0.9940)	0.0010 (0.8437)	0.0004 (0.9380)	-0.0007 (0.8839)	0.0001 (0.9908)
Prior two-month abnormal return	0.0134 (0.1841)	0.0133 (0.1870)	0.0133 (0.1875)	0.0126 (0.2091)	0.0137 (0.1742)
<i>Joint effect and significance for:</i>					
No 10b5-1 plan + No 10b5-1 plan × Governance measure	-0.0021 (0.3284)	-0.0012 (0.7010)	-0.0009 (0.7305)	-0.0030 (0.1919)	-0.0024 (0.3155)
Year and industry fixed effects	Yes	Yes	Yes	Yes	Yes
N	13,930	13,930	13,930	13,930	13,930
Adjusted R ²	0.0216	0.0214	0.0214	0.0230	0.0214
Regression's <i>p</i> -value	0.0001	0.0001	0.0001	0.0001	0.0001

Panel B: Restricted stock sales					
Dependent variable = CAR _[t+1, t+40]	Governance Measure				
	Non-Classified Board	Non-Coopted Board	No Entrenchment Index	Board Diversity	Proportion of Independent Directors
	Model 1	Model 2	Model 3	Model 4	Model 5
No 10b5-1 plan	-0.0243*** (0.0038)	-0.0146*** (0.0043)	-0.0282** (0.0175)	-0.0183** (0.0169)	-0.1006*** (0.0035)
No 10b5-1 plan × Governance measure	0.0222** (0.0143)	0.0178** (0.0256)	0.0095* (0.0732)	0.0153* (0.0770)	0.1116*** (0.0066)
Governance measure	-0.0041 (0.5438)	-0.0103* (0.0773)	-0.0030 (0.4791)	0.0043 (0.5156)	-0.0621** (0.0465)
<i>Joint effect and significance for:</i>					
No 10b5-1 plan + No 10b5-1 plan × Governance measure	-0.0021 (0.6208)	0.0032 (0.6185)	-0.0001 (0.9268)	-0.0030 (0.5086)	-0.0002 (0.9729)
Controls and fixed effects as in Panel A	Yes	Yes	Yes	Yes	Yes
N	2,818	2,818	2,818	2,818	2,818
Adjusted R ²	0.0464	0.0450	0.0449	0.0469	0.0460
Regression's <i>p</i> -value	0.0001	0.0001	0.0001	0.0001	0.0001

Table 9: The impact of corporate governance on high CEO incentive 10b5-1 stock sales

Panel A presents estimates from OLS models of cumulative abnormal returns (CARs) over the 40 days following CEO stock sales. The data are for 8,554 CEO stock sales under a Rule 10b5-1 plan during the 2013 to 2020 period. All variables are defined in the previous tables. *P*-values are in parentheses. The joint significance tests for high *CEO incentive* + high *CEO incentive* × *Governance measure* is evaluated at one standard deviation above the mean for continuous governance measures and at one for indicator governance measures. Panel B uses a subsample of 1,572 restricted stock sales executed under Rule 10b5-1 plans. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: All 10b5-1 stock sales					
Dependent variable = CAR _[t+1, t+40]	Governance Measure				
	Non-Classified Board	Non-Coopted Board	No Entrenchment Index	Board Diversity	Proportion of Independent Directors
	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	0.0070 (0.6453)	0.0076 (0.6209)	0.0121 (0.4276)	0.0019 (0.9005)	0.0079 (0.6933)
High CEO incentive	-0.0262*** (0.0001)	-0.0138*** (0.0005)	-0.0362*** (0.0001)	-0.0153*** (0.0053)	-0.0598** (0.0173)
High CEO incentive × Governance measure	0.0173** (0.0161)	0.0012 (0.8545)	0.0115*** (0.0077)	0.0011 (0.8635)	0.0510* (0.0680)
Governance measure	-0.0040 (0.2021)	-0.0066** (0.0355)	-0.0029 (0.1190)	-0.0113*** (0.0005)	-0.0056 (0.6988)
ln(Transaction value)	-0.0071*** (0.0000)	-0.0074*** (0.0000)	-0.0069*** (0.0000)	-0.0072*** (0.0000)	-0.0070*** (0.0000)
Reporting lag	-0.0484 (0.8028)	-0.0493 (0.7956)	-0.0493 (0.7987)	-0.0524 (0.7876)	-0.0637 (0.7349)
ln(Market value of the firm's equity)	0.0078*** (0.0000)	0.0079*** (0.0000)	0.0077*** (0.0000)	0.0089*** (0.0000)	0.0079*** (0.0000)
Tobin's <i>q</i>	0.0040*** (0.0000)	0.0039*** (0.0000)	0.0040*** (0.0000)	0.0039*** (0.0000)	0.0039*** (0.0000)
Leverage	-0.0017 (0.7947)	-0.0005 (0.9361)	-0.0013 (0.8436)	-0.0033 (0.6175)	-0.0008 (0.9063)
Prior two-month abnormal return	0.1345*** (0.0000)	0.1342*** (0.0000)	0.1347*** (0.0000)	0.1321*** (0.0000)	0.1350*** (0.0000)
<i>Joint effect and significance for:</i>					
High CEO incentive + High CEO incentive × Governance measure	-0.0090** (0.0134)	-0.0126** (0.0173)	-0.0074* (0.0548)	-0.0142*** (0.0002)	-0.0139*** (0.0002)
Year and industry fixed effects	Yes	Yes	Yes	Yes	Yes
N	8,554	8,554	8,554	8,554	8,554
Adjusted R ²	0.0488	0.0486	0.0489	0.0498	0.0490
Regression's <i>p</i> -value	0.0001	0.0001	0.0001	0.0001	0.0001
Panel B: All 10b5-1 restricted stock sales					
Dependent variable = CAR _[t+1, t+40]	Governance Measure				
	Non-Classified Board	Non-Coopted Board	No Entrenchment Index	Board Diversity	Proportion of Independent Directors
	Model 1	Model 2	Model 3	Model 4	Model 5
High CEO incentive	-0.0364** (0.0343)	-0.0194** (0.0176)	-0.0535** (0.0160)	-0.0176* (0.0719)	-0.0666* (0.0529)
High CEO incentive × Governance measure	0.0218 (0.2234)	0.0058 (0.6321)	0.0182* (0.0804)	0.0012 (0.9294)	0.0569 (0.4029)
Governance measure	-0.0027 (0.7199)	-0.0109 (0.1393)	-0.0034 (0.4822)	0.0077 (0.3353)	-0.0499 (0.1798)
<i>Joint effect and significance for:</i>					
High CEO incentive + High CEO incentive × Governance measure	-0.0146** (0.0320)	-0.0138* (0.0836)	-0.0190*** (0.0044)	-0.0164*** (0.0090)	-0.0154** (0.0389)
Controls and fixed effects as in Panel A	Yes	Yes	Yes	Yes	Yes
N	1,572	1,572	1,572	1,572	1,572
Adjusted R ²	0.0395	0.0397	0.0403	0.0390	0.0393
Regression's <i>p</i> -value	0.0001	0.0001	0.0001	0.0001	0.0001