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The corporate calendar and the timing of share repurchases and equity compensation*

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Abstract

This study examines whether the CEO uses share repurchases to sell her equity grants at inflated stock prices, a concern regularly voiced in politics and media. We find that the timing of buyback programs and equity compensation, i.e., the granting, vesting, and selling of equity, is largely determined by the corporate calendar through blackout periods and earnings announcement dates. As a consequence, share repurchases and equity compensation are positively correlated. This correlation disappears once we account for the corporate calendar and should thus not be interpreted causally. Our results do not support the conclusion that CEOs systematically misuse share repurchases at the expense of shareholders. To the contrary, equity compensation increases the propensity to launch a buyback program when buying back shares is beneficial for long-term shareholder value.

Keywords: Payout policy, share repurchases, equity-based incentives, short-termism

[JEL]-classification: G14, G35, M12, M52

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“We give stock to corporate managers to convince them to create the kind of long-term value that benefits American companies and the workers and communities they serve. Instead, what we are seeing is that executives are using buybacks as a chance to cash out their compensation at investor expense.” - SEC Commissioner Robert J. Jackson Jr, March 2019.

1. Introduction

The growth in buyback volumes over the past two decades has fueled concerns that CEOs misuse share repurchases to maximize their own personal wealth at the expense of long-term shareholder value. The main argument posits that CEOs use share repurchases to temporarily increase the stock price above fundamental value in order to sell their shares at inflated prices. Share repurchases would consequently constitute a transfer of wealth from non-selling to selling shareholders, implying a detrimental effect on long-term shareholder value. While this concern has received significant attention from U.S. politicians and the press, calling for stricter regulation of share buybacks, systematic empirical evidence on the matter is still scarce, but tends to be supportive of the argument.¹

In this paper, we examine whether the CEO uses share buybacks to sell equity at inflated stock prices. We combine data on US buyback programs extracted from SEC-filings, the CEO’s equity grants and their vesting dates, and the CEO’s insider trades to provide a detailed analysis on this question. We find that both the firm and the CEO are constrained by the corporate calendar which we define as the firm’s

¹On 17 October 2019, this concern was at the centre of a hearing before the U.S. House Committee on Financial Services (Hearing no. 116-58). Also, Appendix A.1 provides a list of commentaries pointing at the misuse of share repurchases. Empirical research finds that insiders ([Bonaimé and Ryngaert, 2013](#)) and specifically the CEO ([Moore, 2020](#)) are more likely to sell equity when firms buy back stock. [Edmans et al. \(2021\)](#) document that share repurchases are positively associated with vesting equity and present evidence consistent with stock price manipulation.

schedule of financial events and news releases throughout its fiscal year, such as blackout periods and earnings announcements. Many firms initiate buyback programs and grant equity around quarterly earnings announcements, leading to a correlation between share repurchases and equity compensation.² The corporate calendar, captured by fiscal-month fixed effects and the monthly share of blackout days, can fully account for the positive correlation between share repurchases and equity-based compensation observed in the data. Hence, we argue that this correlation is spurious and should thus not be interpreted causally. Consistent with our argument, we do not find systematic evidence of price manipulation when the CEO's equity vests or when the CEO sells her vested equity.

We obtain data on US buyback programs executed in the open market from the firm's quarterly reports because detailed data on US buybacks is not readily available. We collect the number or amount of shares authorized for repurchase under each buyback program, the number of shares repurchased, and the average price at which the shares were repurchased. From Equilar, we determine the dates and size of equity grants and when these grants vest. From Thomson Reuters, we obtain data on the CEO's and other insiders' trades in the company's stock. We construct a monthly panel of all firms listed in the US and match it with the Equilar and Thomson Reuters data. Our resulting data set covers 2,375 repurchasing firms, 6,199 buyback programs, and 57,754 months with open market repurchases for the period 2006-2019.

We start our analysis by plotting a firm's repurchase activity over its fiscal calendar. We document that repurchases are lowest in the first month and highest in the second month of each fiscal quarter. From the first to the second month of the fiscal quarter,

²Major financial decisions have to be approved by the board and we conjecture that compensation and buyback decisions are taken during the board meeting which is scheduled ahead of the earnings announcement, leading to a clustering of firm-related announcements/events around the earnings announcement. Note that the reason for this clustering around earnings announcements is not important for our argument. See Section 5.1 for a more detailed this discussion.

repurchase volumes increase by 50% on average. We identify two drivers of this pattern: First, we find that the announcement of a repurchase program often falls on the same day as the announcement of the quarterly earnings, normally taking place at the beginning of the second month of the fiscal quarter. Repurchase activity is highest at the beginning of the program because firms front-load their buyback programs in order to minimize price risk, causing repurchase activity to peak in the second month of the fiscal quarter (Hillert et al., 2016). Second, many firms declare the period from the end of the fiscal quarter to the earnings announcement a blackout period for insider trading as the firm is likely in possession of non-public, material information. As share repurchases can be considered insider trading on behalf of the firm, many firms also suspend their repurchase activity during blackout periods to avoid litigation, causing repurchase activity to be particularly low in the first month of the quarter.

In the next step, we try to better understand to what extent the granting, vesting, and sale of equity depend on the corporate calendar. We find patterns that are very similar to those documented for repurchases. The CEO's equity grants cluster in the 10 days after the earnings announcement date. Granted equity normally vests, i.e., it is transferred to the CEO and can be sold, at the exact same date n years or n quarters in the future. Therefore, the vesting of equity is correlated with earnings announcements, too. Edmans et al. (2017) document that executives immediately sell some of their equity after it vests. We can confirm this relationship between equity vesting and CEO sales for our sample, implying that CEOs' sales of equity also peak in the second month of a fiscal quarter.

We move on to examining the direct relationship between open market share repurchases and the CEO's equity-based compensation, and ask to what extent that relationship is associated with the corporate calendar. We document an economically and statistically significant relation between share repurchases and equity grants, and between share repurchases and vesting equity. However, after accounting for the firms'

corporate calendar by adding fiscal-month fixed effects and the share of blackout days in a calendar month as control variables, these correlations decrease and become statistically insignificant. We rely on such a simple definition of the corporate calendar to ensure its exogeneity with respect to the timing of buybacks and equity grants. In particular, the share of blackout days is solely based on the date of the earnings announcement, which is set well ahead of decisions about buyback programs and equity grants. We conclude that neither the granting of equity nor the vesting of equity has a direct influence on the execution of buyback programs in the open market.

If CEOs use share repurchases to sell their equity at higher prices, we should observe a positive correlation between share repurchases and the CEOs' sales. However, we find that CEOs tend to buy more and sell significantly less when firms buy back shares. These results hold regardless of whether we account for the corporate calendar, but accounting for the corporate calendar makes these findings stronger. In addition, we find that CEOs sell a larger share of their vesting equity towards the end of the buyback program when repurchase volumes are relatively low. While we acknowledge that these results cannot be interpreted causally, they can certainly not be interpreted as evidence that the CEO trades against the firm.

Earlier research documents a negative correlation between share repurchases and net insider trading and our results are not in contradiction with this research. In line with [Bonaimé and Ryngaert \(2013\)](#), we find that share repurchases and net insider trading are negatively correlated, i.e., insiders sell more when firms buy back. Further analyses reveal that this correlation is not driven by the firm's executives but mainly by large blockholders: large blockholders are also classified as insiders and they sell more when firms buy back stock. This finding is consistent with the results in [Hillert et al. \(2016\)](#) and [Busch and Obernberger \(2017\)](#) that firms provide liquidity when large blockholders sell their shares in order to provide price support at fundamental values.

After examining the trading behaviour of the firm, we move our attention to the

firm's decision to initiate a buyback program and how this decision relates to equity-based compensation. We corroborate earlier reports that insiders sell more stock after the start of a repurchase program (cf., e.g., [Jackson Jr, 2019](#), and [Edmans et al., 2021](#)). [Bettis et al. \(2000\)](#) and [Klein and Maug \(2020\)](#) document that executives make more insider trades after the earnings announcement because they mark the end of firms' blackout periods. In line with these studies, we find that CEOs generally sell more shares after earnings announcements. We, therefore, conjecture that CEOs sell more stock after buyback announcements merely because they largely coincide with earnings announcements. Consistent with our argument, CEOs do not sell more of their stock when buyback announcements are not preceded by blackout periods.

Running a linear probability model of the start of buyback programs on firm-level panel data, we find that CEOs are actually more likely to buy stock in the month in which the repurchase program starts, and they are not more likely to sell stock at this point. Interestingly, we find that the probability of launching a buyback program increases when the CEO's equity vests. Overall, these results suggest that CEOs initiate buyback programs when they believe that the stock is undervalued, which is consistent with the findings of [Babenko \(2009\)](#) and [Cziraki et al. \(2019\)](#). An analysis of long-run abnormal returns will shine more light on this interpretation, which is the focus of the remainder of this paper.

In the final step, we examine the return patterns around buyback programs and open market share repurchases, in particular when the vesting or sale of equity takes place simultaneously. Our baseline hypothesis put forward in earlier research states that CEOs use share repurchases to manipulate stock prices to the benefit of their equity-based compensation. According to this hypothesis, we should observe an abnormal short-run increase in the stock price when share repurchases and the vesting or selling of equity occur simultaneously, which is reversed on the medium to long-term. As an alternative hypothesis, we propose that equity-based compensation increases the

CEO's propensity to launch a buyback program when share repurchases have a positive impact on long-term shareholder value. This hypothesis is rooted in the observation that equity grants and subsequent equity sales are not singular events for a CEO. As granted equity periodically vests over a time horizon of several years, CEOs are more likely to profit from long-term increases in shareholder value than from short-term price manipulation at the expense of long-term shareholder value. Hence, under this alternative hypothesis, share repurchases should have a positive impact on shareholder value, both on the short run and on the long run.

We find that buyback *programs* which coincide with the vesting of equity are followed by positive abnormal returns over the subsequent 48 months, and their performance is not different from the average buyback program. When CEOs sell large amounts of their equity in the first 12 months after the start of the program, the associated long-run performance is even more positive than the one observed for the average program, which is inconsistent with the notion that CEO sales of equity and long-run performance are negatively correlated. These results and the observation that equity grants increase the propensity of launching a buyback program, suggest that the interests of the CEO and the shareholders become more aligned through equity grants.

Actual repurchases of stock through trading in the open market, i.e., open market repurchases, which coincide with the vesting or selling of equity are also generally followed by positive abnormal returns. Furthermore, firms conduct these repurchases at prices below contemporaneous market prices. Firms, therefore, either buy back shares before stock prices increase or they trade contrary to the market. Hence, there is no evidence that firms use share repurchases to bid up the stock price. Taken together, these results do not support the conclusion that CEOs systematically misuse share repurchases to their benefit and at the expense of shareholder value.

In conclusion, we find that the timing of share repurchases and the CEO's equity-based compensation is largely determined by the corporate calendar, creating a spuri-

ous correlation between the two variables. Blackout periods confine the CEO and the firm to the same trading periods, but they tend to trade in the same direction. Hence, the CEO's personal trades are consistent with the firm's decision to initiate a buyback program and to repurchase shares. Overall, our results suggest that equity-based compensation incentivizes CEOs to launch buyback programs when the stock price is undervalued.

We are indebted to [Edmans et al. \(2017\)](#) for constructing a viable vesting variable, allowing us to make several contributions to the literature. First, we highlight the role of the corporate calendar for the timing of share repurchases and equity grants. We show that repurchase activity varies substantially within a fiscal quarter, which has hitherto not been documented. As a consequence, any study of repurchase activity suffers from omitted variable bias if the variables of interest, like equity compensation variables, are correlated with the corporate calendar. Furthermore, we document that the vesting date depends mechanically on the equity grant date, implying that vesting dates are also correlated with the corporate calendar. Hence, vesting equity is a predetermined, but not exogenous variable. Second, we highlight the relevance of the corporate calendar for the relationship between share repurchases and equity based compensation. We argue that earlier reports of a correlation between share repurchases and equity-based compensation are accurate, but that this relationship should not be interpreted in a causal way. Third, we provide a novel perspective on the relevance of equity grants for the firm's payout policy. We present evidence consistent with the notion that equity grants incentivize the CEO to launch a buyback program when it is beneficial for long-term shareholder value, suggesting a novel channel of how equity grants help to align the interests of shareholders and the CEO.

The paper is organized as follows: The next section discusses the related literature and Section 3 the regulation of share repurchases, equity grants, and insider trading. Section 4 contains our data and methodology which is followed by our results. Finally,

Section 6 concludes.

2. Related literature

The literature on the relationship between share repurchases and equity-based compensation has focused on three different compensation-related events: equity grants, equity vesting, and sales of equity. Babenko (2009) finds that firms make fewer stock option and stock awards after repurchases. The author argues that share repurchases increase the pay-performance sensitivity of the equity grants: a higher pay-performance sensitivity would allow firms to issue lower equity grants in the future while maintaining the level of incentivization. Kahle (2002) shows that firms announce repurchases when executives have large numbers of options outstanding and when employees have large numbers of options currently exercisable. Her results are consistent with managers repurchasing both to maximize their own wealth and to counter dilution from employee stock option exercises. Bens et al. (2003) find that executives use share repurchases to counter the dilutive effect of outstanding employee stock options (ESOs) on earnings per share (EPS). The dilution-channel has been recently confirmed in Bonaimé et al. (2020).

Moore (2020) uses equity vesting schedules to predict the CEO's sales of equity. The author finds that predicted CEO sales are positively related to the probability and size of share repurchases, concluding that the CEO's equity-based compensation motivates share repurchases. However, the author does not find any impact of the opportunistic timing on long-term shareholder value. Edmans et al. (2021) show that firms buy back more stock after managers' stock options vest. As a consequence of firms' abnormal repurchase behavior, stock returns are more positive in the two quarters surrounding repurchases, but more negative in the two years following repurchases, which is contrary to Moore (2020). The authors argue that both studies come to different conclusions by pointing out the fact that they have a larger sample than Moore (2020). Edmans

[et al. \(2021\)](#) also document that CEOs sell more stock in the month after the buyback announcements than in the month before the buyback announcement. These papers demonstrate that vesting equity creates short-term incentives that motivate CEOs to use share repurchases to (potentially) temporarily increase the stock price.

[Bonaimé and Ryngaert \(2013\)](#) find that the probability of repurchases is highest in quarters with net insider selling. The authors conclude that share repurchases which coincide with insider selling are more likely done to support share prices or to avoid dilution, and are less likely motivated by undervaluation. [Babenko et al. \(2012\)](#) find that insider purchases ahead of buyback announcements are positively related to buyback announcement returns and post-announcement stock returns. [Cziraki et al. \(2019\)](#) document that insiders buy more stock than they sell prior to buyback announcements, which suggests that insiders and the firm share a consistent valuation of the firm's current market value.

To briefly review the more general literature on repurchases, several papers document a positive relation between buyback announcements and long-term shareholder value (cf, e.g., [Ikenberry et al., 1995](#), [Peyer and Vermaelen, 2009](#), [Lee et al., 2020](#)), between open market share repurchases and shareholder value ([Ben-Rephael et al., 2014](#), [Dittmar and Field, 2015](#)), and between open market share repurchases and price efficiency ([Busch and Obernberger, 2017](#)). [Almeida et al. \(2016\)](#) show that repurchases undertaken to meet earnings per share (EPS) forecasts reduce employment, investment, and cash holdings, but these repurchases have no measurable impact on shareholder value. [Bargeron and Farrell \(2021\)](#) use the setting of dual-class shares to show that repurchases have a temporary price impact, but the authors argue that the price impact would be too small for CEOs to benefit from it.

3. Regulation of share repurchases, equity grants, and insider trading

3.1. U.S. regulation of share repurchase programs

3.1.1. Authorization of share repurchase programs and repurchases in the open market

The creation of a buyback program is of major significance for the strategic and financial policies of the firm. The decision to initiate a buyback program has thus to be made on the executive level and the CEO will usually be involved in that decision. The firm's board of directors has to officially authorize a program before it can start, and the execution of the program should be preceded by a share repurchase announcement. There is no requirement to obtain approval from shareholders at the shareholders' meeting.

3.1.2. Disclosure of share repurchase programs and repurchase activity

There are no specific rules or regulations regarding the announcement of newly authorized buyback programs. Firms are in general required to disclose all material information as soon as possible.³ Buyback programs have an impact on the firm's financial resources and affect the firm's capital structure. The authorization to launch a buyback program therefore constitutes material information and should thus be communicated to the public via SEC's 8-K, 10-Q, or 10-K filings.

Item 703 of Regulation S-K (17 CFR § 229.703) requires the firm to provide information about its repurchase activity retrospectively in its quarterly reports. For each month covered by the report, the firm must report (a) the total number of shares purchased, (b) the average price paid per share, (c) the total number of shares purchases as part of publicly announced programs, and (d) the maximum number of shares that may yet be purchases under these programs. The firm must also disclose the type of

³For example, the NYSE mentions buyback program starts as material information: https://www.nyse.com/publicdocs/nyse/regulation/nyse/NYSE_2020_Listed_Company_Compliance_Guidance.Memo.pdf

transaction (open market repurchase, tender offer, privately negotiated repurchase, or accelerated share repurchase) and whether the purchase was made to satisfy the firm's obligations to provide shares to their employees as part of their compensation and pension schemes.⁴ For each publicly announced program, the firm must further disclose the program's date of announcement, the approved dollar value of the program, and the expiration date (if any).

3.1.3. Regulation of the purchase of securities by the issuer

The firm's trading in its own stock is subject to SEC rules 10b-5 and SEC rule 10b-5-1, which articulate that it is unlawful to employ "manipulative or deceptive devices" (17 CFR § 240.10b-5) and to trade on the basis of material non-public information (17 CFR § 240.10b-5-1). As such, the firm is liable for any damages caused by manipulation or insider trading.

SEC rule 10b-18 (17 CFR § 240.10b-18), whose amendment in 2003 paved the way for the growth in buyback activity, provides a safe harbor from liability for manipulation with respect to the manner, timing, price, and volume of their repurchases, provided they adhere to a number of conditions. Most notably, repurchases are exempt from anti-manipulation provisions with respect to the aforementioned manners of trading if the firm (1) uses only one broker per trading day, (2) refrains from trading at the beginning and at the end of the trading day, (3) purchases stock at prices lower than the highest independent bid, and purchases less than 25 percent of the average daily trading volume.

⁴The SEC rule provides a template for the repurchase table and clarifies the information to be disclosed in the footnote to the table: <https://www.govinfo.gov/app/details/CFR-2008-title17-vol2/CFR-2008-title17-vol2-sec229-703>.

3.2. U.S. regulation of equity grants, vesting periods, and insider trading

To overcome the agency problems stemming from the separation of ownership and control in publicly traded firms, executives are usually compensated by equity grants of the firm they manage. Executive compensation must be extensively disclosed since 2006, including the executives' equity grants and the vesting periods of any equity grants. Executive compensation packages are disclosed on a yearly level in the invitation to the annual meeting (DEF 14a). In addition, insiders are commonly defined as a firm's executives, directors and any owners of more than 10% of the firm's shares.⁵ Insider trades must be filed to the SEC within two business days by filling in the SEC Form 4.

