PANDEMIC REACTIONS

A STUDY ON THE IMPACT OF SHARE REPURCHASE ANNOUNCEMENTS ON ABNORMAL RETURNS DURING THE COVID-19 PANDEMIC

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Pandemic Reactions: A Study on the Impact of Share Repurchase Announcements on Abnormal Returns During the Covid-19 Pandemic

Abstract:

This paper examines how U.S. equities listed on Nasdaq and NYSE reacted to open-market share repurchase announcements during Covid-19. We document abnormal returns following share repurchase announcements during the pandemic and attempt to investigate if a causal relationship can be established. Our findings suggest that the elevated returns was affected by differences in firm characteristics among companies choosing to announce during the pandemic. Therefore, we cannot conclude that the Covid-19 pandemic gave rise to higher abnormal returns following share repurchase announcements. This paper contributes to prior studies on share repurchases and uncertain market conditions and encourages further research on legislative initiatives.

Keywords:

Covid-19, Share Repurchase, Announcements, Nasdaq, NYSE

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1. Introduction

In December 2019, the coronavirus, SARS-CoV-2, first surfaced in Wuhan, China. After a few months, the virus had been identified in 114 countries and following the alarming levels of severity and spread, the World Health Organization characterized Covid-19 as a global pandemic in March 2020. Consequently, plenty of countries adopted strict policies, including workplace closures and travel bans (Oxford University, 2022). By the end of March 2020, over 100 countries had a full or partial lockdown (BBC, 2020). As a result, labor markets, economies and businesses, including global supply chains, were largely impacted, resulting in business disruptions and uncertainty worldwide (ILO, 2022). Between February 19th and March 23rd, the S&P 500 fell by approximately 40 percent (S&P Global, 2022). Consequently, due to the prevailing uncertainty and its impact on financial markets, Covid-19 poses an interesting area for further research. In this paper, we examine the stock market reactions to share repurchase announcements during the pandemic, compared to normal market conditions.

Share repurchases, that is when a company repurchases some of its shares and then either retires them or holds them as treasury stock, is an interesting area of study for various reasons. Firstly, the number of share repurchases in the United States has grown steadily over many years and has recently become the primary form of payout (Skinner, 2008). Grullon and Ikenberry (2000) studied a sample of US companies and concluded that in 1972, less than 27% of the companies repurchased shares, compared to over 84% in 2000. The boom in the United States is partly attributed to the implementation of SEC Rule 10b-18 in 1982 (Grullon and Ikenberry, 2000; Grullon and Michaely, 2002).

Secondly, share repurchases have lately become a frequent topic of discussion in business and political contexts. Opponents of share repurchases argue that the buyback benefits management when the money instead could be reinvested into the company and its staff (Chen and Obizhaeva, 2022). There have been numerous suggestions to limit the corporate payout policy. For instance, the Biden administration signed a bill in August 2022 on a new excise tax of 1 percent, applicable on all share repurchases after the 31st of December 2022 (White House, 2022). Share buybacks were also limited during the pandemic by the ”Coronavirus Aid, Relief, and Economic Security Act” (CARES) that was passed into law in March 2020. If a company received a loan or financial aid from this act or the following similar acts, it was prohibited from buying back shares until September 2022 or until the load was repaid (U.S. Department of the Treasury, 2022).

Thirdly, there has been extensive research on share repurchase during normal market conditions, but only a few attempts to better understand it during market uncertainty. Lintner (1956) concluded that share repurchases are pro-cyclical and increase during booms while decreasing during busts, and similar findings have been reported by Jagannathan, Stephens and Weisbach (2000).

Furthermore, studies on information uncertainty have shown that earnings announcements during market busts generate high abnormal returns, compared to announcements during market booms (Schmalz and Zhuk, 2019). Similarly, during times of uncertainty when the implications of new information for a company’s value are

ambiguous, the market reacts with higher expected returns following good news (Zhang, 2006). If applied to the case of Covid-19, when there was a high degree of information uncertainty, this would indicate a higher share price reaction to new information. Since share repurchases also are found to convey a signaling value according to the literature (e.g., Vermaelen, 1981; Ikenberry, Lakonishok and Vermaelen, 1995; Dittmar, 2000), we wanted to investigate this further.