4. Data and methodology

4.1. Repurchase data

To date, there is no commercial database that provides detailed repurchase activity on a monthly basis or includes details on the nature of the repurchases. Hence, we resort to obtaining the repurchase data directly from the quarterly filings with the SEC. We start the collection process with a script in Python that downloads all the 10K and 10Q filings of US firms available in the EDGAR database. Then, we parse through the filings in search for repurchase information under Item 2(e) of Form 10-Q or under Item 5(c) of Form 10-K. For the filings that contain repurchase information, we extract the total number of shares purchased, the average price paid per share, the total number of shares purchases as part of publicly announced programs, and the maximum number of shares that may yet be purchases under these programs.

⁵The SEC definition of insider trading does not provide a complete list of people who need to file. The SEC's definition is "Illegal insider trading refers generally to buying or selling a security, in breach of a fiduciary duty or other relationship of trust and confidence, on the basis of material, nonpublic information about the security". See <https://www.investor.gov/introduction-investing/investing-basics/glossary/insider-trading>.

Besides the numerical data in the repurchase table, firms disclose detailed information on the nature of the transaction and characteristics of repurchase programs. We write a separate Python-script that extracts all the text surrounding the repurchase table and performs a textual analysis. This textual analysis identifies relevant information on the characteristics of the buyback program. For example, we identify the transaction method (open market, private negotiation, or tender offer) and, in case of a publicly announced program, the program's date of announcement, approved dollar amount of the program, and, if applicable, the expiration date.

After the automated scripts have been run, a process of manual work follows to check and supplement the automatic output. The manual work is mainly for four purposes. First, some firms did not adhere to the standard format of reporting share repurchase activity, so for those respective filings we look up the repurchase information manually. Second, we aggregate our monthly repurchase dataset to the quarterly level and compare it with the Compustat quarterly variables for share repurchases. We examine the original SEC filings in case of substantial discrepancy between Compustat and our dataset. Third, since SDC Platinum is the standard data source for announcements of repurchase programs, we compare the announcement information in our dataset with that in SDC, and check the original SEC filing if there is any difference. Lastly, to avoid outliers due to errors in data collection, we manually check the highest percentiles of repurchases volume, repurchased stocks as a fraction of total shares outstanding, and repurchasing price, respectively.

Our final repurchase data set covers 3,556 repurchasing firms, 11,451 buyback programs, and 106,935 open market repurchasing months.

4.2. Construction of firm-level data set

We start building our firm-level data set by identifying all U.S. firms that trade on the NYSE, AMEX, and NASDAQ in the CRSP database (using share codes 10

and 11), for the period between January 2004 to December 2019. This amounts to 8,424 firms. Using the CRSP-Compustat merged database, the firms are linked to the respective identifiers for the Compustat and EDGAR database. There are 356 firms that have missing data in the linking process, and thus 8,068 firms are left that can be found on CRSP, Compustat, and EDGAR.

Using these firms, we construct a monthly panel dataset and match the monthly repurchase data to it. We exclude all firms that never repurchase within our sample period. In addition, we exclude firms in the financial and utility industries.

For this current project, we are particularly interested in the CEO vesting schedule which listed firms must disclose since January 2006 under a SEC disclosure rule. We therefore match our dataset to Equilar data which contains detailed CEO compensation data for Russell 3000 firms. The resulting dataset contains 2,375 repurchasing firms, 6,199 buyback programs, and 57,754 open market repurchasing months over the period 2006 to 2019.

4.3. Variable construction

4.3.1. Measures of repurchase activity

The dependent variable in our baseline regression is *Repurchase intensity*, which is constructed as the number of shares repurchased during the month, divided by the number of shares outstanding at the beginning of the month.

4.3.2. Measures of the CEO's equity based compensation and insider trading

We look at three distinct events, which appear to be of significance for the CEO's equity-based compensation: (1) The granting of equity, (2) the vesting of equity, and, finally, (3) the sale of vested equity. Below, we describe how we construct variables for each of these three events.

A CEO's equity compensation consists of awarded stocks and awarded options. We use Equilar to observe the grant dates and dollar amounts of the awarded stocks

and options. Determining when the CEO’s granted equity subsequently vests is more cumbersome, and different approaches need to be applied for stocks and options. In line with the methodology in [Edmans et al. \(2017\)](#) and [Edmans et al. \(2021\)](#), we construct *Vesting equity*, which is the dollar value of vesting equity on a monthly level.

The Thomson Reuters Insider Data provides detailed transaction data of firm insiders. We aggregate daily data to calculate a monthly measure and remove records a cleanse indicator of “A” or “S”, which indicate that the data was not verified ([Dai et al., 2016](#) and [Rossi and Sahlström, 2019](#)). In line with [Bonaimé and Ryngaert \(2013\)](#) we construct *Insider trading* to denote the net dollar amount of insider acquisitions minus insider disposals. The variable is positive if insiders have bought more than they sold, and negative if the opposite is true. We decompose *Insider trading* into the trading activity done by each group of insiders according to their functional role, which is provided by the Thomson Reuters Insiders Data Feed Manual. Based on this categorization, we classify trading done by the CEO, CxO (all Chief Officers except for the CEO), Officers, Directors, Beneficial owners, Affiliates, Committee members and Others. In addition to decomposing *Insider trading*, we also decompose insiders’ buying activity and selling activity. Buying and selling activity are always a positive dollar amount or zero. As a result, we have the following set of insider trading variables: *CEO buying*, *CEO selling*, *CxO buying*, *CxO selling*, *Officers buying*, *Officers selling*, *Directors buying*, *Directors selling*, *Owners buying*, *Owners selling* and *Affiliates selling*. For *Affiliates buying* and *Committee members and Others*, we do not record any activity during the sample and thus they are excluded from the list.

4.3.3. Blackout periods

We examine the economic relevance of blackout periods for monthly repurchase activity. Most firms voluntarily impose blackout periods for the time from the end of the fiscal quarter until the release of the earnings. We employ a simple procedure to

construct an empirical proxy for blackout periods. We identify all days from the end of a firm's fiscal quarter to the following earnings announcement as blackout days. To obtain a monthly measure we compute the fraction of trading days that are blackout days within a month.

Our procedure is consistent with survey results of [Bettis et al. \(2000\)](#). They report that the majority of firms impose blackout periods that restrict trading prior to earnings announcements. [Roulstone \(2003\)](#) uses a comparable procedure to identify blackout periods.

In our sample the mean (median) time span between the end of quarter and the earnings announcement, which resembles our empirical proxy for blackout periods, is 31.7 (29.0) days (not mentioned in the tables). The earnings announcement usually takes place before the filing. The average time between the end of the fiscal quarter and the filing is 44.9 calendar days in our sample. This corresponds well to the SEC regulation that demands annual (quarterly) reports to be filed within 60 to 90 days (40 to 45 days) after the end of the fiscal year (quarter). Based on hand-collected information on insider trading restriction policies of 260 firms, [Jagolinzer et al. \(2011\)](#) report that on average blackout periods start 46 days before the earnings announcement. We conclude that our estimate is likely to be at the lower bound of the true length the blackout periods. Consequently, our analyses on the impact of blackout periods on repurchase activity might underestimate the true magnitude.

4.3.4. Further control variables

The control variables used in the regressions are consistent with the existing share repurchase literature. We use the set of control variables deployed in [Hillert et al. \(2016\)](#) which includes the lagged returns for the past three months, the firm's total assets, the ratio of cash to assets, the ratio of EBITDA to total assets, the ratio of dividends to assets, leverage, book-to-market ratio, options exercised, and two dummy

variables that indicate whether the firm is a target or acquiror in a takeover.

In addition, we include several other control variables that complement the set. Market conditions are further proxied by adding a measure for trading volume as well as a measure for market liquidity. *Trading volume* is constructed by first taking the sum of the shares traded minus the shares repurchased in a particular month, followed by dividing that number by the number of shares outstanding at the beginning of that month. Our measure for market liquidity is *Relative spread*, which is the natural logarithm of the average relative spread within a month. We construct the relative spread as the difference between the bid and ask price multiplied by two, divided by the sum of the bid and ask price.

As documented by [Liu and Swanson \(2016\)](#) and [Campello et al. \(2020\)](#), the execution of share repurchases may be linked to the amount of short selling pressure a stock receives. In this regard, we follow [Liu and Swanson \(2016\)](#) in constructing *Change in short interest*, which denotes the first difference of shares sold short as of the 15th business day scaled by the shares outstanding at the beginning of the month. We expect this variable to show a positive sign, as share repurchases and short selling often move in the same direction. Lastly, we add *Options outstanding*, which shows variation on a yearly base in the number of options outstanding.

4.4. Descriptive statistics

Table 1 provides an overview of all variables used in this paper along with their definition and data source. Table 2 presents the descriptive statistics for these variables. Our firm-level panel covers 248,884 observations. *Repurchase dummy* is 0.2427 on average, indicating that open market repurchases under a publicly announced program have occurred in roughly a quarter of all firm-months in our sample. Over the full sample, firms buy back on average 0.1571% of their shares outstanding per month. Equity is granted in 7.7% of the months in our sample and equity vests in 19.5% of

the months in our sample, suggesting that equity grants vest gradually over time.

4.5. Research Design

Our analysis is based on a firm-level panel data set using monthly observations between 2006 and 2019. Our full specification regresses a measure of repurchase activity on measures related to the CEO’s equity based compensation, standard controls, controls for the corporate calendar (*Blackout ratio* and *Fiscal-quarter month dummies*), and time, firm, and program month fixed effects:

$$\begin{aligned} \text{Repurchases}_{i,t} = & \beta_1 \cdot \text{CEO-comp}_{i,t} + \delta \cdot \text{Blackout ratio}_{i,t} + \gamma \cdot \text{Controls}_{i,t} \\ & + \lambda_j + \eta_t + \mu_i + \kappa_k + \epsilon_{i,t} \end{aligned} \quad (1)$$

where $\text{Repurchases}_{i,t}$ measures firm i ’s repurchase activity in month t and $\text{CEO-comp}_{i,t}$ measures firm i ’s equity-based compensation of the CEO in month t (*Granted equity*, *Vesting equity*, or *CEO selling*). λ_j represents the fiscal-quarter month dummies and η_t , μ_i and κ_k denote the time, firm and program month fixed effects respectively. The standard errors are clustered at the firm level, and regressions are unweighted.

5. Results

This section presents the results of our empirical analysis. In Section 5.1, we analyze how the corporate calendar affects the timing of the firm’s repurchases and the CEO’s equity based compensation. In Section 5.2, we examine how the interplay between share repurchases and equity-based compensation affects stock prices.

5.1. The corporate calendar, the timing of share repurchases and the CEO’s equity based compensation

In this section, we provide a detailed analysis of the interplay between share repurchases and the CEO’s equity-based compensation. In Section 5.1.1, we examine

to what extent share repurchases and the CEO's equity-based compensation depend on the corporate calendar. We define the corporate calendar as the firm's schedule of financial events and news releases throughout its fiscal year, such as blackout periods and earnings announcements. We argue that this schedule determines when firms implement decisions about buyback programs and equity compensation and when firms and CEOs can execute trades in the open market. Hence, we examine how buyback program initiations and open market repurchases are distributed over the fiscal year and whether firms suspend trading during voluntary blackout periods. Then, we provide similar analyses for the CEO's granting, vesting, and selling of equity. In Section 5.1.2, we investigate the interplay of share repurchases and the CEO's equity based compensation and ask to what extent that connection is associated with the corporate calendar.

5.1.1. The impact of the corporate calendar on the timing of share repurchases and the CEO's equity based compensation

Figure 1, Panel A, plots the initiation of buyback programs over the twelve months of the corporate calendar and presents a remarkable pattern over the fiscal year. Most announcements take place in the second, fifth, eighth, and eleventh month. These months represent the second month in each of the four quarters of the fiscal year. We conjecture that buyback announcements are related to a firm's earnings announcements, which usually take place at the end of the first month or the beginning of the second month in a fiscal quarter. Figure 1, Panel B, plots the difference in calendar days between the announcement of a buyback program and the announcement of earnings. It turns out that the majority of buyback programs are announced on the same day as the firm's quarterly earnings. We conclude that the announcement and thus start of buyback programs is not randomly distributed over the corporate calendar, but coincides with the announcement of quarterly earnings. This observation is reasonable

because both earnings and buyback programs need to be authorized by the board. The start of a buyback program will thus have to wait until the next board meeting and there are less than two board meetings in the quarter (Vafeas, 1999, Adams et al., 2021).

Figure 2, Panel A, plots the execution of buyback programs in the open market from the month after the initiation of the program to 12 months later. For each program month, we compute the average of *Repurchase intensity* over all open buyback programs. We observe a clear pattern, first documented in Hillert et al. (2016): Firms buy back their stock at a decreasing rate, which is consistent with how large, risk-averse block-traders execute their trades in order to minimize price risk.⁶

Figure 2, Panel B, translates the calendar-time plot presented in Panel A into corporate time. In order to plot the execution of buyback programs with regards to the corporate calendar, we adjust the program month for those programs that do not start in the first month of the fiscal quarter. For programs starting in the second (third) month of the quarter, we shift program month by one (two) month(s). Thus, the first program month for all programs starting in the second (third) month of the fiscal quarter is $q, m=3$ ($q+1, m=1$). This transformation brings out a very persistent pattern of repurchase activity within buyback programs: repurchase activity is highest in the second month and lowest in the first month of each quarter and the average relative difference between the first and the second month is equal to 71%.

Figure 3 provides a different perspective on the repurchase activity within a quarter by looking at the number of blackout days in a given quarter-month.⁷ We group repurchase months into three categories (none, partial, full) according to how much of

⁶Theoretical work on block trading strategies concludes that risk-averse investors with a limited time horizon should front-load their trades to reduce the exposure to stock price risk and to improve risk sharing (cf. Bertsimas and Lo, 1998, Almgren and Chriss, 2001, Vayanos, 2001, and He and Mamaysky, 2005).

⁷See Section 4.3.3 for details on how we identify blackout days.

a month is covered by blackout days. We find that the relative difference of *Repurchase intensity* between months with no blackout days and months with only blackout days is equal to 76% $(=(0.167\%-0.095\%)/0.095\%)$. Hence, we conclude that repurchase activity is largely determined by the timing of the earnings announcement and the firm's blackout periods.

We move on to examining to what extent the timing of the CEO's equity based compensation is determined by the corporate calendar. Figure 4, Panel A, plots the difference in calendar days between the granting of equity and the announcement of earnings. The relationship between the two variables is not as pronounced as the one depicted in Figure 1, but the graph still clearly indicates that equity grants cluster around earnings announcements. This insight is important because the timing of equity grants prescribes at what point in time in the future equity vests and is potentially sold. If equity vests three years after its granting, vesting dates will again coincide with earnings announcements. Furthermore, [Edmans et al. \(2018\)](#) state that CEO vesting is significantly correlated with CEO equity sales, suggesting that the CEO's trades in the company's stock will also be correlated with earnings announcements.

In Panel B and Panel C of Figure 4, we plot the vesting of equity and the CEO's sale of equity over the first 12 months of a buyback program. Again, we transform the graph such that it provides us with the perspective of the corporate calendar. We find a very striking pattern which is the same for equity vesting and equity sales: volumes roughly double when you consider the first or third month of the fiscal quarter and compare it to the second month of the fiscal quarter. We conclude that a major determinant of both equity vesting and equity sales are the timing of earnings announcements and, consequently, the firm's blackout periods. By comparing Panel B and Panel C, it furthermore becomes apparent that CEOs tend to sell more of their vested equity towards the end of the program: we observe that the level of CEO sales is relatively stable while vesting equity is negatively associated with the time since the start of the

program.

In Table 3, we estimate the impact of the corporate calendar on our main variables of interest using our full panel of firm-month observations. We use binary variables indicating months in which repurchases, granted equity, vesting equity, or CEO's sales of vested equity are larger than zero. For all of our dependent variables, an increase in *Blackout ratio* decreases the likelihood of a repurchase or equity-based compensation event. Based on the coefficient estimate of *Blackout ratio*, the likelihood of a share repurchase taking place decreases by 5.26, which is a decrease of roughly 20% relative to unconditional probability of a repurchase (24.27%). For our equity-based compensation events, the coefficient of *Blackout ratio* is roughly of the same order of magnitude. Adding dummy variables for the respective month in the fiscal quarter reveals that the likelihood of a repurchase or equity-based compensation event is the highest in the second month of the quarter. We obtain very similar conclusions when we use volumes instead of binary variables for our dependent variables (cf. Table OA1). Overall, we conclude that repurchases in the open market, like all equity-based compensation events, are confined by the corporate calendar. Most notably, the results indicate that the corporate calendar creates a correlation between repurchases and the vesting of equity. We conclude that the vesting of equity is endogenously determined and does not satisfy the exclusion restriction necessary to qualify as an instrument for CEO selling in a regression of repurchases.

5.1.2. Regressions of share repurchases on the CEO's equity-based compensation

This section provides a detailed analysis of the interplay between share repurchases and the CEO's equity-based compensation. We track the CEO's equity-based compensation from the initial granting of equity to its eventual sale in the open market. We put a particular focus on the granted equity's vesting dates, because these mark the point in time where the CEO can first sell her equity. Many insiders sell their equity

immediately after it vests and, therefore, vesting equity has been used as an instrument of insider sales in earlier studies (see [Edmans et al., 2018](#), [Moore, 2020](#)).

In Table 4, we examine the direct relationship between open market share repurchases and the CEO’s equity-based compensation, and to what extent that relationship is associated with the corporate calendar. In Table 4, Panel A, column (1), we regress *Repurchase intensity* on *Granted equity dummy*, standard controls, and firm and time fixed effects. We obtain a statistically significant coefficient for *Granted equity dummy* of 0.0124, which means that an equity grant increases *Repurchase intensity* by 0.0124 percentage points on average, which is equal to 7.89% of the average *Repurchase intensity* (=0.1571%, from Table 2) in our sample.⁸ In column (2), we add controls for the corporate calendar: fiscal month-fixed effects and Blackout ratio. As a consequence of adding controls for the corporate calendar, the coefficient estimate of *Granted equity dummy* decreases by 70% and is no longer statistically significant. Hence, we conclude that the correlation between *Repurchase intensity* and the granting of equity is driven by the corporate calendar and thus spurious to a large extent. We obtain qualitatively similar results for *Granted equity* in columns (4) and (5).

In columns (3) and (6), we add program month dummies to the regressions. As discussed above, firms regularly front-load their buyback program and program month dummies capture the pattern with which buyback programs are executed over time. Adding program month dummies removes the effect entirely—also in those specifications where a residual effect remains after controlling for the corporate calendar. We conclude that the execution of buyback programs is entirely unrelated to events related to *Granted equity dummy* or *Granted equity*.

Panel B reports very similar results for the vesting of equity. As pointed out earlier,

⁸In the Appendix, we provide a discussion of the control variables and how well they blend in with the existing literature. Our general conclusion is that all control variables align well with the existing literature.

we expect a correlation between share repurchases and the vesting of equity because equity usually vests at the same point in a fiscal quarter, just some (often four) quarters in the future. There is a caveat to this finding: It might be conceivable that vesting of equity influences the start of a new program and its size. Hence, columns (3) and (6) of Panel B might be endogenous. That caveat doesn't extend to columns (2) and (4) as the variables are clearly exogenous. These columns clearly show that vesting equity has no significant effect on *Repurchase intensity*. We will further discuss the impact of *Vesting equity* on the propensity to launch a buyback program below.