We conduct the study by testing if share repurchase announcements during Covid-19 generated higher abnormal returns than during normal market conditions. Particularly, we focus on open-market share repurchase announcements in the United States by companies listed on Nasdaq and NYSE. Our stated research questions are:

i. *Does share repurchase announcement give rise to higher abnormal share price reactions during Covid-19 compared to normal market conditions?*

ii. *To what extent can the difference in abnormal returns be explained by announcement, company and trading characteristics?*

iii. *To what extent can the difference in abnormal returns be explained by increased uncertainty?*

Prior literature on share repurchases has primarily investigated how repurchase announcements impact abnormal returns, as well as their signaling value. Our study, however, investigates whether there is a difference in abnormal repurchase announcement returns during Covid-19, compared to normal market conditions. In addition, we also investigate whether firms with specific characteristics were more likely to announce a share repurchase during Covid-19, compared to normal market conditions. Thus, in addition to elaborating findings from literature studying the dynamics and characteristics of share buybacks, we also incorporate the unprecedented uncertainty stemming from Covid-19. Thereby, our study stands out and contributes to exciting research.

To determine whether share repurchase announcements during Covid-19 generated abnormal returns, we study U.S. firms listed on Nasdaq and NYSE during the fiscal years 2017 until the beginning of 2022. We retrieve data on repurchase announcements from Thomson Financial Securities Data Company (SDC) Mergers and Acquisitions database. The database also provides additional details such as announcement date, deal size, and transaction technique. Further, Refinitiv is used to retrieve stock price data and company financials.

To test our stated research questions, we first calculate abnormal returns during a 3-day window surrounding the repurchase announcements during the control- and treatment period. Based on these, a time-series ordinary least squares (OLS) regression is employed to investigate if abnormal returns were obtained during Covid-19. Thereafter, we conduct a fixed-effects regression with panel data to conclude if the difference in abnormal returns can be explained by unobserved heterogeneity. A probit regression is

then conducted to study if firms with different characteristics chose to repurchase shares during Covid-19, compared to the pre-Covid-19 period. Lastly, we test the robustness of our results by employing a placebo and permutation test.

We found that abnormal share returns (3-day BHAR) during Covid-19 were on average 1.04% higher compared to the control period. In addition, Covid-19 correlated with abnormal returns at a significance level of 1%. To conclude if the abnormal return stemmed from differences in firm characteristics among repurchasing firms, noise in the market, or purely due to a change in market reactions, we performed multiple robustness tests. A placebo and permutation test indicated that our main regression had not captured general market noise. However, a fixed effects regression indicated that unobserved heterogeneity affected the results. By the same token, the probit regression found that firm characteristics impacting the likelihood of repurchasing shares largely differed between the control and treatment periods. Thus, the increase in abnormal announcement returns was likely attributed to firm differences between companies announcing repurchases during Covid-19, compared to pre-Covid-19.

2. Theoretical Framework and Literature Review

2.1 Background

In order to study the impact of share repurchase announcements on abnormal returns during Covid-19, we have developed a theoretical framework based on prior areas of research. In section one, we describe the informational value of share repurchases and how they can be used by firms as a means of conveying private information. Here, we also shed light on prior literature researching the motives behind share repurchases, as well as market reactions to firm-specific announcements. The second section covers the documented impact of some of the above-mentioned factors during market uncertainty. Lastly, the third section discusses the contribution of this study to prior literature.

2.2 The Informational Value, Motives and Stock Market Reactions to Share Repurchases

Prior research has been conducted on firm-specific announcements and the following stock market reactions. In a study conducted by Mitchell and Mulherin (1994), a direct relation between market activity variables, such as the absolute value of firm-specific stock returns, and the number of news announcements reported on Dow Jones & Co was established. Mehndiratta and Gupta (2010) also found that the stock market has an instant reaction to dividend announcements. Neuhierl, Scherbina and Schiusene (2013) found strong stock price reactions to firm-specific news announcements, as well as a decreasing level of informational asymmetry. These studies illustrate how the market re-prices securities following meaningful news announcements and are in line with Fama's (1970) conclusion that security prices in efficient markets incorporate all available information. Based on the efficient market notion and the fact that equity markets often are experiencing semi-strong efficiency, share repurchase announcements should have an

instant effect on security prices. However, the question of how and why share repurchases could convey new information to the market remains to be answered.