In Panel C of Table 4, we observe that the correlation between repurchases and the CEO's sale of equity is not affected by the corporate calendar in the same way, even though the CEO's sale of equity is generally also confined by the corporate calendar (see Table 3). We do not document an increase in *Repurchase intensity* in months with CEO selling. Conversely, there is a negative correlation between the amount of CEO selling and *Repurchase intensity*, which is even exacerbated by accounting for the corporate calendar. These results are not consistent with the CEO making use of share repurchases to boost her equity sales. However, the results are consistent with the notion that the CEO tends to view the stock price undervalued when repurchases take place and thus refrains from selling larger amounts of equity at the same time.

Bonaimé et al. (2020) report that firms increasingly make use of SEC rule 10b5-1 when they buy back stock. SEC Rule 10b5-1 exempts repurchases from prosecution for insider trading if repurchases follow a pre-defined, written plan that either specifies the amounts, dates, and prices at which trading should take place, or executes a pre-defined trading formula.⁹ Hence, buybacks under 10b5-1 programs should be less dependent on the corporate calendar, in particular blackout periods, because there is lower risk of litigation. We test and corroborate this prediction. When we estimate Table 3, Panel

⁹For a detailed discussion of 10b5-1 trading plans and their use by insiders, see Jagolinzer (2009).

A, for the sub-sample of 10b5-1 programs, we can no longer document a significant impact of the corporate calendar on buyback activity (Table OA2). Furthermore, the effects reported in Table 4 are only present in flexible programs, but not in 10b5-1 programs, corroborating the notion that conventional buyback programs are hampered by trading restrictions directly related to the firm's corporate calendar (Table OA3 vs. Table OA4). We find that 15% (12%) of repurchase months in the most recent five (all) years of our sample are associated with SEC rule 10b5-1 (in these cases, firms have indicated that some or all repurchases may have taken place under 10b5-1; hence, this number constitutes the upper bound of repurchases under 10b5-1), suggesting that the corporate calendar will remain a significant factor for buyback activity for the foreseeable future.

Overall, the results presented in Table 4 suggest that the relationship between *Repurchase intensity* and the granting and vesting of equity is largely moderated by the corporate calendar. Blackout periods and earnings announcements influence the timing of both share repurchases and the CEO's equity based compensation.¹⁰

Bonaimé and Ryngaert (2013) document a negative relationship between share repurchases and net insider trading. In order to reconcile our results reported in Panel C of Table 4 with Bonaimé and Ryngaert (2013), we take a closer look at the CEO's actual trades of equity in Table 5. In Panel A, we aim to establish common ground with earlier literature and regress *Repurchase intensity* on *Net insider trading*, controls for the corporate calendar, and additional control variables used in the literature. In column

¹⁰Note that this analysis is based on open market repurchases made under a publicly announced program. Firms regularly buy back shares to satisfy obligations from employee stock option plans and these repurchases are usually made outside of publicly announced buyback programs. These buybacks are mechanically related to the CEO's equity-based compensation, but they are outside of the influence of the CEO and are thus not considered in this study. These Non-program share repurchases don't appear in Table 2. The mean of Non-program Repurchase intensity is 0.0140 and the standard deviation is 0.2888. We replicate the results of Table 4 repurchases outside of publicly announced programs in Table OA5 in the appendix. We conclude that studies analyzing the total number of share repurchases also pick up the mechanical correlation between share repurchases and equity vesting, which is not motivated by opportunistic timing.

(1), we document a negative relationship between share repurchases and net insider trading, which is statistically highly significant, in line with [Bonaimé and Ryngaert \(2013\)](#). Again, statistical and economic significance disappears once we control for the corporate calendar in column (2).

In Panel B, we decompose net insider trading into trading by the CEO, the other lead executive officers (CxO), other officers, directors, beneficial owners, and affiliates. Decomposing net insider trading into separate groups reveals that the CEO in fact trades in the same direction as the firm. Moreover, lead executive officers do not trade against the firm. The negative sign on the overall insider trading variable is driven by beneficial owners and directors only, as shown in column (3). Beneficial owners, whose tradings are most strongly negatively related to share repurchases, are usually funds or trusts who hold large blocks of shares. This result is consistent with [Hillert et al. \(2016\)](#) and [Busch and Obernberger \(2017\)](#) who argue that firms provide liquidity when large blockholders sell their shares in order to provide price support at fundamental values.

In Panel C, we additionally distinguish insider buying from insider selling. *CEO selling* and *Repurchase intensity* are negatively correlated, suggesting that the CEO sells actually less stock when firms buy back stock in the open market (as also presented in [Table 4, Panel C](#)). Directors and officers trade in repurchase months in both directions. Hence, some directors and officers may just trade alongside the firm, whereas others sell their equity as soon as it vests. The latter conjecture is corroborated by the observation that the corporate calendar decreases the correlation with "selling" in column (2). Note that insiders mostly sell stock: the purchase of equity is a relatively rare event, constituting 1.24% of all trades. Thus, equity sales dominate the coefficient estimates reported in Panel B, even though the coefficient estimates for buys are orders of magnitude larger, which suggests that if insiders make larger investment decisions when firms buy back stock, they tend to trade in the same direction.

In Table 6 and Table 7, we examine earlier reports that CEOs tend to sell their vested equity shortly after the firm announces the start of a new buyback program (cf., e.g., Edmans et al., 2021, Jackson Jr, 2019). In Table 6, Panel A, we compute the difference in CEO sales of equity between a period of equal length before and after the program announcements. We find that CEOs indeed sell more equity after the announcement than before. CEOs sell more than twice as many shares twenty days after the announcement than they do 20 days before the announcement.

However, as pointed out above, buyback announcements tend to coincide with earnings announcements and earnings announcements usually mark the end of voluntary blackout periods. In Panel B, we therefore check to what extent we find a similar picture when there is an earnings announcement instead of the buyback announcement. We find that the differences observed in Panel A are even larger, which corresponds with our results from Table 4, Panel C, that CEOs tend to sell less stock when firms buy back shares in the open market. In Panel C, we document that the share of blackout days is much higher before the buyback announcement. In Panel D, we perform the same analysis as in Panel A for those buyback announcements which do not have blackout days from 20 days before to 20 days after the announcement. For this sample of buyback announcements, we are no longer able to document differences in trading between the pre- and post-period.

In order to obtain a more comprehensive picture on the connection between buyback announcements and CEO trading, we repeat the analysis depicted in Table 5 using *Program initiation* instead of *Repurchase intensity* as the dependent variable. The results are presented in Table 7. Interestingly, we find that the probability of launching a buyback program increases when the CEO's equity vests. We also find that the CEO is more likely to buy stock when a new program is announced and the CEO is not likely to sell more stock. Overall, these results suggest that the CEO tends to believe that the stock is undervalued when she initiates a buyback program. There is no evidence

for the notion that the CEO uses buyback announcements to create short-term private benefits.

5.2. Share repurchases, equity based compensation, and returns

The hypothesis that CEOs use share repurchases to boost the stock price when they want to sell their equity contains two testable predictions. Above, we examine the first prediction of a positive correlation between share repurchases and the CEO's sales of vested equity. In this section, we test the second prediction that share repurchases inflate the stock price when the CEO has an opportunity to sell her equity. Hence, we examine whether buybacks move prices away from fundamental values when they coincide with either the vesting of equity or the sale of equity. If buybacks move prices away from fundamental values, we should observe positive abnormal returns in the short-run and a reversal of these abnormal returns (i.e., negative abnormal returns) on the long-run. The prediction of a reversal of abnormal returns is based on the assumption that deviations from fundamental value cannot be sustained permanently, a basic premise of efficient financial markets.

Meanwhile, several empirical studies have documented that buyback programs create long-term shareholder value. As a tool of payout policy, share repurchases can create value for shareholders when the firm's agency costs of free cash flow are high and the firm's cash is worth more in the hands of shareholders. Share repurchases can also create value for shareholders if firms manage to repurchase shares at prices below fundamental value. In this case, share repurchases simply transfer wealth from selling to non-selling shareholders. Hence, equity grants provide an incentive to the CEO to launch a buyback program when she profits from its long-term impact on stock prices. Because granted equity continuously vests over a time horizon of several years, CEOs are actually more likely to profit from long-term increases in shareholder value than from short-term increases in shareholder value if these come at the expense of long-term

shareholder value.

Hence, a direct link between equity-based compensation and share repurchases is not per se evidence of an agency problem. To constitute an agency problem, share repurchases have to temporarily move prices away from fundamental values; and to constitute evidence of better aligned incentives, share repurchases have to exhibit strictly positive long-run abnormal returns.

We start our analysis by looking at the returns to buyback programs from their inception to four years later. Table 8 presents the results of a calendar time-series regression of equally-weighted repurchase portfolio returns for 12 (24, 36, 48, respectively) months on the value-weighted market return and the Fama-French risk factors high minus low (HML) and small minus big (SMB):¹¹

$$R_{pt} - R_{ft} = \alpha_p + \beta_p (R_{mt} - R_{ft}) + \gamma_p SMB_t + \delta_p HML_t + \varepsilon_{pt} \quad (2)$$

The intercept of that regression denotes the average abnormal return over the respective time period.

For the full sample of 6,199 buyback announcements reported in Panel A, we find highly significant average monthly abnormal returns of 0.25% (0.23%, 0.20%, 0.19%, respectively) for all four event windows, in line with the results in Lee et al. (2020) who also look at a recent time period. The average monthly returns translate into cumulative abnormal returns of 3.0% (5.5%, 7.2%, 9.1%, respectively). Thus, the initiation of buyback programs is generally followed by positive abnormal returns, which continue to accumulate even after the first 12 months of the program.

In Table 8, Panel B, we consider only those buyback programs where the start of the

¹¹All three factors are taken from Kenneth French's Website. Stocks do not get a higher weight in our equally-weighted portfolios if they have more than one event during the event window. If we build portfolios based on the value or amount of vesting equity or equity sales, we use all observations with non-zero values in a given calendar year to determine the ranges of these portfolios. Hence, portfolios based on quintiles will not be of equal size.

program coincides with the month in which the CEO's equity vests. Hence, we look at time periods during which the firm and the CEO can certainly trade against each other in the open market. In total, 1,173 buyback announcements fall into this category. For this sample, we obtain strictly positive abnormal returns which are marginally higher than the results shown in Panel A (full sample) and we conclude that we do not observe an unusual return pattern for this sample. Taking the earlier finding into account that equity grants increase the likelihood of launching a buyback program (Table 7), the long-run stock returns suggest that vesting equity encourages the CEO to initiate a buyback program if it is beneficial for shareholder value.

The CEO's incentive to use share repurchases to temporarily increase the stock price should increase in the amount of her vesting equity. We, therefore, group the 1,173 buyback announcements into five portfolios according to the value of the CEO's vesting equity. We classify the CEO's vesting equity into five quintiles according to the value of their vesting equity at the time of the buyback initiation. The quintile ranges are determined by all CEO's vesting equity in the respective calendar month. We find that buyback programs exhibit the largest positive abnormal returns on the long-run if they coincide with relatively large dollar-amounts of vesting equity. Overall, the results in Panel B are consistent with the notion that vesting equity increases managers' incentives to launch a buyback program when the stock is currently undervalued. The results are not consistent with the notion of stock price manipulation.¹²

In Table 8, Panel C, we consider only those buyback programs where the CEO sells some or all of her vested equity within the first 12 months of the program. Hence, the event window spans over a time period during which the firm and the CEO have actually traded against each other in the open market. We observe CEO sales in the

¹²In Table OA6, we sort buyback announcements into five quintiles according to within-firm variation of the dollar-value of vesting equity. Here, we find that the smallest portfolios exhibit the largest positive abnormal returns, but the results are in general still inconsistent with the notion of stock price manipulation.

first 12 months of the program for 40% of buyback programs in our sample. Hence, we do not record any sale of the CEO's equity for 60% of buyback programs, which might be because the CEO thinks that the stock is currently undervalued or because the firm prohibits simultaneous sales of equity. We find that buyback programs with sales of equity by the CEO in the subsequent 12 months perform better on the long-run than the average buyback program (14.88% versus 9.12%) and we observe the strongest effects for quintiles with the largest sales of equity by the CEO. Overall, the results in Panel C suggest that CEOs sell their equity towards the end of the buyback program when the effect of the buyback program on the stock price has already been reflected into the stock price. The CEO profits from the long-term consequences of initiating a buyback program, rather than from short-termism.

In Table 9, we use the methodology described in equation (2) to more closely examine the temporary impact of share repurchases on stock prices when the CEO's equity vests or the CEO sells her equity. For all samples used in the analysis, we report the average abnormal monthly returns for the repurchase month and different time windows covering the subsequent 12 months. In Panel A, we provide the results for our full sample of open market repurchases ($N=58,828$). The results suggest managerial timing ability because repurchases are followed by positive abnormal returns. We do not find evidence of a positive price impact in the month of the repurchase.

In Panel B, we only consider those open market repurchases which coincide with the month in which the CEO's equity vests. In total, 8,943 repurchase months fall into this category. For this sample, we obtain values of very similar size as the results shown in Panel A. Sorting into five portfolios according to the dollar-value of the vesting equity does not provide any patterns consistent with stock price manipulation either or short-termism.

In Panel C, we only consider those open market repurchases which coincide with months in which the CEO sells her equity. We caution the reader to draw any causal

conclusions from this analysis. CEO sales are usually followed by negative abnormal returns. If decisions about the firm's execution of buyback programs and the CEO's sale of equity are taken separately, we may well expect a small overlap between share repurchases and CEO sales, followed by negative abnormal returns.

For the event month, we document a positive and statistically significant abnormal return, which may suggest that share repurchases have had a relatively high price impact. Meanwhile, this result may be simply explained by the fact that CEOs are more likely to sell their equity after an abnormal increase in the stock price.

Over the following 12 months, we document positive abnormal returns on average, which strictly increase over time. Sorting repurchase months which coincide with sales of equity by the CEO into five quintiles according to the value of the CEO's equity sales does not reveal a clear pattern. However, the repurchases in the largest quintile (Q5) are followed by negative abnormal returns which are statistically significant at the 10% level over a 12 month horizon. Further analysis of Q5 reveals that it contains very few observations, compared to the other quintiles (693 observations for Q5 versus 2,492 observations for Q4). Hence, the CEO rarely sells large amounts of equity when the firm conducts share repurchases. Furthermore, average *Repurchase intensity* is lower in Q5 than in any other quintile (0.49% versus 0.59%-0.72%), and it is also lower than the average *Repurchase intensity* recorded for all repurchase months (0.49% vs. 0.66%). In the light of the results in Figure 2, which indicate that repurchases are lower towards the end of the program, and Table 8, Panel C, which indicates that CEOs sell most of their equity when the buyback program has performed exceptionally well, we conclude that Q5 contains repurchases made towards the end of a buyback program, where subsequent long-run returns are systematically lower because most of the abnormal returns associated with the buyback program have already been incorporated into the stock price. In conclusion, our results are consistent with the notion that CEOs sell their equity after abnormal increases in the stock price. Again, the results do not

support the notion that CEOs systematically misuse share repurchases to increase their executive compensation.

Edmans et al. (2021) argue the case of stock price manipulation by showing that vesting equity and subsequent abnormal returns are negatively correlated when firms buy back stock in the same month (cf. Table 3, Panel A, in their paper). We replicate their analysis and confirm their results (Table A2, Panel A). However, in the appendix we show that the abnormal returns are just less positive, but not negative, when vesting equity is high (Table A3), and, secondly, that the return pattern seems to stem from high stock prices, rather than high vesting equity (Table A2, Panel B). If we change, the definition of vesting equity, the return patterns actually disappear (Table A2, Panel C) or reverse (Table A2, Panel D). In conclusion, we can confirm the results in Edmans et al. (2021), but do not find them to be convincing evidence of stock price manipulation. For a more thorough discussion of these aspects, we refer the reader to Appendix A.2.

As a final test, we compare repurchase prices to average market prices to check whether firms buy back at a discount or at a premium when equity vests. Our variable of interest, *Repurchase bargain*, is defined as the difference between average market price and average repurchase price, scaled by average market price. If firms buy back stock with the intention of bidding up the stock price, repurchase prices should be higher than average market prices, leading to negative repurchase bargains. We expect a similar outcome if CEOs would sell their shares directly back to the company at a premium.

Our results in Table 10 suggest that *Repurchase bargain* is positive on average, i.e., firms buy back their stock at prices which are generally lower than average market prices. This insight holds true for repurchases when equity vests and for repurchases when no equity vests (Panel A). In the month of the repurchase, the repurchase discount is equal to 0.68% for vesting months and 0.82% for all other months. Even though the

difference of 0.14% is statistically significant, the discounts reported for both groups are of similar magnitude and constitute evidence of managerial timing ability. Relative to the average market prices computed over the following six months, firms appear to be buying back at a larger discount if the repurchase coincides with the vesting of equity. The results are very similar when we look at CEOs' sales of equity (Panel B). Also note that firms buy back at a bargain for all CEO sale-quintiles reported (Panel C). Hence, contemporaneous CEO sales do not have any impact on the firm's ability to buy back at a bargain.

In this section, we largely confirm earlier research suggesting that firms time their repurchases well and buy back at relatively low prices.¹³ These results generally hold for the subsample of repurchases that coincide with the vesting of the CEO's equity. We conclude that the results of this section are most consistent with the notion that equity-based compensation increases the CEO's propensity to start a buyback program when the stock is currently undervalued.

6. Discussion and conclusion

In this paper, we document that the corporate calendar creates a spurious correlation between share repurchases in the open market and the CEO's equity compensation in terms of equity grants, vesting equity, and equity sales. Taking the corporate calendar into account, the CEO and all other officers of the firm are less likely to sell equity when firms buy back. Overall, the analysis of abnormal returns around share repurchases, the vesting of equity, and the sale of vested equity suggests that equity-based compensation better aligns the interests of shareholders and the CEO. Our results do not support the conclusion that CEOs systematically misuse share repurchases at the

¹³The following studies cover parts of our sample period: [Lee et al. \(2020\)](#) report similar results for buyback announcement returns. [Dittmar and Field \(2015\)](#) and [Ben-Rephael et al. \(2014\)](#) document that firms buy back at prices which are lower than average market prices.

expense of shareholder value.

Our findings suggests that any study of repurchase activity suffers from omitted variable bias if the variables of interest, like equity compensation variables, are correlated with the corporate calendar. Furthermore, this paper calls into question the use of stock vesting as a valid instrument for insider selling.

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A Appendix

A.1 Quotes on share repurchases by media and politicians

Below, we cite commentaries linking share repurchases to stock price manipulation.

“With the majority of their compensation coming from stock options and stock awards, senior corporate executives have used open-market repurchases to manipulate their companies’ stock prices to their own benefit [...]”

William Lazonick, Mustafa Erdem Sakinç, and Matt Hopkins in the Harvard Business Review, January 2020.

Retrieved from: <https://hbr.org/2020/01/why-stock-buybacks-are-dangerous-for-the-economy>.

“[...] there are currently no meaningful limits to stop executives from using corporate money on stock buybacks to raise share prices for their own short-term gain.”

Leonore Palladino of the Roosevelt Institute in her testimony before the United States House of Representatives’ Committee on Financial Services, October 2019.

Retrieved from: <https://financialservices.house.gov/uploadedfiles/hhrg-116-ba16-wstate-palladinol-20191017.pdf>.

“Executives might also conduct repurchases to exert upward price pressure on the stock while selling their shares, which would systematically transfer value from public investors to themselves.”

Jesse M. Fried in his testimony before the United States House of Representatives’ Committee on Financial Services, October 2019.

Retrieved from: <https://financialservices.house.gov/uploadedfiles/hhrg-116-ba16-wstate-friedj-20191017.pdf>.

“We give stock to corporate managers to convince them to create the kind of long-term value that benefits American companies and the workers and communities they

serve. Instead, what we are seeing is that executives are using buybacks as a chance to cash out their compensation at investor expense.”

SEC Commissioner Robert J. Jackson Jr, March 2019.

Retrieved from: <https://www.sec.gov/news/speech/speech-jackson-061118>

“[...] buybacks were treated as stock manipulation for decades because that is exactly what they are,” she said. “The SEC needs to recognize that.”

Elizabeth Warren in the Boston Globe, June 4, 2015.

Retrieved from: <https://www.bostonglobe.com/news/nation/2015/06/04/sen-elizabeth-warren-decries-stock-buybacks-and-high-ceo-pay-seeks-overturn-rules/story.html>”

A.2. Replication and robustness tests of Edmans et al. (2021)

Edmans et al. (2021) argue the case of stock price manipulation by showing that vesting equity and subsequent abnormal returns are negatively correlated when firms buy back stock in the same month (Table 3, Panel A, in their paper). We replicate their analysis and confirm their results (Table A2, Panel A). However, we have two concerns regarding their analysis. First, while their analysis documents lower abnormal returns when vesting equity is higher, the results do not indicate whether abnormal returns are in fact *negative* when vesting equity is high. We replicate the analysis in Edmans et al. (2021) using our methodology in Table A3, Panel A. We select all repurchase months which coincide with the vesting of equity and build five portfolios according to the within-firm variation in the dollar-value of the vesting equity. We find that the abnormal returns decrease from lowest to highest portfolio, which is consistent with the results in Edmans et al. (2021). However, repurchase months are never followed by negative abnormal returns, not even in the portfolio with highest vesting equity. Because the returns are just less positive, but not negative, the evidence does not satisfy the conditions of stock price manipulation. None of the portfolios suggests a negative impact on long-term shareholder value.

Second, we are concerned about the use of the *dollar*-value of vesting equity. The

argument goes as follows: a typical stock or option grant vests over different periods of time. Consider a realistic setting where the number of shares that vests for a CEO is equally divided over the years, then the within-firm variation in the dollar-value of vesting equity will simply reflect changes in the stock price. Would the CEO really be more inclined to use repurchases to boost the stock price in periods when the stock price is already high? It seems more intuitive to expect the CEO to attempt to boost the stock price when prices are relatively low. In fact, we find that the pattern reverses largely when we sort portfolios according to the *number* of shares vesting (Table A3, Panel B). We also run the specification of [Edmans et al. \(2021\)](#) for months where no repurchases take place and find that the observed price reversal is even more dramatic when equity vests and there are no simultaneous repurchases (Table A2, Panel B). We, therefore, conjecture that the specification picks up a general reversal pattern, rather than a pattern specific to the interplay between share repurchases and vesting equity. Consistent with this conjecture, the relation between share repurchases and subsequent abnormal returns actually becomes zero if we use a repurchase dummy instead of the dollar-value of vesting equity (Table A2, Panel C). Moreover, we even observe a pattern with opposite, i.e., positive signs if we use the number of vesting shares, rather than their dollar value (Table A2, Panel D). In conclusion, we can confirm the results in [Edmans et al. \(2021\)](#), but do not find them to be convincing evidence of stock price manipulation.

Table A1
Overview of the control variables and their interpretation.

Control variable	Reason for use and references	Our results	Consistency with literature	Interpretation of our results
Acquiror	Bagwell (1991) developed a theoretical model to show that repurchases may serve as a takeover defense. However, an empirical relationship between being an acquiror and share repurchases has not been established.	Insignificant	Yes	There is no relation between being an acquiror and the execution of share repurchases.
Assets	Dittmar (2000) : Small firms are more likely to be misvalued and more likely to repurchase stock.	(+)	Yes	Holding more assets increases share repurchases.
Book-to-market	Dittmar (2000) finds that firms buy back more when their book-to-market ratio is higher, which is in line with the undervaluation hypothesis for share repurchases.	(+)	Yes	A higher book-to-market ratio is related to more share repurchases.
Cash-to-assets	Stephens and Weisbach (1998) find that firms tend to repurchase more shares if they have stronger cash flows.	(+)	Yes	A higher cash-to-assets ratio is related to more share repurchases.
Change in short interest	Firms increase repurchases to provide price support for a stock that is deemed overvalued by short sellers.	(+)	Yes	A larger change in short selling is related to a higher level of share repurchases.
Dividends-to-assets	Grullon and Michaely (2002) find that firms have gradually substituted dividends for repurchases.	(-)	Yes	Lower dividend payout is associated with higher share repurchases.
EBITDA-to-assets	Stephens and Weisbach (1998) find that firms tend to repurchase more shares if they have stronger cash flows.	(+)	Yes	A higher EBITDA-to-assets ratio is related to more share repurchases.
Leverage	Dittmar (2000) shows that firms use repurchases to increase leverage.	(-)	Yes	Higher leverage is associated with conducting fewer repurchases.
Options exercised	Dittmar (2000) finds that options exercised has a positive impact on repurchases, most likely because firms want to hold the number of shares outstanding constant and avoid dilution from option exercises. According to the management incentive hypothesis, firms with more outstanding stock options will repurchase more stock (Dittmar (2000) ; Fenn and Liang (2001)).	Insignificant	No	Options exercised does not affect the number of actual shares repurchased under publicly announced programs.
Options outstanding	Hillert et al. (2016) find a highly significant negative effect of the program month and suggest that firms front-load their repurchases.	(+)	Yes	Share repurchases increase when there are more options outstanding.
Program month	Liquidity influences how firms execute repurchase programs: On average, firms buy back more when liquidity is high, in order to save transaction costs (Hillert et al. (2016)).	(-)	Yes	Repurchase activity is highest in the starting months of the program.
Relative spread	Busch and Obernberger (2017) suggest that the lagged Repurchase intensity is the best predictor for current Repurchase intensity. A motivation for share repurchases is undervaluation and one indication of undervaluation is a history of low returns. Stephens and Weisbach (1998) and Dittmar (2000) find that share repurchases are driven by lagged returns.	(-)	Yes	Firms buy back more when liquidity is high.
Repurchase intensity (lagged)		(+)	Yes	Lagged share repurchase activity predicts current share repurchase activity.
Return (t-1)		(-)	Yes	Firms repurchase more when previous returns were low.

Continued on next page

Table A1 continued

Target	Bagwell (1991) developed a theoretical model to show that repurchases may serve as a takeover defense and Dittmar (2000) finds that firms that are at a higher risk of being a target conduct more share repurchases.	(+)	Yes	Being a target for takeover is positively related to share repurchases.
Trading volume	This variable was used in Hillert et al. (2016) as a control variable to proxy for lagged market liquidity.	(+)	Yes	Firms buy back more when the stock is more liquid.

Table A2

Share repurchases, equity based compensation, and abnormal returns

This table reports the results of regression of buy-and-hold abnormal return (BHAR) on measures of CEO vesting in months with and without repurchases. The dependent variable in all panels is the BHAR over various time periods (from two months before to four years after the current month), subtracting the value-weighted market return. In Panel A, the sample is the repurchasing months. The regressor, *Vesting equity in billions*, is the value of equity being vested to the CEO in the current month measured in billions of US dollars. In Panel B, the sample is the non-repurchasing months and the regressor is also *Vesting equity in billions*. In Panel C, the sample is the repurchasing months and the regressor is *Vesting dummy*. *Vesting dummy* equals one if some of the CEO's equity is vested in the current month and zero otherwise. In Panel D, the sample is the repurchasing months and the regressor is *Vesting number*. *Vesting number* is the number of equity being vested to the CEO in the current month. The firm fixed effect are controlled for throughout all specifications in this table. T-statistics, adjusted for clustering at the firm level, are presented in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: CEO equity vesting and abnormal returns in repurchasing months

Dependent variable: BHAR over	[-2, -2]	[-1, -1]	[0, 0]	[1, 12]	[13, 24]	[25, 36]	[37, 48]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Vesting equity in billions	0.3371 (1.17)	0.9959*** (3.04)	0.2076 (0.66)	-2.4090** (-2.28)	-1.7368* (-1.69)	-2.2672** (-2.12)	-1.9822* (-1.76)
Constant	0.0056 (1.14)	-0.0133*** (-3.32)	0.0032 (0.54)	-0.0071 (-0.33)	-0.0149 (-0.65)	-0.0393 (-1.55)	-0.0353 (-1.42)
Observations	57,745	57,754	58,828	45,477	44,638	43,863	43,363
R ²	0.0291	0.0274	0.0286	0.0239	0.0262	0.0281	0.0290

Panel B: CEO equity vesting and abnormal returns in non-repurchasing months

Dependent variable: BHAR over	[-2, -2]	[-1, -1]	[0, 0]	[1, 12]	[13, 24]	[25, 36]	[37, 48]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Vesting equity in billions	1.1375*** (3.67)	1.9578*** (6.24)	-0.4570 (-1.54)	-10.9138*** (-7.25)	-10.2915*** (-6.71)	-9.2614*** (-6.07)	-8.8053*** (-5.66)
Constant	0.0137*** (4.26)	0.0071** (2.51)	0.0497*** (14.52)	0.0161 (1.15)	0.0273*** (1.98)	-0.0089 (-0.64)	-0.0166 (-1.15)
Observations	184,044	184,629	189,923	141,801	138,896	137,526	135,666
R ²	0.0377	0.0381	0.0376	0.0550	0.0547	0.0547	0.0552

Panel C: CEO equity vesting dummy and abnormal returns in repurchasing months

Dependent variable: BHAR over	[-2, -2]	[-1, -1]	[0, 0]	[1, 12]	[13, 24]	[25, 36]	[37, 48]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Vesting dummy	0.0003 (0.32)	-0.0003 (-0.26)	0.0031*** (2.81)	0.0046 (1.10)	0.0065 (1.49)	0.0049 (1.11)	0.0037 (0.79)
Constant	0.0056	-0.0133***	0.0031	-0.0074	-0.0153	-0.0396	-0.0355

Continued on next page

Table A2 continued

	(1.14)	(-3.32)	(0.52)	(-0.34)	(-0.67)	(-1.56)	(-1.42)
Observations	57,745	57,754	58,828	45,477	44,638	43,863	43,363
R^2	0.0291	0.0273	0.0287	0.0238	0.0262	0.0280	0.0290
Panel D: CEO equity vesting number and abnormal returns in repurchasing months							
Dependent variable: BHAR over	[-2, -2]	[-1, -1]	[0, 0]	[1, 12]	[13, 24]	[25, 36]	[37, 48]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Vesting number	0.0045 (1.03)	-0.0019 (-0.46)	0.0131** (2.56)	0.0389** (2.30)	0.0397** (2.53)	0.0413** (2.44)	0.0364** (2.01)
Constant	-0.0011 (-0.09)	-0.0028 (-0.29)	-0.0067 (-0.31)	0.0087 (0.25)	0.0072 (0.22)	-0.0345 (-0.98)	-0.0393 (-1.10)
Observations	10385	10336	10576	8384	8278	8176	8134
R^2	0.0455	0.0462	0.0460	0.0584	0.0655	0.0601	0.0560

Table A3**Share repurchases, equity based compensation, and abnormal returns (alternatives of Table 9, Panel B)**

The table reports Fama and French calendar-time portfolio regressions for various event windows around repurchases between 2006 and 2019. The time windows are consistent with the Table 3 in [Edmans et al. \(2021\)](#). For each row, we conduct separate Fama-French three-factor regressions for the seven calendar portfolios with different window lengths. We report the abnormal returns but not the factor loadings in the table. The first row of Panel A uses a portfolio of firms that repurchases when the CEO's equity vests simultaneously in the corresponding time window. For the rest rows, quintile ranges for quintiles Q1 through Q5 are based on all non-zero values of *Vesting equity* of a given firm in a given calendar year. In Panel B, quintile ranges for quintiles Q1 through Q5 are based on all non-zero numbers of the CEO's vesting equity of a given firm in a given calendar year. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Table 1.

Panel A: Returns to repurchases when the CEO's equity vests simultaneously, sorted by within-firm-year variation in *Vesting equity*

Dependent variable: Event window:	Equally-weighted portfolio return						
	[-2, -2]	[-1, -1]	[0, 0]	[1, 12]	[13, 24]	[25, 36]	[37, 48]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Full sample	-0.0021 (-1.63)	-0.0025 (-1.63)	0.0016 (1.13)	0.0026*** (3.27)	0.0023** (2.37)	0.0015 (1.43)	0.0019 (1.22)
Vesting equity Q1	-0.0038** (-2.33)	-0.0083*** (-3.92)	0.0091*** (5.47)	0.0033*** (4.06)	0.0020** (2.03)	0.0016 (1.58)	0.0019 (1.21)
Vesting equity Q2	0.0019 (0.65)	0.0017 (0.44)	-0.0043 (-1.26)	0.0019 (1.62)	0.0027* (1.87)	0.0026 (1.27)	0.0027 (1.20)
Vesting equity Q3	0.0003 (0.09)	0.0003 (0.10)	-0.0057* (-1.67)	0.0005 (0.36)	0.0026** (2.02)	0.0008 (0.44)	0.0018 (0.67)
Vesting equity Q4	-0.0041 (-1.12)	0.0097** (2.41)	-0.0096** (-2.14)	0.0015 (1.14)	0.0019 (1.33)	-0.0013 (-0.73)	0.0022 (0.84)
Vesting equity Q5	0.0020 (0.26)	0.0046 (0.58)	-0.0046 (-0.74)	-0.0000 (-0.00)	0.0030 (0.92)	-0.0007 (-0.24)	-0.0000 (-0.01)

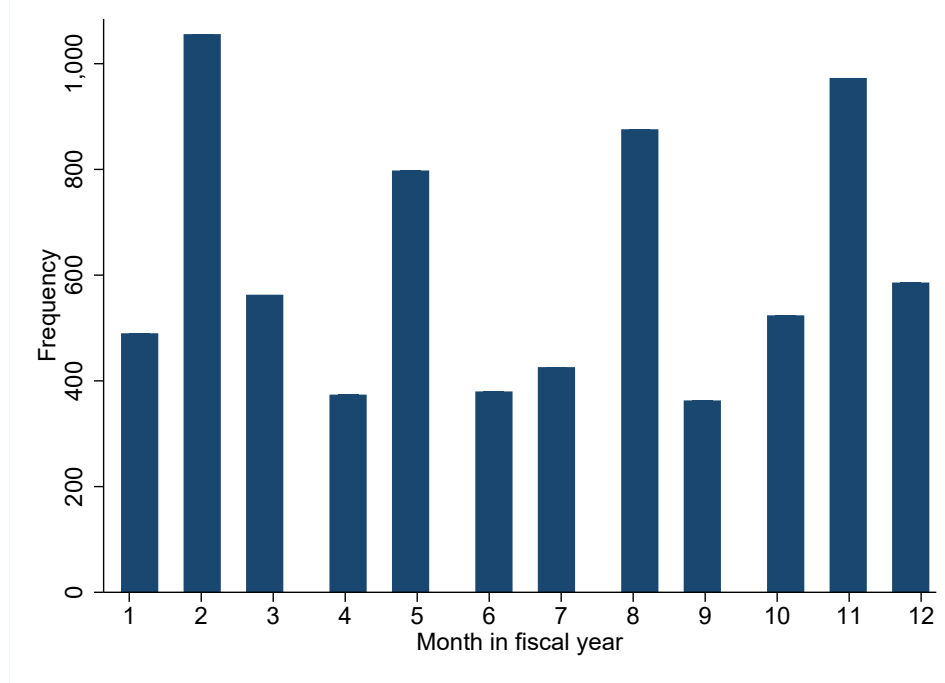
Panel B: Returns to repurchases when the CEO's equity vests simultaneously, sorted by within-firm-year variation in the number of vesting shares

Dependent variable: Event window:	Equally-weighted portfolio return						
	[-2, -2]	[-1, -1]	[0, 0]	[1, 12]	[13, 24]	[25, 36]	[37, 48]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
# Vesting shares Q1	-0.0009 (-0.56)	-0.0031 (-1.56)	0.0042** (2.53)	0.0023*** (2.81)	0.0022** (2.12)	0.0020* (1.98)	0.0025 (1.46)
# Vesting shares Q2	-0.0068* (-1.80)	-0.0023 (-0.52)	-0.0025 (-0.64)	0.0027** (1.99)	0.0024 (1.60)	0.0016 (0.99)	0.0019 (1.28)
# Vesting shares Q3	-0.0002 (-0.07)	-0.0058** (-1.99)	0.0009 (0.28)	0.0028** (2.41)	0.0036*** (2.89)	0.0009 (0.61)	-0.0012 (-0.71)
# Vesting shares Q4	-0.0048 (-1.31)	-0.0020 (-0.57)	0.0010 (0.27)	0.0031** (2.24)	0.0041** (2.33)	0.0001 (0.09)	0.0011 (0.64)
# Vesting shares Q5	-0.0066 (-1.03)	-0.0036 (-0.45)	0.0084 (1.29)	0.0031 (1.06)	-0.0010 (-0.36)	-0.0000 (-0.01)	-0.0016 (-0.57)

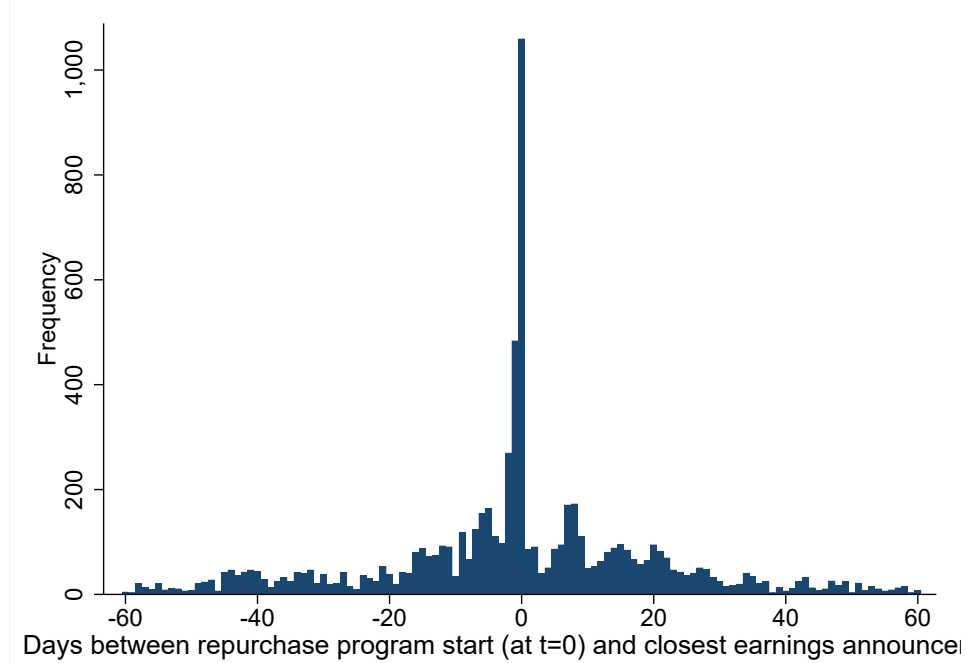
B Figures

Figure 1
Share repurchases and the corporate calendar

Panel A: Buyback program initiations during fiscal year



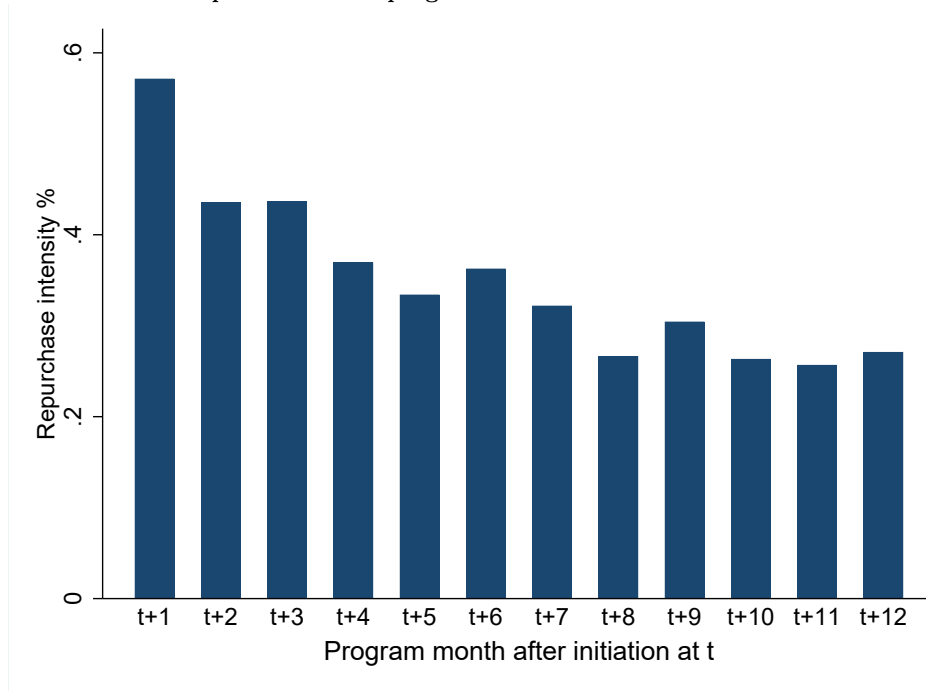
Panel B: Repurchase program start date versus earnings announcements