Extensive prior research has been conducted concerning the motivation behind share repurchase announcements, as well as the signaling value and consequent market reactions. The signaling hypothesis, mentioned in prominent share repurchase literature (Vermaelen, 1981; Dittmar, 2000), suggests that firms buy back shares when their stock is recognized as undervalued. In line with this, Ikenberry et al. (1995) found that abnormal returns often are experienced by firms with low market-to-book ratios. Likewise, Lang and Litzenberger (1989) found a positive relationship between abnormal returns post-dividend announcements and the firm's capacity to overinvest, measured by Tobin's Q. Due to the nature of dividends as a means of corporate payout, it is reasonable to argue that it possesses similar characteristics to share repurchases, and thus these findings could potentially be applied to buybacks as well. However, He, Howe, and Kao (1992) did not find a relation between abnormal returns and Tobin's Q following tender offer share repurchases.

Another useful hypothesis is therefore free cash flow. Jensen (1986) and Easterbrook (1984) proposed that firms with excess cash, exceeding their potential investment opportunities, tend to invest in negative present value (PV) projects. The agency costs arising from this may be reduced by the dispense of cash, either in the form of a share repurchase or dividend. Hence, they suggest that one major influencing factor behind share repurchases is the distribution of excess cash. In line with this, Grullon and Michaely (2004) found that high abnormal announcement returns are anticipated for firms that typically overinvest in negative PV projects, as it decreases the excess cash as well as the systematic risk. Stephens and Weisbach (1998), as well as Barth and Kasznik (1999), also found a positive relationship between the level of cash flow and share repurchases, indicating that firms with more excess cash are more likely to repurchase shares (Dittmar 2000; Mitchell and Dharmawan 2007). Similarly, Anolick, Batten, Kinateder and Wagner (2021) concluded that repurchase announcements from firms with excess cash generate higher abnormal returns, compared to firms with less excess cash. Contradicting these findings, He et al. (1992) did not find any evidence for the principal-agent hypothesis when studying the relationship between free cash flow and firm value for fixed-price tender offers. This finding implies that open-market share repurchases might not affect firm value since they reduce excess cash flow by a smaller amount than fixed-price tender offers (McNally, 1999).

Prior literature further indicates that one objective with share repurchases is to reduce information asymmetry. Information-signaling theory advocates that firms have better information regarding their type (good or bad) than investors, and thus good firms can differentiate themselves by conveying a high-cost signal, such as distributing cash (Bhattacharya, 1979; Miller and Rock, 1985). Since share repurchase is an example of distributing cash, it is reasonable to apply the theory to share repurchases. Furthermore, Ikenberry et al. (1995) found that small-size firms generate higher abnormal returns than large firms following share repurchase announcements. The explanation provided for this

is that firm size is suggested to have a negative relation with information asymmetry (Vermaelen, 1981).

The vast majority of this paper is based on Babenko, Tserlukevich and Vedrashko's paper "The Credibility of Open Market Share Repurchase Signaling", published in the Journal of Financial and Quantitative Analysis (2012). The authors researched whether insider purchase is an important factor to consider when assessing the reliability of undervaluation signaling values from open market share repurchase announcements. In order to conduct the study, data on share repurchase announcements between 1993-2008 were collected from Thomson Financial Securities Data Corporation (SDC). Further, insider trading data was obtained through the Thomson Financial database, while stock price return data was extracted from CSRP. Then a 3-day window was used to calculate abnormal returns. The findings indicated that the stock market responded in favor of announcements by firms where insiders recently purchased stock.

Moreover, the area of study, as well as the methodology used in Babenko et al.'s research has similarities and is applicable to our study, although a few differences are prevalent. Their study examines if insider purchases contribute to the undervaluation signaling value from open market share repurchase announcements. On the other hand, our study rather examines if times of uncertainty have an effect on the signaling value of share repurchase announcements. As a result, we will also draw inspiration from studies researching stock market reactions to announcements during times of uncertainty.

2.3 Share Repurchase Announcements During Times of Uncertainty: Motives and Stock Market Reactions

Our main research question aims to answer if Covid-19 had an impact on abnormal returns following share repurchase announcements. To the best of our knowledge, no prior literature has investigated this specific effect on U.S. stocks during Covid-19. However, there is extensive literature on how general uncertainty impacts news announcements, firm characteristics and abnormal announcement returns.