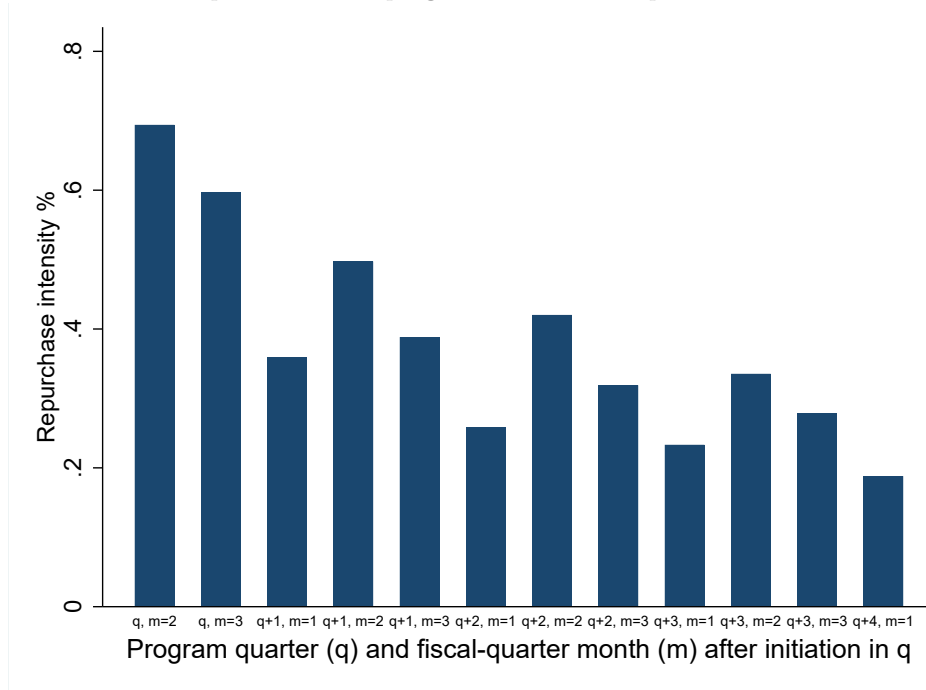
The graphs plot the timing of the announcement of buyback programs. Panel A depicts the initiation of buyback programs over the twelve months of the corporate calendar. Panel B plots the difference in calendar days between the announcement of a buyback program and the announcement of earnings.

Figure 2
Execution of buyback programs in the open market

Panel A: Share repurchases over program months in calendar time

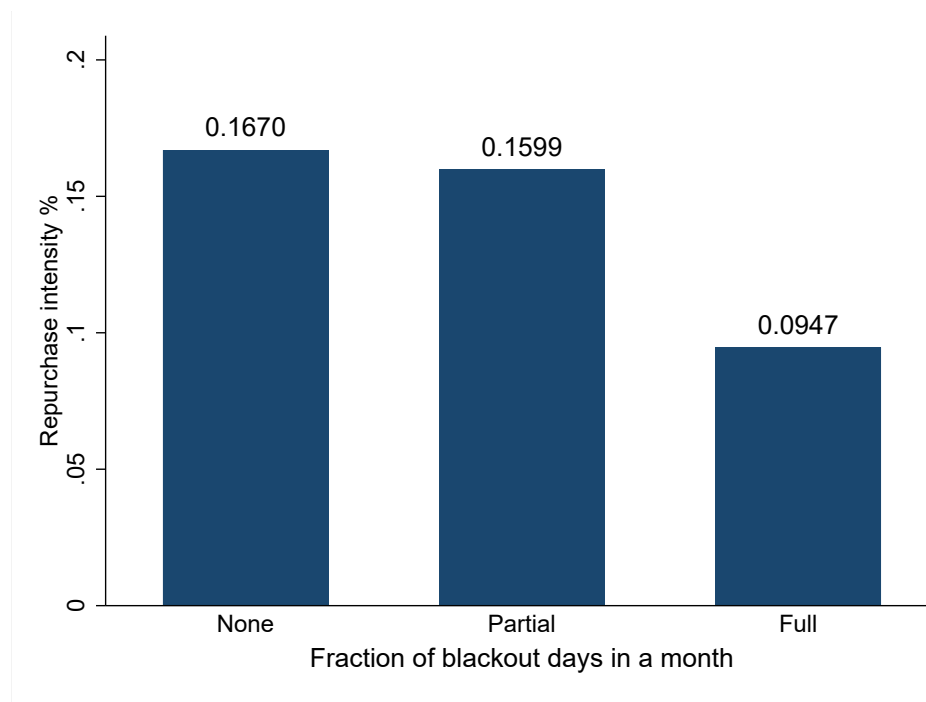


Panel B: Share repurchases over program months in corporate fiscal time



The graphs depict the average of *Repurchase intensity* from the month after the initiation of the buyback program to 12 months later. Panel A presents the execution of share repurchases in calendar-time, whereas in Panel B the calendar-months are transformed according to corporate time, by adjusting the program month for those programs that do not start in the first month of the fiscal quarter. For programs starting in the second (third) month of the quarter, we shift program month by one (two) month(s).

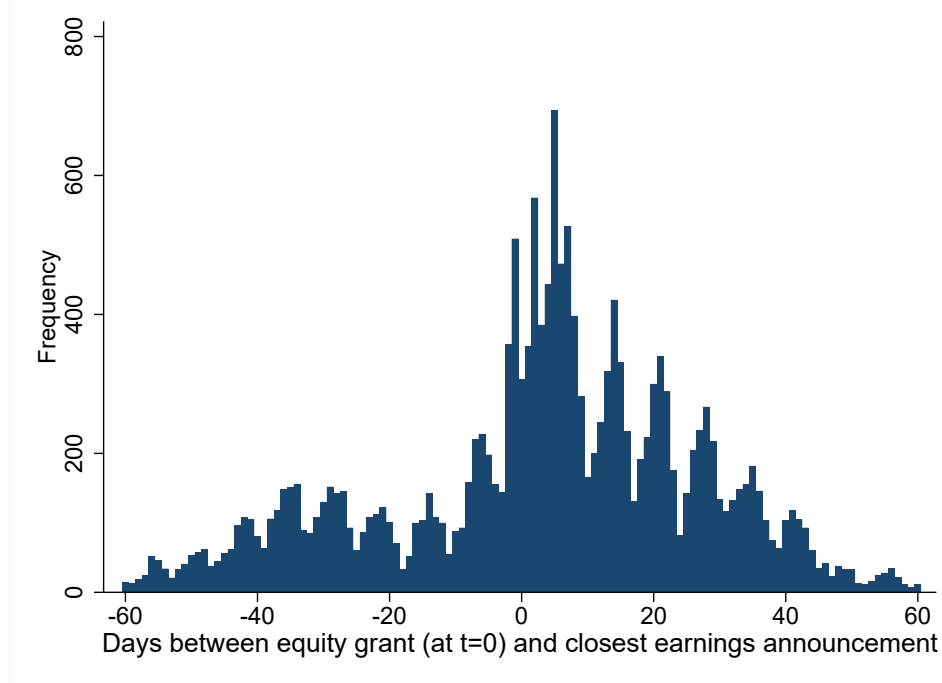
Figure 3
Share repurchases during trading windows and blackout periods



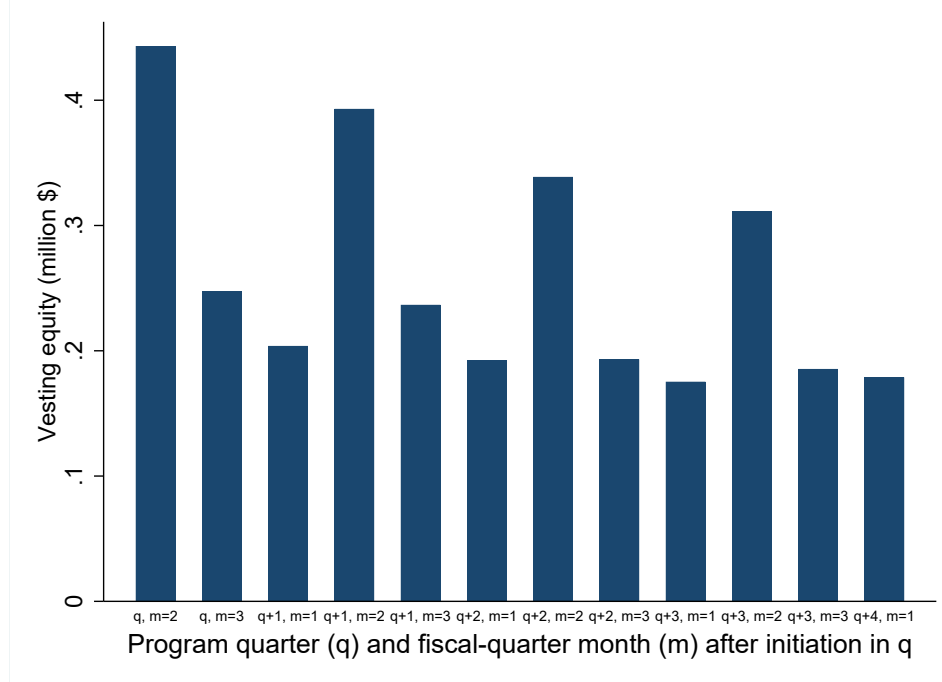
The graph shows the average of *Repurchase intensity* over different fractions of blackout days in a given quarter-month. Repurchase months are grouped into three categories (none, partial, full) according to how much of a month is covered by blackout days.

Figure 4
CEO Equity compensation and the corporate calendar

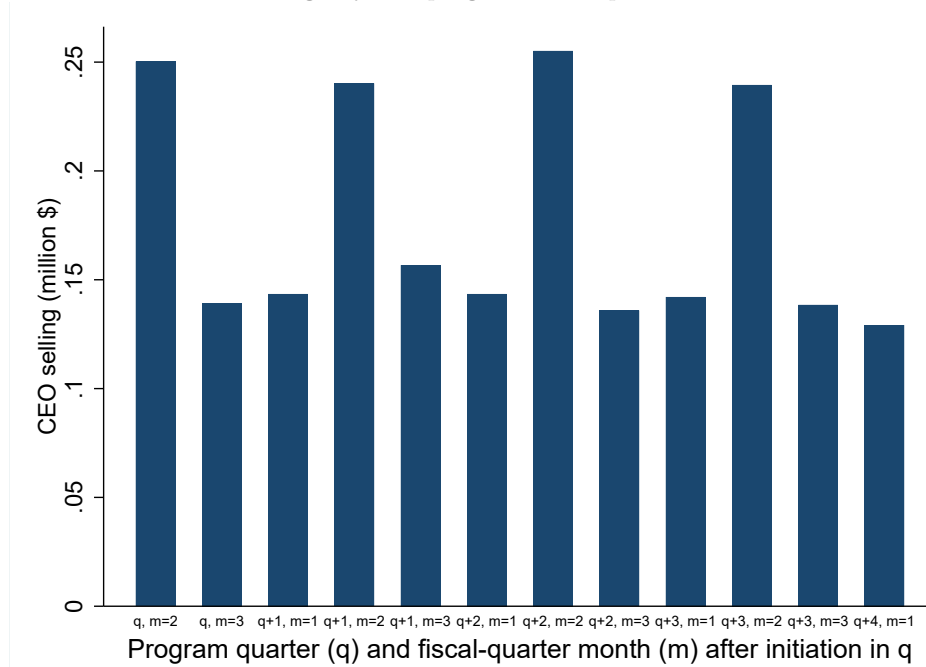
Panel A: Equity grants versus earnings announcements



Panel B: Equity vesting during buyback programs in corporate fiscal time



Panel C: CEO sales during buyback programs in corporate fiscal time



These graphs examine to what extent the timing of the CEO's equity based compensation is determined by the corporate calendar. Panel A plots the difference in calendar days between the granting of equity and the announcement of earnings. Panel B and Panel C plot respectively the vesting of equity and the CEO's sale of equity over the first 12 months of a buyback program in corporate calendar time.

C Tables

Table 1
Definition of variables

This table presents all variables used in this paper. For each variable the table reports the definition, the data source, and the unit of measurement. Variables denoted with (ln) are expressed as natural logarithms.

Name	Definition	Source	Unit
Program and repurchase variables			
Program length	The total number of months the repurchase program lasted	SEC	Unit
Program size	The number of shares to be repurchased under a program scaled by shares outstanding	SEC	Ratio
Repurchase dummy	1 if repurchase transaction takes place in a month	SEC	Binary
Repurchase intensity	Number of shares repurchased under a program during the month divided by the number of shares outstanding at the beginning of the month	SEC/CRSP	Ratio
Main variables of interest			
Blackout ratio	Fraction of blackout days (the days between the end of a fiscal quarter until the day of the earnings announcement) within a month	Compustat	Ratio
Fiscal-quarter month	The 1st, 2nd or 3rd month within a fiscal quarter	Compustat	Binary
Insider trading	Net insider trading (buying minus selling) in a month	TR Insider Data	Million \$
Equity granted dummy	1 if equity is granted in a month	Equilar	Binary
Equity granted	Total granted equity in a month	Equilar	Million \$
Vesting dummy	1 if equity vests in a month	Equilar	Binary
Vesting equity	Total equity vesting in a month	Equilar	Million \$
Insider trading variables decomposed			
Affiliates buying	Buying by insiders classified as "Affiliates" in a month	TR Insider Data	Million \$
CEO buying	Buying by insiders classified as "CEO" in a month	TR Insider Data	Million \$
CxO buying	Buying by insiders classified as "CFO", "CJ", "CO", "CT" in a month	TR Insider Data	Million \$
Directors buying	Buying by insiders classified as "Directors" in a month	TR Insider Data	Million \$
Officers buying	Buying by insiders classified as "Officers" in a month	TR Insider Data	Million \$
Owners buying	Buying by insiders classified as "Beneficial owners" in a month	TR Insider Data	Million \$
Affiliates selling	Selling by insiders classified as "Affiliates" in a month	TR Insider Data	Million \$
CEO selling	Selling by insiders classified as "CEO" in a month	TR Insider Data	Million \$
CxO selling	Selling by insiders classified as "CFO", "CJ", "CO", "CT" in a month	TR Insider Data	Million \$
Directors selling	Selling by insiders classified as "Directors" in a month	TR Insider Data	Million \$
Officers selling	Selling by insiders classified as "Officers" in a month	TR Insider Data	Million \$
Owners selling	Selling by insiders classified as "Beneficial owners" in a month	TR Insider Data	Million \$
Affiliates trading	Net insider trading by Affiliates in a month	TR Insider Data	Million \$

Continued on next page

Table 1 continued

CEO trading	Net insider trading by CEOs in a month	TR Insider Data	Million \$
CxO trading	Net insider trading by CFOs, CIs, Cos and CTs in a month	TR Insider Data	Million \$
Directors trading	Net insider trading by Directors in a month	TR Insider Data	Million \$
Officers trading	Net insider trading by Officers in a month	TR Insider Data	Million \$
Owners trading	Net insider trading by Beneficial owners in a month	TR Insider Data	Million \$
Control variables			
Acquirer	1 if firm is currently (time between announcement and end of the offer) bidding for another company	SDC	Binary
Assets	Total assets (Compustat item: atq) (ln)	Compustat	Million \$
Book-to-market	Book value equity (Compustat item: ceqq) divided by market cap	Compustat	Ratio
Cash-to-assets	Cash and short-term investments (Compustat item: cheq) divided by total assets	Compustat	Ratio
Change in short interest	Change in short interest as of the 15th business day scaled by the shares outstanding at the end of the previous month	Compustat	Ratio
Dividends-to-assets	Total dividends (Compustat item: dvt) divided by total assets	Compustat	Ratio
EBITDA-to-assets	Operating income before depreciation (Compustat item: oibdpq) divided by total assets	Compustat	Ratio
Leverage	(Total asset - book value equity) / (total asset - book value equity + market cap)	Compustat/CRSP	Ratio
Market capitalization	Monthly average of daily market capitalization (ln)	CRSP	Million \$
Options exercised	Number of shares obtained by option exercises of corporate insiders in the respective month scaled by shares outstanding	TR Insider Data	Ratio
Options outstanding	Outstanding options scaled by shares outstanding	Compustat	Ratio
Program month	The n-th month after the repurchase program initiation	SEC	Binary
Relative spread	The monthly average of the daily relative spread calculated as $2 * (\text{ask-bid}) / (\text{bid} + \text{ask})$	CRSP	Ratio
Return	Monthly holding period stock return	CRSP	Unit
Shares outstanding	Number of shares outstanding at last trading day of month	CRSP	Million
Target	1 if firm is currently (time between announcement and end of the offer) a target of another company	SDC	Binary
Trading volume	Monthly total trading volume excluding repurchases scaled by shares outstanding at the last trading day of the previous month	CRSP	Ratio

Table 2
Descriptive statistics

This table reports the descriptive statistics for the dependent variables, main independent variables, and the control variables for firms that conducted at least one share repurchase between 2006 and 2019. All variables are defined in Table 1. For each variable, the arithmetic mean, the median, the standard deviation, the within-firm standard deviation, the 1st percentile, and the 99th percentile of the distribution is reported. Within-firm variation is calculated from a regression of the respective variable on firm fixed effects. Variables denoted with (ln) are expressed as natural logarithms. All continuous variables are winsorized at the 1st and 99th percentile.