Prior studies have found a positive relationship between high uncertainty and abnormal returns. Anolick et al. (2021) concluded that high levels of economic policy and financial uncertainty were linked to considerably higher abnormal returns following share repurchase announcements. Similar findings are reported by Schmalz and Zhuk (2019), stating that certain firms experience up to 70% stronger stock price reactions following earnings announcements during busts compared to booms. Zhang (2006) also studied the relationship between information uncertainty and stock returns and found that increased information uncertainty results in lower expected returns following bad news, while higher expected returns are associated with positive news.

Moreover, since share repurchases are more flexible than dividends, for instance as firms are not obliged to follow through on open market share repurchases, Jagannathan et al. (2000) suggested that firms might reduce the completion rate of share repurchases during times of uncertainty. Likewise, e.g. Lie (2005) and Anolick et al. (2012) found that firms are more likely to have strong precautionary motives to hold on to cash during

times of uncertainty, rather than paying it out through e.g., share repurchases. Nonetheless, these findings give no implications of how the number of share repurchase announcements will be impacted during Covid-19, as firms are not obliged to follow through on open-market buyback announcements. Thereby, the signaling hypothesis becomes an area of interest as this might explain why firms announce share repurchases, while the completion rate decreases. There is a documented increased risk of incorrect valuation during times of high policy uncertainty, due to information asymmetry (Nagar, Schoenfeld and Wellman, 2019). In the context of share repurchase activity, it is thereby plausible to suggest that firms' propensity to use share repurchase announcements as a means of sending positive signals to the market about their underlying could increase during times of uncertainty.

2.4 Contribution

To the best of our knowledge, this report is the first to study how share repurchase announcements impact abnormal returns for U.S. stocks during Covid-19, as well as research if the types of firms repurchasing shares during the pandemic had different characteristics compared to companies repurchasing in the control period. In addition, our study contributes to the existing literature on the characteristics, signaling value and market reactions to share repurchases announcements by e.g., Vermaelen (1981), Jensen (1986), Ikenberry et al. (1995), Dittmar (2000) and others. Further, we contribute to literature on the motives behind share repurchase by investigating what types of firm characteristics impacted the likelihood of repurchasing shares during Covid-19, compared to normal market conditions. Our study also adds value to the continuously developing stream of literature that studies the effects of uncertainty on firm-specific announcements (e.g., Zhang, 2006; Schmalz and Zhuk, 2019). By combining the previously mentioned research and incorporating the relatively recent event of Covid-19, our study stands out and contributes to the exciting research.

3. Hypotheses

i. *We expect higher abnormal stock returns to share repurchase announcements during Covid-19 compared to pre-Covid-19.*

To begin with, there is evidence that significant abnormal returns are achieved post-share repurchase announcements, as documented by for instance Ikenberry et al. (1995). Further, Mitchell and Mulherin (1994) and Neuhierl et al. (2013) have found a positive relation between firm-specific news announcements and high abnormal returns. We expect these findings to still be applicable during times of uncertainty due to a number of reasons. For instance, Schmalz and Zhuk (2019) suggest that firms experience immense abnormal positive returns following earnings announcements during market busts, compared to booms. Combining these findings, we expect to find higher abnormal returns to share repurchase announcements during Covid-19.

ii. *We hypothesize that the abnormal returns will vary across industries, and we anticipate that the strongest market reactions will be seen among stocks within wholesale trade, retail trade, services and high-tech.*

Since different industries have varying characteristics, there are inherent differences in terms of default risks when comparing industries that are more and less impacted by times of uncertainty. In addition, it is reasonable to expect variations in terms of informational value between industries during the pandemic, as they were impacted to various extents (S&P, 2022). For instance, some of the industries most impacted by the pandemic were wholesale and retail trade, transportation and storage, and lastly services divided into food, accommodation and others (Office for National Statistics, 2021). Thereby, based on our broad industry classifications (SIC), we anticipate strong market reactions in the following industries: "wholesale trade", "retail trade" and "services". However, we do not include "transportation and storage" in this hypothesis as it does not correspond to our obtained industry definition of "transportation and public utilities". In line with Babenko et al. (2012), we also formed the industry "high-tech" since Covid-19 positively impacted the industry in terms of demand (McKinsey, 2020).

iii. *We predict that the independent regression variables "Cash to Asset", "Repurchase Program Size", "Insider Purchases", "Report on Announcement Day" and "Stated Reason: Undervaluation" will have a positive correlation with the dependent abnormal returns variable.*

Jensen (1986) found that firms with a large amount of excess cash flow are likely to invest heavily in projects with negative present value, consequently increasing agency costs. Nonetheless, agency costs can be reduced by distributing the excess cash through share buybacks. In addition, Grullon and Michaely (2004) suggest that share repurchase announcements from firms that are inclined to overinvest in negative present value projects will give rise to positive stock returns. Hence, we expect the Cash to Assets ratio to be positively correlated to abnormal returns.