	Mean	Median	SD	SD (within)	1st Perc.	99th Perc.	N
Program and repurchase statistics							
Program length	20.4676	13	21.1055	14.9561	1	104	6,199
Program size	0.0799	0.0628	0.0662	0.0401	0.0034	0.3647	6,199
Repurchase dummy	0.2427	0	0.4287	0.3676	0	1	248,884
Repurchase intensity (%)	0.1571	0	0.6041	0.5825	0	2.4489	248,884
Repurchase intensity>0 (%)	0.6645	0.3544	1.0984	0.9661	0.0006	4.9126	57,754
Main variables of interest							
Blackout ratio	0.4115	0.2333	0.4375	0.4321	0	1	248,884
Fiscal-quarter month	2.0087	2	0.8220	0.8218	1	3	248,884
Insider trading	-0.5184	0	1.5293	1.3722	-7.7996	0.1686	248,884
Vesting dummy	0.1474	0	0.3545	0.3403	0	1	248,884
Vesting equity	0.1950	0	0.7858	0.7584	0	5.0994	248,884
Granted equity	0.2803	0	2.5640	2.5238	0	7.9528	248,884
Granted equity dummy	0.0770	0	0.2665	0.2624	0	1	248,884
Insider trading variables							
Affiliates buying	0	0	0	0	0	0	248,884
CEO buying	0.0006	0	0.0059	0.0058	0	0.0237	248,884
CxO buying	0	0	0.0006	0.0006	0	0	248,884
Directors buying	0.0044	0	0.0291	0.0286	0	0.1686	248,884
Officers buying	0.0002	0	0.0018	0.0018	0	0.0027	248,884
Owners buying	0.0014	0	0.0228	0.0221	0	0.0041	248,884
Affiliates selling	0.0081	0	0.0534	0.0509	0	0.3010	248,884
CEO selling	0.1336	0	0.6369	0.5977	0	3.8390	248,884
CxO selling	0.0446	0	0.2209	0.2086	0	1.2313	248,884
Directors selling	0.1482	0	0.6623	0.6228	0	4.4531	248,884
Officers selling	0.1807	0	0.6673	0.6107	0	4.0730	248,884
Owners selling	0.0097	0	0.0981	0.0935	0	0.2805	248,884
Affiliates trading	-0.0081	0	0.0534	0.0509	-0.3010	0	248,884
CEO trading	-0.1330	0	0.6370	0.5978	-3.8390	0.0237	248,884
CxO trading	-0.0446	0	0.2209	0.2086	-1.2313	0	248,884

Continued on next page

Table 2 continued

Directors trading	-0.1438	0	0.6627	0.6233	-4.4524	0.1467	248,884
Officers trading	-0.1806	0	0.6673	0.6107	-4.0730	0.0011	248,884
Owners trading	-0.0083	0	0.1004	0.0959	-0.2805	0.0020	248,884
Control variables							
Acquiror	0.0349	0	0.1834	0.1579	0	1	248,884
Assets (ln)	6.8745	6.8644	1.9207	0.4125	2.7781	11.4376	248,884
Book-to-market	0.5516	0.4378	0.6144	0.4369	-0.5405	2.9251	248,884
Cash-to-assets	0.1811	0.1152	0.1851	0.0849	0.0009	0.7712	248,884
Change in short interest	0.0001	0	0.0116	0.0115	-0.0381	0.0410	248,884
Dividends-to-assets	0.0141	0	0.0304	0.0213	0.0000	0.1655	248,884
EBITDA-to-assets	0.0300	0.0315	0.0374	0.0263	-0.0959	0.1150	248,884
Leverage	0.3366	0.2999	0.2160	0.1065	0.0222	0.9048	248,884
Options exercised	0.0007	0	0.0238	0.0236	0	0.0070	248,884
Options outstanding	0.0643	0.0481	0.0619	0.0364	0	0.2933	248,884
Program month	12.8011	2	21.7397	15.7485	0	102	248,884
Relative spread (ln)	-4.8454	-5.0554	0.3090	0.2828	-5.1463	-4.3581	248,884
Return	0.0106	0.0070	0.1369	0.1364	-0.3244	0.4042	248,884
Target	0.0280	0	0.1649	0.1441	0	1	248,884
Trading volume	0.2011	0.1492	0.1910	0.1350	0.0054	1.0262	248,884

Table 3**The impact of the corporate calendar on share repurchases and equity based compensation**

The table presents the impact of variables based on the corporate calendar on share repurchases and equity based compensation. The dependent variable is *Repurchase intensity dummy* in Panel A, *Granted equity dummy* in Panel B, *Vesting equity dummy* in Panel C, and *CEO selling dummy* in Panel D. The independent variables are *Blackout ratio*, which is the percentage of blackout days within a month, and dummies for 2nd and 3rd month in a fiscal quarter. Year-month fixed effects and firm fixed effects are controlled for throughout all specifications in this table. T-statistics, adjusted for clustering at the firm level, are presented in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Table 1.

Panel A: Share repurchases and the corporate calendar

	(1)	(2)	(3)
Dependent variable:	Share repurchase dummy		
Blackout ratio	-0.0526*** (-15.19)		-0.0449*** (-6.42)
Fiscal-quarter month=2		0.0604*** (17.06)	0.0304*** (5.46)
Fiscal-quarter month=3		0.0439*** (11.76)	0.0019 (0.26)
Observations	248,884	248,884	248,884
R ²	0.0300	0.0303	0.0306
Year-month FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes

Panel B: Granted equity and the corporate calendar

	(1)	(2)	(3)
Dependent variable:	Granted equity dummy		
Blackout ratio	-0.0364*** (-9.20)		-0.0639*** (-10.95)
Fiscal-quarter month=2		0.0662*** (14.79)	0.0235*** (4.37)
Fiscal-quarter month=3		0.0110** (2.39)	-0.0488*** (-6.96)
Observations	248,884	248,884	248,884
R ²	0.0342	0.0376	0.0388
Year-month FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes

Panel C: Vesting equity and the corporate calendar

	(1)	(2)	(3)
Dependent variable:	Vesting equity dummy		
Blackout ratio	-0.0479*** (-8.35)		-0.0890*** (-10.16)
Fiscal-quarter month=2		0.0794*** (11.72)	0.0198** (2.37)
Fiscal-quarter month=3		0.0153** (2.31)	-0.0681*** (-6.59)
Observations	248,884	248,884	248,884
R ²	0.0489	0.0514	0.0528
Year-month FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes

Panel D: CEO sales and the corporate calendar

	(1)	(2)	(3)
Dependent variable:	CEO selling dummy		
Blackout ratio	-0.0235***		-0.0364***

Continued on next page

Table 3 continued

	(-9.70)		(-7.71)
Fiscal-quarter month=2		0.0400*** (13.21)	0.0156*** (3.71)
Fiscal-quarter month=3		0.0098*** (3.61)	-0.0243*** (-4.61)
Observations	248,884	248,884	248,884
R^2	0.0138	0.0150	0.0154
Year-month FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes

Table 4
Repurchases and equity based compensation

This table presents the relationship between actual monthly share repurchases and equity based compensation. The dependent variable is *Repurchase intensity*, which denotes the number of shares repurchased during the month divided by the number of shares outstanding at the last trading day of the previous month. Panel A presents the relationship between granted equity and share repurchases whereas Panel B describes the relationship with vesting equity and share repurchases. Panel C shows the relation between CEO selling and share repurchases. Throughout all panels, we control for the same variables as in Table 4, Panel A and the estimates are qualitatively similar. Year-month fixed effects and firm fixed effects are controlled for throughout all specifications in this table. T-statistics, adjusted for clustering at the firm level, are presented in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Table 1.

Panel A: Share repurchases and Granted equity

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Repurchase intensity					
Granted equity dummy	0.0124*** (2.72)	0.0037 (0.83)	0.0007 (0.15)			
Granted equity				0.0010** (2.24)	0.0006 (1.59)	0.0002 (0.55)
Blackout ratio		-0.0732*** (-7.10)	-0.0642*** (-6.42)		-0.0733*** (-7.13)	-0.0642*** (-6.44)
Fiscal-quarter month=2		0.0496*** (6.14)	0.0458*** (5.79)		0.0496*** (6.14)	0.0458*** (5.78)
Fiscal-quarter month=3		-0.0343*** (-2.92)	-0.0290** (-2.54)		-0.0343*** (-2.93)	-0.0289** (-2.55)
Repurchase intensity _{t-1}	0.2287*** (18.47)	0.2302*** (18.58)	0.1988*** (15.47)	0.2287*** (18.47)	0.2302*** (18.58)	0.1988*** (15.47)
Options exercised	-0.0049 (-0.12)	-0.0094 (-0.23)	-0.0209 (-0.52)	-0.0046 (-0.11)	-0.0093 (-0.23)	-0.0209 (-0.52)
Options outstanding _{t-12}	-0.0016 (-0.02)	-0.0026 (-0.04)	0.0150 (0.25)	-0.0013 (-0.02)	-0.0028 (-0.04)	0.0150 (0.24)
Return _{t-1}	-0.1340*** (-13.08)	-0.1360*** (-13.18)	-0.1378*** (-13.70)	-0.1341*** (-13.09)	-0.1360*** (-13.18)	-0.1378*** (-13.70)
Return _{t-2}	-0.0849*** (-9.32)	-0.0832*** (-9.13)	-0.0800*** (-9.05)	-0.0850*** (-9.32)	-0.0832*** (-9.13)	-0.0800*** (-9.05)
Return _{t-3}	-0.0362*** (-4.48)	-0.0367*** (-4.55)	-0.0268*** (-3.43)	-0.0363*** (-4.48)	-0.0367*** (-4.56)	-0.0268*** (-3.43)
Trading volume	0.0543*** (3.45)	0.0461*** (2.95)	0.0623*** (4.27)	0.0543*** (3.45)	0.0461*** (2.95)	0.0623*** (4.27)
Relative spread (ln) _{t-1}	-0.1469** (-2.10)	-0.0987 (-1.40)	-0.1055 (-1.52)	-0.1462** (-2.09)	-0.0987 (-1.40)	-0.1056 (-1.52)
Acquiror	0.0151 (1.14)	0.0150 (1.13)	-0.0016 (-0.13)	0.0151 (1.14)	0.0150 (1.13)	-0.0016 (-0.13)
Target	0.0270* (1.94)	0.0270* (1.95)	0.0146 (1.14)	0.0270* (1.94)	0.0270* (1.95)	0.0146 (1.14)
Assets (ln) _{t-3}	0.0359*** (7.02)	0.0358*** (7.00)	0.0095** (2.12)	0.0358*** (7.00)	0.0357*** (6.99)	0.0095** (2.12)
Cash-to-assets _{t-3}	0.1201*** (6.01)	0.1194*** (5.99)	0.0972*** (5.40)	0.1204*** (6.02)	0.1195*** (5.99)	0.0972*** (5.40)
EBITDA-to-assets _{t-3}	0.2209*** (4.60)	0.2213*** (4.62)	0.0964** (2.26)	0.2207*** (4.59)	0.2212*** (4.61)	0.0964** (2.26)
Dividends-to-assets _{t-3}	-0.2275*** (-3.86)	-0.2297*** (-3.90)	-0.1826*** (-3.38)	-0.2276*** (-3.86)	-0.2298*** (-3.90)	-0.1827*** (-3.38)
Leverage _{t-3}	-0.1889*** (-9.48)	-0.1852*** (-9.32)	-0.0671*** (-3.79)	-0.1883*** (-9.45)	-0.1849*** (-9.31)	-0.0670*** (-3.78)
Book-to-market _{t-3}	0.0315*** (5.16)	0.0313*** (5.13)	0.0210*** (3.73)	0.0315*** (5.16)	0.0313*** (5.13)	0.0210*** (3.73)
Change in short interest	2.4656*** (8.38)	2.4529*** (8.33)	2.3861*** (8.22)	2.4655*** (8.38)	2.4528*** (8.33)	2.3861*** (8.22)
Observations	248,884	248,884	248,884	248,884	248,884	248,884
R ²	0.0727	0.0750	0.1049	0.0727	0.0750	0.1049
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes

Continued on next page

Table 4 continued

Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Program month FE	No	No	Yes	No	No	Yes
Panel B: Share repurchases and Vesting equity						
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Share repurchase intensity					
Vesting dummy	0.0095*** (2.58)	0.0032 (0.86)	0.0000 (0.01)			
Vesting equity				0.0048*** (3.10)	0.0023 (1.52)	0.0001 (0.04)
Blackout ratio		-0.0732*** (-7.10)	-0.0643*** (-6.42)		-0.0731*** (-7.10)	-0.0643*** (-6.43)
Fiscal-quarter month=2		0.0496*** (6.14)	0.0458*** (5.79)		0.0496*** (6.14)	0.0458*** (5.79)
Fiscal-quarter month=3		-0.0342*** (-2.92)	-0.0290** (-2.54)		-0.0342*** (-2.91)	-0.0290** (-2.55)
Observations	248,884	248,884	248,884	248,884	248,884	248,884
R ²	0.0727	0.0750	0.1049	0.0727	0.0750	0.1049
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Program month FE	No	No	Yes	No	No	Yes
Panel C: Share repurchases and CEO sales						
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Repurchase intensity					
CEO selling dummy	-0.0020 (-0.39)	-0.0074 (-1.44)	-0.0080 (-1.61)			
CEO selling				-0.0032* (-1.71)	-0.0053*** (-2.83)	-0.0055*** (-3.12)
Blackout ratio		-0.0737*** (-7.15)	-0.0645*** (-6.46)		-0.0739*** (-7.17)	-0.0648*** (-6.48)
Fiscal-quarter month=2		0.0498*** (6.16)	0.0460*** (5.80)		0.0498*** (6.16)	0.0459*** (5.80)
Fiscal-quarter month=3		-0.0346*** (-2.95)	-0.0291** (-2.56)		-0.0349*** (-2.97)	-0.0294*** (-2.59)
Observations	248,884	248,884	248,884	248,884	248,884	248,884
R ²	0.0727	0.0750	0.1049	0.0727	0.0751	0.1049
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Program month FE	No	No	Yes	No	No	Yes

Table 5
Share repurchases and insider trading

This table presents the relationship between actual monthly share repurchases and insider trading. The dependent variable is *Repurchase intensity*, which denotes the number of shares repurchased during the month divided by the number of shares outstanding at the last trading day of the previous month. Panel A presents the relationship between share repurchases and net insider trading, defined as insider buying activity minus insider selling activity. Panel B shows the relation for insider trading decomposed in different groups. Panel C decomposes the different insider groups further into buy-and sell activity variables. Throughout all panels, we control for the same variables as in Table 4, Panel A and the estimates are qualitatively similar. Year-month fixed effects and firm fixed effects are controlled for throughout all specifications in this table. T-statistics, adjusted for clustering at the firm level, are presented in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Table 1.

Panel A: Share repurchases and net insider trading

	(1)	(2)	(3)
Dependent variable:	Repurchase intensity		
Insider trading	-0.0033*** (-2.93)	-0.0014 (-1.27)	-0.0012 (-1.09)
Blackout ratio		-0.0729*** (-7.07)	-0.0638*** (-6.38)
Fiscal-quarter month=2		0.0495*** (6.13)	0.0457*** (5.77)
Fiscal-quarter month=3		-0.0340*** (-2.90)	-0.0286** (-2.52)
Observations	248,884	248,884	248,884
R^2	0.0727	0.0750	0.1049
Controls	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Program month FE	No	No	Yes

Panel B: Share repurchases and insider trading decomposed by group

	(1)	(2)	(3)
Dependent variable:	Repurchase intensity		
CEO trading	0.0070*** (3.78)	0.0077*** (4.19)	0.0076*** (4.36)
CxO trading	-0.0001 (-0.02)	0.0021 (0.32)	0.0017 (0.27)
Officers trading	-0.0071*** (-3.07)	-0.0044* (-1.88)	-0.0032 (-1.45)
Directors trading	-0.0070** (-2.48)	-0.0050* (-1.80)	-0.0056** (-2.02)
Owners trading	-0.0659*** (-3.12)	-0.0656*** (-3.11)	-0.0721*** (-3.48)
Affiliates trading	-0.0350 (-1.15)	-0.0265 (-0.87)	-0.0090 (-0.31)
Blackout ratio		-0.0728*** (-7.07)	-0.0639*** (-6.39)
Fiscal-quarter month=2		0.0491*** (6.08)	0.0453*** (5.72)
Fiscal-quarter month=3		-0.0341*** (-2.91)	-0.0288** (-2.54)
Observations	248,884	248,884	248,884
R^2	0.0729	0.0752	0.1051
Controls	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Program month FE	No	No	Yes

Continued on next page

Table 5 continued

Panel C: Share repurchases and insider sales decomposed by group and activity			
	(1)	(2)	(3)
Dependent variable:	Repurchase intensity		
CEO selling	-0.0070*** (-3.79)	-0.0077*** (-4.20)	-0.0077*** (-4.37)
CxO selling	0.0001 (0.01)	-0.0021 (-0.32)	-0.0017 (-0.26)
Officers selling	0.0070*** (3.04)	0.0044* (1.88)	0.0032 (1.45)
Directors selling	0.0078*** (2.77)	0.0058** (2.08)	0.0063** (2.27)
Owners selling	0.0717*** (3.30)	0.0714*** (3.29)	0.0782*** (3.66)
Affiliates selling	0.0343 (1.13)	0.0261 (0.86)	0.0087 (0.29)
CEO buying	0.2570 (0.76)	0.1820 (0.54)	0.0978 (0.30)
CxO buying	2.6341 (0.77)	2.1747 (0.64)	2.1816 (0.65)
Officers buying	3.6628*** (2.95)	3.3812*** (2.73)	3.0775** (2.55)
Directors buying	0.4084*** (6.26)	0.3717*** (5.70)	0.3254*** (5.17)
Owners buying	0.0318 (0.30)	0.0317 (0.30)	0.0322 (0.31)
Blackout ratio		-0.0722*** (-7.01)	-0.0633*** (-6.34)
Fiscal-quarter month=2		0.0468*** (5.79)	0.0433*** (5.46)
Fiscal-quarter month=3		-0.0343*** (-2.93)	-0.0291** (-2.56)
Observations	248,884	248,884	248,884
R^2	0.0736	0.0758	0.1056
Controls	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Program month FE	No	No	Yes

Table 6
Share repurchase announcements and CEO sales

This table reports the results of a series of t-tests to show how CEO equity sales distribute around buyback program announcements in vesting months. Panel A reports the CEO sales around buyback announcements in vesting months. Column (2) reports the average CEO equity sales as a fraction of firm market capitalization in the x days before buyback announcements in vesting months, while Column (3) reports the CEO sales in the symmetric x days following those announcements. Column (4) shows the difference between post- and pre- announcement CEO sales. Panel B reports the CEO sales around earnings announcements in vesting months. Column (2) reports the average CEO equity sales as a fraction of firm market capitalization in the x days before earnings announcements in vesting months, while Column (3) reports the CEO sales in the symmetric x days following those announcements. Panel C reports the blackout ratios around buyback announcements in vesting months. Column (2) reports the average fraction of blackout days in the x days before buyback announcements in vesting months, while Column (3) reports the fraction of blackout days in the symmetric x days following those announcements. Panel D reports a similar t-test as Panel A, except that Panel D runs on a subsample of buyback announcements in vesting months such that there is no blackout days in x days either before or after buyback announcements. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Table 1.