We expect the Repurchase Program Size variable to have a positive correlation with abnormal returns post announcement, in line with Ikenberry and Vermaelen (1996), as well as Comment and Jarell (1991). In addition, Babenko et al. (2012) found that insider purchases prior to share repurchase announcements are associated with higher positive abnormal returns. Based on this, we anticipate that Insider Purchase is positively correlated with abnormal returns.

iv. *We expect that the independent variables "Share Price Run-Up", "Firm Size", "Tobin's Q", "Insider Sales" and "Recurring Announcement" will have a negative correlation with the dependent abnormal returns variable.*

In accordance with the signaling hypothesis, firms repurchase shares when they characterize their stock as undervalued (Vermaelen, 1981; Dittmar, 2000). Stephens and Weisbach (1998) also concluded that prior stock market returns have a negative relation with share repurchase activity, implying that the Share Price Run-Up variable should be negatively correlated with abnormal returns.

Furthermore, small firms are more likely to experience higher abnormal returns than large firms after share buyback announcements, as information asymmetry and firm size is negatively correlated (Ikkenberry et al., 1995). Consequently, we expect the Firm Size variable to be negatively correlated with abnormal returns. In addition, Ikenberry et al (1995) suggested that firms with low Tobin's Q commonly experienced abnormal returns, hence the hypothesis of negative correlation between them.

Moreover, we expect that Insider Sales have a negative correlation with abnormal returns in line with the findings by Babenko et al. (2012). Lastly, our data includes firms that repurchase shares on multiple occasions during our time period. Andriosopoulos and Lasfer (2015) suggested that due to the large amount of recurring share repurchase announcements in the United States, recurring announcements generate lower returns. Therefore, we expect Recurring Announcements to be negatively correlated with abnormal stock returns.

4. Data

4.1 The Ideal Data Set

In the ideal data set, the firms that repurchased shares would be completely randomized in the two periods. Alternatively, the same firms would have repurchased in both periods, or only companies with identical characteristics and announcements. However, this does not hold true in reality as share repurchases are largely associated with signaling motives and other management objectives that can be more common in certain types of firms, making it difficult to find any causality. The consequence of this is that the likelihood of sample selection bias increases. In addition, the sample size would ideally be large and there would be no missing data points for any variables in order to avoid bias in the estimation of parameters or reduce the representativeness. Furthermore, every industry and year would have the same number of announcements and the frequency of the announcements would be constant in the time periods. Using this ideal data set would eliminate biases and unwanted effects and isolate the Covid-19 effect to a greater extent, which would develop more robust results. However, it is not possible to access this type of data in reality. Additionally, in an ideal setting, firms' true motives behind share repurchase announcements would be observable. As we can only rely on literature to find indications of motives there is a margin of error prevalent, and limited conclusions that can be drawn on why companies repurchase shares during Covid-19. Additional limitations to our study are discussed in section 8.2.

4.2 Share Repurchases

Adhering to Babenko et al. (2012), we obtain data on share repurchase announcements through the Thomson Financial Securities Data Company (SDC) Mergers & Acquisition database. The export includes all share repurchase announcements by public companies that are listed on Nasdaq and NYSE. Exchanges in other countries, over-the-counter exchanges, and small exchanges are excluded as they vary in terms of transactional activity, regulations and requirements (Manconi, Peyer and Vermaelen, 2019). For instance, board approval is required for buybacks in the U.S. and there is no time limit on the authorization, while explicit shareholder meeting approval is needed in the EU and there is an 18-month time limit on the authorization. In addition, adhering to the reasoning by Grullon and Michaely (2004), highly regulated industries such as financial institutions are not excluded from the sample since they constitute a large proportion of it.

In total, we obtained 2293 announcements for the period. Besides the announcement date, we also exported other information on the repurchase program, repurchase technique, value of the transaction, stated reason and company identifiers, industry code and more. Once the share repurchase announcement data from SDC was extracted, additional filters described below were applied to address incomplete data and insufficient relevance to our study.

Table 1:

Mapping of Filtering Actions

		No. of data points	
Filtering Action		Before	After
1	Removal of missing transaction values	2293	2290
2	Removal of all repurchase techniques other than open market	2290	2207
3	Removal of missing share price data	2207	2169

Filtering action 2 is in line with the methodology used by Babenko et al. (2012) and is because open market share repurchase is the most common technique (Skinner, 2008). Because the different types of share repurchase techniques differ, including all types in our analysis would require us to test and analyze them separately and later compare the results (Comment and Jarell, 1991). Since the less common techniques only accounted for a minor part of the sample, it would likely not contribute to any valuable conclusions.

4.3 Trading and Financial Data

Daily share price data was collected from Refinitiv for each share repurchase announcement. However, as SDC does not report the specific time of the announcement, it is not possible to determine whether the announcement was done during, or outside of, market opening hours. Hence, we calculate share price returns using a 3-day window surrounding the announcement. This methodology is in line with Babenko et al. (2012), and is also extensively used in previous stock repurchase literature.

We retrieve data on company financials from Refinitiv for all firms announcing share repurchases. Specifically, we obtain data on Book Assets, Book Equity, Market

Capitalization, Free Cash Flow and Shares Outstanding. Data on insider purchases and sales are collected through Thomson Table 1, accessed through WRDS. The database collects the data from the SEC Form 4 filed by investors after a PDMR transaction has occurred. In line with Babenko et al. (2012), we excluded shares obtained via stock options or grants.

4.4 Time Series Regression: Variables

4.4.1 Abnormal Stock Returns

In order to quantify the informational value of share repurchases during Covid-19, we measure abnormal stock returns. In line with the methodology used by Babenko et al. (2012), as well as previous prominent share repurchase literature by for instance Comment and Jarell (1991) and Maxwell and Stephens (2003), abnormal returns are calculated using a 3-day window for share price data. Further, we calculate abnormal returns as the 3-day buy-and-hold (BHAR) return of the firm minus the expected return of the market, estimated as the return of the stock exchange index, that is Nasdaq or NYSE composite depending on what index the firm is listed on.

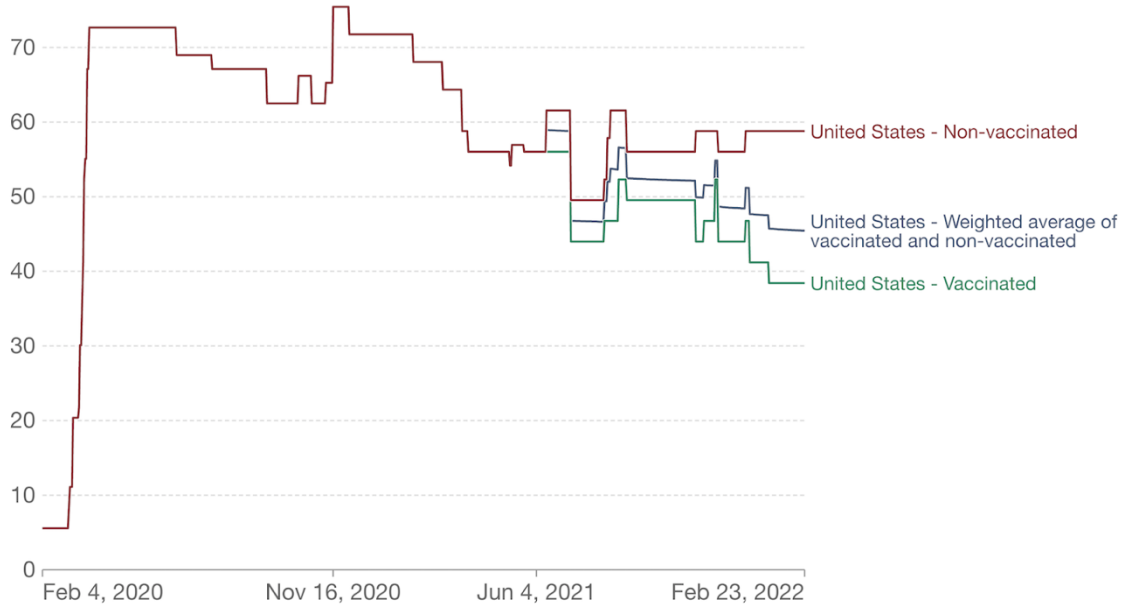
Given that share repurchases are not limited to being announced solely when the market is open, some announcements in our sample took place when the stock market was closed. In this event, the next market trading date was applied as an adjusted date of announcement, in an effort to isolate the impact of share repurchase announcements on the abnormal price returns to the largest extent possible.