Panel A: CEO sales post- versus pre- buyback announcements in vesting months

	(1)	(2)	(3)	(4)	(5)
		CEO sales over			
Starting/ending point	Observations	[-x, 0]	(0, +x]	(3) - (2)	t-statistic
x=2	916	0.0023	0.0034	0.0011	0.60
x=5	916	0.0042	0.0071	0.0029	1.30
x=10	916	0.0060	0.0159	0.0099***	3.20
x=15	916	0.0087	0.0206	0.0119***	3.40
x=20	916	0.0109	0.0257	0.0147***	3.05

Panel B: CEO sales post- versus pre- earnings announcements in vesting months

	(1)	(2)	(3)	(4)	(5)
		CEO sales over			
Starting/ending point	Observations	[-x, 0]	(0, +x]	(3) - (2)	t-statistic
x=2	11,969	0.0007	0.0042	0.0035***	7.00
x=5	11,969	0.0015	0.0110	0.0095***	11.45
x=10	11,969	0.0030	0.0175	0.0145***	13.80
x=15	11,966	0.0045	0.0228	0.0183***	15.65
x=20	11,966	0.0064	0.0271	0.0207***	15.70

Panel C: Blackout ratio post- versus pre- buyback announcements in vesting months

	(1)	(2)	(3)	(4)	(5)
		Blackout ratio over			
Starting/ending point	Observations	[-x, 0]	(0, +x]	(3) - (2)	t-statistic
x=2	907	0.4884	0.2756	-0.2128***	-14.70
x=5	894	0.5092	0.1984	-0.3107***	-20.20
x=10	881	0.5585	0.1489	-0.4096***	-25.45
x=15	856	0.5777	0.1383	-0.4394***	-25.85
x=20	849	0.5872	0.1385	-0.4488***	-25.90

Panel D: CEO sales post- versus pre- buyback announcements in vesting months, unaffected by blackout days

	(1)	(2)	(3)	(4)	(5)
		CEO sales over			
Starting/ending point	Observations	[-x, 0]	(0, +x]	(3) - (2)	t-statistic
x=2	426	0.0044	0.0044	0.0000	0.00
x=5	401	0.0082	0.0081	-0.0001	-0.05
x=10	298	0.0092	0.0156	0.0064	1.30
x=15	215	0.0164	0.0101	-0.0062	-1.55
x=20	115	0.0270	0.0220	-0.0050	-0.50

Table 7**Linear probability model of CEO sales around share repurchase announcements**

This table reports the results of linear probability model regression of repurchase program announcements on insider trading and other controls. The dependent variable is an indicator that equals one if there is a repurchase program announcement in the current month and zero otherwise. The regressors include the buying and selling of insiders (i.e. owners, CEO, CxO, directors and officers), corporate calendar variables (*Blackout ratio* and *Month in fiscal quarter*), and other controls. The year-month fixed effect and firm fixed effect are controlled for throughout all specifications in this table. T-statistics, adjusted for clustering at the firm level, are presented in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Table 1.

Dependent variable:	Indicator of repurchase announcement		
	(1)	(2)	(3)
Granted equity	0.0004** (2.02)	0.0004** (2.00)	0.0004* (1.92)
Vesting equity	0.0048*** (6.78)	0.0046*** (6.47)	0.0042*** (5.97)
CEO selling	0.0008 (1.29)	0.0007 (1.07)	0.0003 (0.53)
CEO buying	0.2857*** (4.26)	0.2764*** (4.15)	0.2505*** (3.76)
Repurchase intensity _{t-1}		0.0085*** (9.57)	0.0089*** (9.96)
Options exercised		-0.0001 (-0.02)	-0.0006 (-0.19)
Options outstanding		-0.0234*** (-2.61)	-0.0237*** (-2.65)
Return _{t-1}		-0.0187*** (-8.43)	-0.0188*** (-8.47)
Return _{t-2}		-0.0215*** (-10.71)	-0.0211*** (-10.51)
Return _{t-3}		-0.0121*** (-5.46)	-0.0123*** (-5.54)
Trading volume ratio		0.0039* (1.71)	0.0035 (1.56)
Relative spread (ln) _{t-1}		0.0137 (0.99)	0.0088 (0.63)
Acquiror		0.0024 (1.11)	0.0024 (1.11)
Target		0.0015 (0.64)	0.0014 (0.64)
Assets (ln) _{t-1}		0.0083*** (9.36)	0.0083*** (9.37)
Cash-to-assets _{t-3}		0.0194*** (5.18)	0.0193*** (5.17)
EBITDA-to-assets _{t-3}		0.0879*** (7.73)	0.0880*** (7.74)
Dividends-to-assets _{t-3}		-0.0654*** (-5.23)	-0.0657*** (-5.25)
Leverage _{t-3}		-0.0403*** (-11.43)	-0.0402*** (-11.42)
Book-to-market _{t-3}		0.0046*** (6.17)	0.0046*** (6.16)
Change in short interest		0.1167*** (3.92)	0.1151*** (3.87)
Blackout ratio			-0.0044 (-1.52)
Month in fiscal quarter=2			0.0138*** (5.35)
Month in fiscal quarter=3			-0.0066** (-2.07)
Observations	248,884	248,884	248,884
R ²	0.0056	0.0092	0.0105
Year-month FE	Yes	Yes	Yes

Continued on next page

Table 7 continued

Firm FE	Yes	Yes	Yes
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Table 8**The initiation of buyback programs and long-run shareholder value**

The table reports Fama and French calendar-time portfolio regressions for various event windows following the initiation (announcement) of 6,199 buyback programs between 2006 and 2019. Portfolios are rebalanced each month and an equally-weighted excess return is calculated. We regress the monthly excess return of this portfolio on the Fama-French three factors (Fama and French, 1993, Fama and French, 1996). Each stock can enter the monthly portfolio only once, even if the stock has experienced more than one event during the event window. For the window of [0, 0], a firm enters this portfolio if it announces a buyback program in the current month. For the other windows, a firm enters this portfolio if it announces a buyback program in the previous month and stays in the portfolio for 12 (24, 36, 48, respectively) months. Panels B and C provide results for subsamples. Panel B examines buyback programs which are initiated when the CEO's equity vests simultaneously. Panel C examines buyback programs where the CEO sells equity within the first 12 months of the program. Quintile ranges for quintiles Q1 through Q5 are based on all non-zero values of *Vesting equity* (CEO sales of equity in 12 months) in a given calendar year. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Table 1.

Panel A: Long-run abnormal returns of buyback programs

	(1)	(2)	(3)	(4)	(5)
Dependent variable:	Equally-weighted portfolio return				
Event window:	[0, 0]	[1, 12]	[1, 24]	[1, 36]	[1, 48]
Intercept	0.0100*** (5.54)	0.0025*** (2.80)	0.0023*** (2.64)	0.0020** (2.34)	0.0019** (2.12)
SMB	0.7156*** (8.64)	0.6025*** (14.52)	0.6170*** (15.55)	0.6429*** (16.63)	0.6557*** (15.92)
HML	-0.0327 (-0.47)	0.0792** (2.27)	0.1481*** (4.45)	0.1661*** (5.12)	0.1954*** (5.65)
MktRF	0.9236*** (19.94)	1.0172*** (43.83)	1.0407*** (46.89)	1.0500*** (48.55)	1.0594*** (45.97)
Observations	168	168	168	168	168
R ²	0.8100	0.9505	0.9574	0.9607	0.9569

Panel B: Long-run abnormal returns of buyback programs when the CEO's equity vests simultaneously

	(1)	(2)	(3)	(4)	(5)
Dependent variable:	Equally-weighted portfolio return				
Event window:	[0, 0]	[1, 12]	[1, 24]	[1, 36]	[1, 48]
Full sample	0.0149*** (3.47)	0.0033*** (2.94)	0.0030*** (3.03)	0.0021** (2.21)	0.0018* (1.91)
Vesting equity Q1 (N=147)	0.0028 (0.27)	0.0020 (0.61)	0.0051* (1.66)	0.0041 (1.56)	0.0046* (1.85)
Vesting equity Q2 (N=184)	0.0393*** (2.68)	0.0008 (0.27)	-0.0005 (-0.22)	-0.0005 (-0.28)	0.0001 (0.04)
Vesting equity Q3 (N=221)	0.0067 (0.87)	0.0016 (0.81)	0.0018 (1.05)	0.0010 (0.64)	0.0001 (0.09)
Vesting equity Q4 (N=250)	0.0205*** (3.10)	0.0054** (2.43)	0.0046*** (2.68)	0.0033** (2.11)	0.0031* (1.96)
Vesting equity Q5 (N=371)	0.0122** (2.19)	0.0029** (2.01)	0.0027** (2.18)	0.0027** (2.21)	0.0023* (1.85)

Panel C: Long-run abnormal returns of buyback programs when the CEO sells equity in the subsequent 12 months

	(1)	(2)	(3)	(4)	(5)
Dependent variable:	Equally-weighted portfolio return				
Event window:	[0, 0]	[1, 12]	[1, 24]	[1, 36]	[1, 48]
Full sample	0.0166*** (7.70)	0.0063*** (6.26)	0.0037*** (4.92)	0.0031*** (4.17)	0.0031*** (3.66)
12-month equity sales Q1 (N=348)	0.0145* (1.96)	0.0010 (0.52)	0.0014 (0.95)	0.0018 (1.52)	0.0020 (1.64)
12-month equity sales Q2	0.0209***	0.0057***	0.0034***	0.0032***	0.0030***

Continued on next page

Table 8 continued

(N=437)	(2.71)	(3.17)	(2.72)	(2.67)	(2.82)
12-month equity sales Q3	0.0126***	0.0062***	0.0050***	0.0034***	0.0030***
(N=552)	(2.74)	(4.18)	(4.74)	(3.45)	(2.92)
12-month equity sales Q4	0.0200***	0.0078***	0.0045***	0.0037***	0.0036***
(N=485)	(4.24)	(4.94)	(4.04)	(3.72)	(3.28)
12-month equity sales Q5	0.0165***	0.0094***	0.0045***	0.0043***	0.0038***
(N=599)	(4.10)	(6.89)	(4.08)	(4.26)	(3.73)

Table 9
The price impact of open market share repurchases

The table reports Fama and French calendar-time portfolio regressions for various event windows following 58,828 open market repurchases between 2006 and 2019. Portfolios are rebalanced each month and an equally-weighted excess return is calculated. We regress the monthly excess return of this portfolio on the Fama-French three factors (Fama and French, 1993, Fama and French, 1996). Each stock can enter the monthly portfolio only once, even if the stock has experienced more than one event during the event window. For the window of [0, 0], a firm enters this portfolio if it repurchases in the current month. For the other windows, a firm enters this portfolio if it repurchases in the previous month and stays in the portfolio for 1 (3, 6, 12, respectively) months. Panels B and C provide results for subsamples. Panel B examines repurchases when the CEO's equity vests simultaneously. Panel C examines repurchases when the CEO sells equity simultaneously. Quintile ranges for quintiles Q1 through Q5 are based on all non-zero values of *Vesting equity (CEO equity sales)* in a given calendar year. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Table 1.

Panel A: Abnormal returns to open market share repurchases

	(1)	(2)	(3)	(4)	(5)
Dependent variable:	Equally-weighted portfolio return				
Event window:	[0, 0]	[1, 1]	[1, 3]	[1, 6]	[1, 12]
Constant	0.0002 (0.21)	0.0030*** (3.68)	0.0029*** (3.61)	0.0023*** (2.93)	0.0021** (2.54)
SMB	0.5412*** (15.94)	0.5164*** (13.85)	0.5504*** (15.26)	0.5627*** (15.96)	0.6011*** (15.65)
HML	0.0391 (1.37)	0.0702** (2.24)	0.0863*** (2.85)	0.1126*** (3.81)	0.1562*** (4.84)
MktRF	0.9721*** (51.20)	0.9909*** (47.51)	1.0011*** (49.61)	1.0172*** (51.56)	1.0252*** (47.71)
Observations	168	168	168	168	168
R ²	0.9621	0.9559	0.9602	0.9634	0.9588

Panel B: Abnormal returns to open market share repurchases when the CEO's equity vests simultaneously

	(1)	(2)	(3)	(4)	(5)
Dependent variable:	Equally-weighted portfolio return				
Event window:	[0, 0]	[1, 1]	[1, 3]	[1, 6]	[1, 12]
Full sample	0.0016 (1.13)	0.0018 (1.38)	0.0029*** (2.97)	0.0026*** (3.14)	0.0026*** (3.27)
Vesting equity Q1 (N=1,129)	0.0063 (1.37)	0.0009 (0.18)	0.0036 (1.30)	0.0037* (1.72)	0.0026 (1.39)
Vesting equity Q2 (N=1,425)	0.0012 (0.28)	0.0012 (0.40)	0.0019 (0.92)	0.0005 (0.31)	0.0014 (0.91)
Vesting equity Q3 (N=1,812)	-0.0006 (-0.21)	0.0013 (0.48)	0.0038** (2.26)	0.0021* (1.70)	0.0013 (1.28)
Vesting equity Q4 (N=1,936)	0.0002 (0.05)	-0.0001 (-0.04)	0.0026* (1.68)	0.0027** (2.11)	0.0021* (1.75)
Vesting equity Q5 (N=2,642)	0.0020 (1.04)	0.0000 (0.03)	0.0022* (1.80)	0.0017* (1.83)	0.0022*** (2.75)

Panel C: Abnormal returns to open market share repurchases when the CEO sells equity simultaneously

	(1)	(2)	(3)	(4)	(5)
Dependent variable:	Equally-weighted portfolio return				
Event window:	[0, 0]	[1, 1]	[1, 3]	[1, 6]	[1, 12]
Full sample	0.0084*** (3.63)	0.0025 (0.67)	0.0027* (1.67)	0.0017* (1.72)	0.0015** (2.09)
CEO equity sales Q1 (N=956)	-0.0019 (-0.37)	0.0003 (0.05)	0.0025 (0.60)	0.0027 (0.70)	0.0026* (1.82)
CEO equity sales Q2 (N=1,142)	0.0063** (2.01)	0.0003 (0.08)	0.0023 (1.11)	0.0021 (1.35)	0.0013 (1.08)
CEO equity sales Q3	0.0145***	0.0012	0.0018	0.0025*	0.0026**

Continued on next page

Table 9 continued

(N=1,265)	(4.06)	(0.41)	(0.94)	(1.70)	(2.25)
CEO equity sales Q4	0.0132***	-0.0027	0.0010	0.0012	0.0011
(N=2,492)	(6.87)	(-1.35)	(0.67)	(1.15)	(1.35)
CEO equity sales Q5	0.0117***	-0.0026	-0.0017	-0.0016	-0.0021*
(N=693)	(3.03)	(-0.89)	(-0.94)	(-1.17)	(-1.88)

Table 10**Share repurchases, equity based compensation, and repurchases prices**

This table reports the results of a series of t-tests to show whether repurchase bargain varies with equity-based CEO compensation. Repurchase bargain is defined as the difference between market price and repurchase price, scaled by market price. The market price is averaged over the current month [0,0] (next month [+1,+1], next three months [+1,+3], next six months [+1,+6], respectively). Panel A compares repurchase bargains in months without versus with CEO equity vesting. Columns (1) and (3) report the number of months without vesting and the number of months with vesting, respectively. Columns (2) and (4) report the average repurchase bargains in months without vesting and months with vesting, respectively. Column (5) shows the difference between Column (2) and Column (4). Column (6) reports the t-statistics for the difference reported in column (5). Panel B compares repurchase bargains in months without versus with CEO sales. Panel C compares repurchase bargains in months without versus with CEO sales, where the latter sample is split into five subsamples by the value of CEO equity sales. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Table 1.

Panel A: Repurchase bargains in months without versus with CEO equity vesting

	(1)	(2)	(3)	(4)	(5)	(6)
	without vesting		with vesting			
Benchmark period	N	Average bargain	N	Average bargain	(2) – (4)	t-statistic
[0, 0]	40,615	0.0082***	7,267	0.0068***	0.0014**	2.56
[+1, +1]	40,615	0.0059***	7,267	0.0110***	-0.0051***	-4.03
[+1, +3]	40,615	0.0071***	7,267	0.0160***	-0.0089***	-5.25
[+1, +6]	40,615	0.0079***	7,267	0.0176***	-0.0097***	-4.29

Panel B: Repurchase bargains in months without versus with CEO equity sales

	(1)	(2)	(3)	(4)	(5)	(6)
	without CEO sales		with CEO sales			
Benchmark period	N	Average bargain	N	Average bargain	(2) – (4)	t-statistic
[0, 0]	42,951	0.0077***	4,931	0.0099***	-0.0022***	-3.49
[+1, +1]	42,951	0.0058***	4,931	0.0145***	-0.0087***	-5.88
[+1, +3]	42,951	0.0076***	4,931	0.0154***	-0.0078***	-3.88
[+1, +6]	42,951	0.0083***	4,931	0.0188***	-0.0105***	-3.94

Panel C: Repurchase bargains with CEO equity sales for time period [0,0], split into quintiles

	(1)	(2)
	N	Average bargain
CEO equity sales Q1	721	0.0107***
CEO equity sales Q2	885	0.0110***
CEO equity sales Q3	943	0.0117***
CEO equity sales Q4	1,791	0.0086***
CEO equity sales Q5	591	0.0085***

D Online Appendix

Table OA1

The impact of the corporate calendar on share repurchases and equity based compensation

The table presents the impact of the corporate calendar on share repurchases and equity based compensation. The independent variables are *Blackout ratio*, which is the percentage of blackout days within a month, and dummies for the 1st, 2nd and 3rd months in a fiscal quarter. The dependent variable is *Repurchase intensity*, *Granted equity*, *Vesting equity* and *CEO selling* respectively for Panel A, B, C and D. Year-month fixed effects and firm fixed effects are controlled for throughout all specifications in this table. T-statistics, adjusted for clustering at the firm level, are presented in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Table 1.

Panel A: Share repurchases and the corporate calendar

	(1)	(2)	(3)
Dependent variable:	Share repurchase intensity		
Blackout ratio	-0.0644*** (-13.18)		-0.0665*** (-6.48)
Fiscal-quarter month=2		0.0891*** (17.74)	0.0446*** (5.78)
Fiscal-quarter month=3		0.0449*** (8.26)	-0.0174 (-1.58)
Observations	248,884	248,884	248,884
R^2	0.0142	0.0148	0.0150
Year-month FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes

Panel B: Granted equity and the corporate calendar

	(1)	(2)	(3)
Dependent variable:	Granted equity		
Blackout ratio	-0.1615*** (-5.79)		-0.3111*** (-6.92)
Fiscal-quarter month=2		0.3088*** (10.04)	0.1006*** (2.79)
Fiscal-quarter month=3		0.0344 (1.00)	-0.2569*** (-4.39)
Observations	248,884	248,884	248,884
R^2	0.0088	0.0097	0.0100
Year-month FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes

Panel C: Vesting equity and the corporate calendar

	(1)	(2)	(3)
Dependent variable:	Vesting equity		
Blackout ratio	-0.0859*** (-7.23)		-0.1680*** (-8.85)
Fiscal-quarter month=2		0.1513*** (9.96)	0.0389** (2.23)
Fiscal-quarter month=3		0.0215 (1.57)	-0.1358*** (-5.95)
Observations	248,884	248,884	248,884
R^2	0.0384	0.0405	0.0415
Year-month FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes

Panel D: CEO sales and the corporate calendar

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Table OAI continued

	(1)	(2)	(3)
Dependent variable:	CEO selling		
Blackout ratio	-0.0433*** (-6.69)		-0.0962*** (-8.56)
Fiscal-quarter month=2		0.0795*** (9.33)	0.0151 (1.39)
Fiscal-quarter month=3		0.0058 (0.79)	-0.0843*** (-6.35)
Observations	248,884	248,884	248,884
R^2	0.0141	0.0152	0.0157
Year-month FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes

Table OA2**The impact of the corporate calendar on share repurchases under SEC's rule 10b5-1**

The table presents the impact of variables based on the corporate calendar on share repurchases that were conducted pursuant SEC's rule 10b5-1. We only consider buyback programs where 100% of repurchases are executed under 10b5-1. The dependent variable is *Repurchase intensity dummy* and the independent variables are *Blackout ratio*, which is the percentage of blackout days within a month, and dummies for 2nd and 3rd month in a fiscal quarter. Year-month fixed effects and firm fixed effects are controlled for. T-statistics, adjusted for clustering at the firm level, are presented in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Table 1.