4.4.2 Independent Variables

4.4.2.1 Treatment Variable: Covid-19

The treatment variable is represented by a dummy variable that stipulates whether the share repurchase was announced during the control period or the treatment period. In order to define the treatment period, we used societal restrictions in the United States as a proxy for the prevailing uncertainty in society. As seen in the graph below, the Government Response Tracker in the United States spiked on 2020-02-05 (Oxford University, 2022), and hence this is used as the start date for the treatment period. Moreover, the Government Responses slightly decreased approximately two years after the spike, the specific date is however difficult to extract. Bearing in mind that Russia invaded Ukraine on 2022-02-24 and that we want to isolate the Covid-19 effect, we chose 2022-02-23 as the end of our treatment period.

Figure 1. Government Stringency Index, United States



Stringency index based on nine indicators including school and workplace closures, travel bans, etc. (100 = strictest) (Oxford University, 2022)

The control period is defined as 2017-01-01 until 2020-02-04, that is until the day prior to the spike in societal restrictions. Notably, the control period is not symmetric to the treatment period in terms of number of days, however, it is nearly symmetric in terms of number of announcements. The main reasoning behind choosing 2017-01-01 as the start date is based on the argument that the longer the control period, the higher certainty that it is not skewed by other significant events.

4.4.2.2 Firm Characteristics: Cash to Assets, Firm Size, and Tobin's Q

To begin with, we attempt to capture the main firm characteristics impacting abnormal returns following announcements. Proxies for these are then used as independent variables, in line with the methodology set by Babenko et al. (2012). The variable Cash to Assets is applied as a proxy for the free-cash-flow hypothesis, largely discussed by Jensen (1986) and Easterbrook (1984). It foremost aims to capture firms with high Cash/Asset ratios, as firms with excess cash are more likely to repurchase shares to diminish agency costs (Grullon and Michaely, 2004). Firm Size, defined as the logarithm of book assets, is included as literature found a negative relation between firm size information asymmetry, while smaller firms experience higher abnormal returns post-buyback announcements (Ikenberry et al., 1995; Comment and Jarell, 1991). Lastly, Tobin's Q, defined using the proxy market-to-book ratio, is incorporated since firms that perceive their stock as undervalued are more likely to announce repurchases, in line with the signaling hypothesis (Ikenberry et al., 1995).

$$\text{Tobin's Q} = \frac{\text{Market Value of Equity}}{\text{Book Value of Equity}} \quad (1)$$

4.4.2.3 Insider Purchases and Sales

Extensive research has been conducted about notable insider trading surrounding corporate announcements, and the implied signaling value (e.g., John and Mishra, 1990; Lee, Mikkelson and Partch 1992). Further building on these findings, Lakonishok and Lee (2001) suggest that insiders often earn abnormal returns on their trades. Similarly, Babenko et al. (2012) found that share repurchase announcement returns are higher and positive for firms if insiders purchase shares prior to the announcement, while insider sales could however have a slightly negative effect on returns. Adhering to the methodology used by Babenko et al. (2012), we include two variables for insider trading: Insider Purchases and Insider Sales.

4.4.2.4 Recurring Repurchases

Recently, it has become common for firms to repurchase shares frequently and Skinner (2008) even concluded that share repurchases have become the main form of payout. As a result, there are likely varying reasons and motives behind firms that repurchase shares on a frequent basis, compared to firms who only repurchase shares occasionally. By the same token, Andriosopoulos and Lasfer (2015) suggested that the credibility of a firm decreases after an initial announcement and found that recurring announcements generated significantly lower results. Hence, with inspiration from the methodology used by Jagannathan and Stephens (2003), we apply the dummy Recurring Repurchases, taking the value 1 if a firm repurchases share more than once during our time period.

4.4.2.5 Report on Announcement Day

Since we want to isolate the additional informational value of share repurchase announcements during Covid-19, it is of interest that the abnormal returns are not affected by other events such as reporting dates. Thus, we apply the dummy variable Report on Announcement Day, indicating if the share repurchase announcements coincided with a reporting date. Specifically, we investigate whether the reporting date occurs within the 3-day window centered around the announcement date, as this is the period applied when calculating abnormal returns.