	(1)	(2)	(3)
Dependent variable:	Share repurchase dummy		
Blackout ratio	-0.0215 (-1.16)		-0.0348 (-0.61)
Fiscal-quarter month=2		0.0152 (0.99)	-0.0017 (-0.04)
Fiscal-quarter month=3		0.0153 (0.82)	-0.0176 (-0.30)
Observations	3,570	3,570	3,570
R^2	0.0256	0.0288	0.0251
Year-month FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes

Table OA3**Repurchases under flexible programs and equity based compensation**

This table presents the relationship between actual monthly share repurchases that were conducted under flexible programs (not pursuant to SEC's Rule 10b5-1) and equity based compensation. The dependent variable is *Repurchase intensity*, which denotes the number of shares repurchased during the month divided by the number of shares outstanding at the last trading day of the previous month. Panel A presents the relationship between granted equity and share repurchases whereas Panel B describes the relationship with vesting equity and share repurchases. Panel C shows the relation between CEO selling and share repurchases. Throughout all panels, we control for the same variables as in Table OA3, Panel A and the estimates are qualitatively similar. Year-month fixed effects and firm fixed effects are controlled for throughout all specifications in this table. T-statistics, adjusted for clustering at the firm level, are presented in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Table 1.

Panel A: Share repurchases and Granted equity

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Share repurchase intensity					
Granted equity dummy	0.0219*** (2.61)	0.0059 (0.71)	0.0030 (0.36)			
Granted equity				0.0048*** (3.10)	0.0023 (1.52)	0.0001 (0.04)
Observations	111,052	111,052	111,052	111,052	111,052	111,052
R^2	0.0665	0.0708	0.0808	0.0664	0.0708	0.0808
Corp. Calendar controls	No	Yes	Yes	No	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Program month FE	No	No	Yes	No	No	Yes

Panel B: Share repurchases and Vesting equity

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Share repurchase intensity					
Vesting dummy	0.0123* (1.87)	0.0002 (0.03)	-0.0027 (-0.41)			
Vesting equity				0.0056** (2.49)	0.0017 (0.78)	0.0000 (0.01)
Observations	111,052	111,052	111,052	111,052	111,052	111,052
R^2	0.0664	0.0708	0.0808	0.0665	0.0708	0.0808
Corp. Calendar controls	No	Yes	Yes	No	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Program month FE	No	No	Yes	No	No	Yes

Panel C: Share repurchases and CEO sales

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Repurchase intensity					
CEO selling dummy	-0.0049 (-0.57)	-0.0148* (-1.71)	-0.0158* (-1.86)			
CEO selling				-0.0006 (-0.23)	-0.0040 (-1.52)	-0.0047* (-1.78)
Observations	111,052	111,052	111,052	111,052	111,052	111,052
R^2	0.0664	0.0709	0.0808	0.0664	0.0709	0.0808
Corp. Calendar controls	No	Yes	Yes	No	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Program month FE	No	No	Yes	No	No	Yes

Table OA4**Repurchases under 10b5-1 programs and equity based compensation**

This table presents the relationship between actual monthly share repurchases that were conducted under SEC's Rule 10b5-1 and equity based compensation. We only consider buyback programs where 100% of repurchases are executed under 10b5-1. The dependent variable is *Repurchase intensity*, which denotes the number of shares repurchased during the month divided by the number of shares outstanding at the last trading day of the previous month. Panel A presents the relationship between granted equity and share repurchases whereas Panel B describes the relationship with vesting equity and share repurchases. Panel C shows the relation between CEO selling and share repurchases. Throughout all panels, we control for the same variables as in Table OA4, Panel A and the estimates are qualitatively similar. Year-month fixed effects and firm fixed effects are controlled for throughout all specifications in this table. T-statistics, adjusted for clustering at the firm level, are presented in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Table 1.

Panel A: Share repurchases and Granted equity

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Share repurchase intensity					
Granted equity dummy	0.0034 (0.07)	-0.0030 (-0.07)	-0.0051 (-0.11)			
Granted equity				-0.0031 (-0.69)	-0.0038 (-0.87)	-0.0041 (-0.93)
Observations	3,051	3,051	3,051	3,051	3,051	3,051
R ²	0.0809	0.0820	0.0789	0.0809	0.0820	0.1049
Corp. Calendar controls	No	Yes	Yes	No	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Program month FE	No	No	Yes	No	No	Yes

Panel B: Share repurchases and Vesting equity

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Share repurchase intensity					
Vesting dummy	0.0589 (1.21)	0.0543 (1.09)	0.0473 (0.94)			
Vesting equity				0.0072 (0.36)	0.0042 (0.21)	0.0003 (0.01)
Observations	3,051	3,051	3,051	3,051	3,051	3,051
R ²	0.0816	0.0826	0.0793	0.0810	0.0821	0.0788
Corp. Calendar controls	No	Yes	Yes	No	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Program month FE	No	No	Yes	No	No	Yes

Panel C: Share repurchases and CEO sales

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Repurchase intensity					
CEO selling dummy	-0.0669 (-1.60)	-0.0704* (-1.69)	-0.0890** (-1.99)			
CEO selling				-0.0172 (-1.10)	-0.0183 (-1.17)	-0.0180 (-1.28)
Observations	3,051	3,051	3,051	3,051	3,051	3,051
R ²	0.0814	0.0825	0.0797	0.0811	0.0823	0.0791
Corp. Calendar controls	No	Yes	Yes	No	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Program month FE	No	No	Yes	No	No	Yes

Table OA5

Repurchases outside a program and equity based compensation

This table presents the relationship between actual monthly share repurchases that were conducted outside of a repurchase program and equity based compensation. These repurchases are (mostly) made to satisfy obligations from compensation schedules. The dependent variable is *Repurchase intensity (non-program)*, which denotes the number of shares repurchased outside a program during the month divided by the number of shares outstanding at the last trading day of the previous month. Panel A presents the relationship between granted equity and non-program share repurchases whereas Panel B describes the relationship with vesting equity and non-program share repurchases. Lastly, Panel C shows the relation between CEO selling and non-program share repurchases. Throughout all panels, we control for the same variables as in Table ??, Panel A and the estimates are qualitatively similar. Year-month fixed effects and firm fixed effects are controlled for throughout all specifications in this table. T-statistics, adjusted for clustering at the firm level, are presented in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Table 1.

Panel A: Non-program share repurchases and Granted equity

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)
	Share repurchase intensity					
Granted equity dummy	0.0136*** (4.22)	0.0134*** (4.14)	0.0133*** (4.06)			
Granted equity				0.0005* (1.85)	0.0005* (1.82)	0.0005* (1.79)
Blackout ratio _t		-0.0081* (-1.77)	-0.0079* (-1.74)		-0.0088* (-1.93)	-0.0086* (-1.90)
Fiscal-quarter month=2		-0.0039 (-0.89)	-0.0040 (-0.90)		-0.0037 (-0.83)	-0.0038 (-0.84)
Fiscal-quarter month=3		-0.0043 (-0.92)	-0.0044 (-0.93)		-0.0049 (-1.03)	-0.0049 (-1.04)
Repurchase intensity _{t-1}	-0.0017* (-1.81)	-0.0017* (-1.80)	-0.0023** (-2.26)	-0.0017* (-1.85)	-0.0017* (-1.82)	-0.0023** (-2.28)
Options exercised	0.1753 (1.03)	0.1752 (1.03)	0.1753 (1.03)	0.1757 (1.03)	0.1755 (1.03)	0.1757 (1.03)
Options outstanding _{t-12}	0.0102 (0.40)	0.0100 (0.39)	0.0116 (0.46)	0.0110 (0.43)	0.0108 (0.42)	0.0123 (0.49)
Return _{t-1}	0.0014 (0.29)	0.0013 (0.26)	0.0011 (0.23)	0.0013 (0.26)	0.0011 (0.23)	0.0010 (0.20)
Return _{t-2}	-0.0040 (-1.15)	-0.0040 (-1.16)	-0.0037 (-1.08)	-0.0041 (-1.18)	-0.0041 (-1.18)	-0.0038 (-1.10)
Return _{t-3}	0.0031 (0.58)	0.0031 (0.58)	0.0033 (0.64)	0.0030 (0.57)	0.0030 (0.57)	0.0033 (0.63)
Trading volume	-0.0145* (-1.95)	-0.0152** (-2.01)	-0.0148** (-1.96)	-0.0146* (-1.95)	-0.0153** (-2.02)	-0.0149** (-1.98)
Relative spread (ln) _{t-1}	0.0095 (0.37)	0.0147 (0.59)	0.0167 (0.66)	0.0106 (0.42)	0.0160 (0.63)	0.0179 (0.71)
Acquiror	-0.0019 (-0.23)	-0.0019 (-0.23)	-0.0022 (-0.25)	-0.0020 (-0.23)	-0.0020 (-0.23)	-0.0022 (-0.26)
Target	-0.0028 (-0.64)	-0.0028 (-0.64)	-0.0029 (-0.69)	-0.0027 (-0.63)	-0.0027 (-0.62)	-0.0029 (-0.67)
Assets _{t-3}	-0.0015 (-0.59)	-0.0015 (-0.59)	-0.0021 (-0.80)	-0.0015 (-0.59)	-0.0015 (-0.60)	-0.0021 (-0.81)
Cash-to-assets _{t-3}	0.0040 (0.32)	0.0039 (0.32)	0.0029 (0.23)	0.0044 (0.35)	0.0042 (0.35)	0.0032 (0.26)
EBITDA-to-assets _{t-3}	0.0443 (1.19)	0.0444 (1.19)	0.0434 (1.19)	0.0442 (1.19)	0.0443 (1.19)	0.0433 (1.19)
Dividends-to-assets _{t-3}	-0.0309 (-1.34)	-0.0312 (-1.35)	-0.0297 (-1.28)	-0.0310 (-1.35)	-0.0312 (-1.36)	-0.0297 (-1.28)
Leverage _{t-3}	-0.0029 (-0.25)	-0.0026 (-0.22)	-0.0013 (-0.11)	-0.0024 (-0.21)	-0.0020 (-0.18)	-0.0007 (-0.07)
Book-to-market _{t-3}	0.0003 (0.20)	0.0003 (0.19)	0.0001 (0.06)	0.0003 (0.19)	0.0003 (0.19)	0.0001 (0.05)
Change in short interest	0.0743 (1.36)	0.0738 (1.35)	0.0726 (1.33)	0.0743 (1.36)	0.0738 (1.35)	0.0725 (1.33)
Observations	248,884	248,884	248,884	248,884	248,884	248,884

Continued on next page

Table ?? continued

R^2	0.0011	0.0012	0.0017	0.0010	0.0010	0.0016
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Program month FE	No	No	Yes	No	No	Yes

Panel B: Non-program share repurchases and Vesting equity

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Share repurchase intensity					
Vesting dummy	0.0122*** (5.83)	0.0121*** (5.82)	0.0120*** (5.72)			
Vesting equity				0.0054*** (6.68)	0.0054*** (6.72)	0.0053*** (6.50)
Blackout ratio		-0.0079* (-1.75)	-0.0077* (-1.72)		-0.0081* (-1.79)	-0.0079* (-1.76)
Fiscal-quarter month=2		-0.0039 (-0.87)	-0.0040 (-0.88)		-0.0038 (-0.87)	-0.0040 (-0.88)
Fiscal-quarter month=3		-0.0042 (-0.90)	-0.0043 (-0.91)		-0.0043 (-0.92)	-0.0044 (-0.93)
Observations	248,884	248,884	248,884	248,884	248,884	248,884
R^2	0.0012	0.0012	0.0017	0.0012	0.0012	0.0017
Controls	Yes	Yes	Yes	Yes	Y	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Program month FE	No	No	Yes	No	No	Yes

Panel C: Non-program share repurchases and CEO sales

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Share repurchase intensity					
CEO selling dummy	0.0001 (0.03)	-0.0001 (-0.05)	-0.0001 (-0.04)			
CEO selling				-0.0004 (-0.40)	-0.0004 (-0.48)	-0.0004 (-0.47)
Blackout ratio		-0.0090* (-1.96)	-0.0088* (-1.93)		-0.0090** (-1.96)	-0.0088* (-1.93)
Fiscal-quarter month=2		-0.0036 (-0.82)	-0.0037 (-0.84)		-0.0036 (-0.82)	-0.0037 (-0.83)
Fiscal-quarter month=3		-0.0050 (-1.06)	-0.0050 (-1.07)		-0.0050 (-1.06)	-0.0051 (-1.07)
Observations	248,884	248,884	248,884	248,884	248,884	248,884
R^2	0.0010	0.0010	0.0015	0.0010	0.0010	0.0015
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Program month FE	No	No	Yes	No	No	Yes

Table OA6**Program initiation and long-run shareholder value, quintiles based on within-firm variation of *Vesting equity***

The table reports Fama and French calendar-time portfolio regressions for various event windows following 1,173 buyback programs which are initiated in a month where the CEO's equity vests simultaneously. The time period is between 2006 and 2019. Portfolios are rebalanced each month and an equally-weighted excess return is calculated. We regress the monthly excess return of this portfolio on the Fama-French three factors (Fama and French, 1993, Fama and French, 1996). Each stock can enter the monthly portfolio only once, even if the stock has experienced more than one event during the event window. For the window of [0, 0], a firm enters this portfolio if it announces a buyback program in the current month. For the other windows, a firm enters this portfolio if it announces a buyback program in the previous month and stays in the portfolio for 12 (24, 36, 48, respectively) months. Panels B and C provide results for subsamples. Quintile ranges for quintiles Q1 through Q5 are computed for each firm separately and are, therefore, based on the within-firm variation of *Vesting equity*. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Table 1.

Panel A: Returns to program initiation when the CEO's equity vests simultaneously, sorted by within-firm-year variation in the dollar value of vesting equity

	(1)	(2)	(3)	(4)	(5)
Numbers in this table:	Abnormal return for the equally-weighted portfolio with the event window below				
Event window:	[0, 0]	[1, 12]	[1, 24]	[1, 36]	[1, 48]
Full sample	0.0149*** (3.47)	0.0033*** (2.94)	0.0030*** (3.03)	0.0021** (2.21)	0.0018* (1.91)
Vesting equity Q1	0.0221*** (3.81)	0.0036** (2.43)	0.0037*** (3.07)	0.0032*** (2.80)	0.0030** (2.61)
Vesting equity Q2	0.0103 (1.19)	0.0032 (1.30)	0.0034* (1.78)	0.0027 (1.56)	0.0019 (1.13)
Vesting equity Q3	0.0019 (0.32)	-0.0008 (-0.33)	-0.0005 (-0.32)	-0.0015 (-0.96)	-0.0018 (-1.21)
Vesting equity Q4	0.0222*** (2.64)	0.0051* (1.92)	0.0033 (1.48)	0.0031 (1.54)	0.0026 (1.32)
Vesting equity Q5	0.0641* (1.98)	-0.0037 (-0.66)	-0.0040 (-0.93)	-0.0012 (-0.36)	-0.0028 (-0.81)

Table OA7**Share repurchases, equity based compensation, and abnormal returns, quintiles based on within-firm variation of *Vesting equity***

The table reports Fama and French calendar-time portfolio regressions for various event windows following open market repurchases between 2006 and 2019. Portfolios are rebalanced each month and an equally-weighted excess return is calculated. We regress the monthly excess return of this portfolio on the Fama-French three factors (Fama and French, 1993, Fama and French, 1996). Each stock can enter the monthly portfolio only once, even if the stock has experienced more than one event during the event window. For the window of [0, 0], a firm enters this portfolio if it repurchases in the current month. For the other windows, a firm enters this portfolio if it repurchases in the previous month and stays in the portfolio for 1 (3, 6, 12, respectively) months. Panel A differs from Table 9, Panel B, only in the way the quintiles are formed: In Panel A, quintile ranges are computed for each firm separately and are, therefore, based on the within-firm variation of *Vesting equity*. In Panel B, we change the definition of the vesting variable and define it as the number of shares vesting. The sorting is the same as in Panel A. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Table 1.

Panel A: Returns to repurchase when the CEO's equity vests simultaneously, sorted by within-firm-year variation in dollar value of vesting equity

Numbers in this table:	Abnormal return for the equally-weighted portfolio with the event window below				
Event window:	[0, 0]	[1, 1]	[1, 3]	[1, 6]	[1, 12]
	(1)	(2)	(3)	(4)	(5)
Full sample	0.0016 (1.13)	0.0018 (1.38)	0.0029*** (2.97)	0.0026*** (3.14)	0.0026*** (3.27)
Vesting equity Q1	0.0091*** (5.47)	0.0045** (2.42)	0.0051*** (4.51)	0.0041*** (4.52)	0.0033*** (4.06)
Vesting equity Q2	-0.0043 (-1.26)	-0.0025 (-0.87)	0.0036* (1.68)	0.0009 (0.65)	0.0019 (1.62)
Vesting equity Q3	-0.0057* (-1.67)	0.0008 (0.29)	0.0002 (0.14)	0.0010 (0.67)	0.0005 (0.36)
Vesting equity Q4	-0.0096** (-2.14)	-0.0006 (-0.20)	0.0017 (0.71)	0.0015 (0.86)	0.0015 (1.14)
Vesting equity Q5	-0.0046 (-0.74)	0.0020 (0.28)	-0.0017 (-0.38)	0.0001 (0.02)	-0.0000 (-0.00)

Panel B: Returns to repurchase when the CEO's equity vests simultaneously, sorted by within-firm-year variation in the number of vesting equity

Numbers in this table:	Abnormal return for the equally-weighted portfolio with the event window below				
Event window:	[0, 0]	[1, 1]	[1, 3]	[1, 6]	[1, 12]
	(1)	(2)	(3)	(4)	(5)
Vesting equity Q1	0.0042** (2.53)	0.0021 (1.17)	0.0023** (2.15)	0.0022** (2.47)	0.0023*** (2.81)
Vesting equity Q2	-0.0025 (-0.64)	0.0041 (1.03)	0.0068*** (2.69)	0.0037** (2.37)	0.0027** (1.99)
Vesting equity Q3	0.0009 (0.28)	0.0061** (2.16)	0.0045** (2.42)	0.0035** (2.31)	0.0028** (2.41)
Vesting equity Q4	0.0010 (0.27)	0.0013 (0.33)	0.0051** (2.37)	0.0046** (2.43)	0.0031** (2.24)
Vesting equity Q5	0.0084 (1.29)	-0.0016 (-0.23)	0.0011 (0.26)	0.0022 (0.61)	0.0031 (1.06)