4.4.2.6 Percentage Sought

The fraction of shares sought in repurchase programs is positively correlated to abnormal returns following the announcement, as stated by both Comment and Jarell (1991) and Ikenberry and Vermaelen (1996). Hence, in line with the application used by Babenko et al. (2012), we control for the percentage of shares sought in the repurchase program by dividing the value of shares sought by the firm's market capitalization.

4.4.2.7 Share Price Run-Up

Schultz (2003) proposed that the abnormal returns calculated in event studies could potentially be impacted by pseudo-market timing, as managers often consider previous stock performance when making decisions. In the instance that share repurchases are announced following bad stock performance, it is implied that positive abnormal returns can be expected. In addition, Stephens and Weisbach (1998) concluded that share repurchase activity is negatively correlated with former stock returns. Comment and Jarell (1991) also found that stock price run-up is negatively correlated with abnormal returns following share repurchase announcements. Therefore, we include a variable for abnormal stock price returns 40 days before the announcement, following the methodology used by Babenko et al. (2012).

4.4.2.8 Stated Reasons

Peyer and Vermaelen (2009) concluded that stated reasons for share repurchases reflect insider information. In addition, they found that the stated reason "undervaluation" is associated with higher abnormal announcement returns. Therefore, we include dummy variables for the stated reasons that are prevalent in our sample; Undervaluation, General Corporate Action and Employee Benefit Plans, Enhance Shareholder Value and Offset Dilution Effects.

4.5 Probit Regression

The purpose of the probit regression is to observe how different characteristics impacted the likelihood of repurchasing shares during Covid-19, compared to the pre-Covid-19 period. Until this point, data on firms that repurchased shares during the control or treatment period has been obtained. However, in order to create a dependent dummy variable Repurchase, stipulating if a firm repurchased shares or not, it is implicit that data on firms not repurchasing shares is required as well. Hence, all firms listed on Nasdaq and NYSE are retrieved through Nasdaq's website. Thereafter, the following financial line items and ratios are obtained from Compustat: Total Assets, Cash, Sales/Turnover, Book/Market, Dividend Payout Ratio, Return on Capital Employed (ROCE), Free Cash Flow/Operating Cash Flow, Total Debt/Total Assets and Current Ratio.

4.5.1 Independent Variables

Expanding on the independent variables in the probit regression, their overarching purpose is to capture firm characteristics that may vary between firms choosing to repurchase shares or not. Particularly, we aim to capture firm characteristics that are related to motives for share repurchases according to literature. Hovakimian, Opler and Titman (2001) and D'Mello and Shroff (2000) proposed that one reason why firms repurchase shares is to make progress towards an optimal leverage ratio. Expanding on this hypothesis, Dittmar (2000), Jagannathan and Stephens (2003) and Mitchell and Dharmawan (2007) suggest that firms with below target leverage ratios are more prone to repurchase shares. Hence, Debt to Assets is included as an independent variable.

Grullon and Michaely (2002) found that U.S. companies repurchase shares using funds that otherwise had been attributed to paying out dividends. Likewise, Brav, Graham, Harvey and Michaely (2005) implied that when free of dividend payout constraints, firms tend to substitute dividends for buybacks. These findings are in line with the dividend substitution hypothesis. Hence, as it is suggested that the funds used for repurchases could originally have been used to increase dividends, we include Dividend Payout Ratio as an independent variable. Lastly, while the variables described in section 4.4.4.1 have large signaling values and impact abnormal returns, they also reflect certain motives for conducting share repurchases. Hence, Firm Size, Cash to Assets and Tobin's Q are incorporated.

To capture motives that might be related to repurchase activity during Covid-19 specifically, we further aim to capture variables describing the firm's profitability, operational activity and liquidity. Thereby, Current Ratio, Sales/Assets, Return on Capital Employed (ROCE) and Free Cash Flow/Operating Cash Flow are included.

5. Methodology

5.1 Background

Following the methodology of Babenko et al. (2012), this study performs an event study with the aim of capturing abnormal returns to share repurchase announcements. While following much of the model specification and analysis in Babenko et al. (2012) we diverge slightly by adding additional robustness tests.

5.2 Statistical T-tests

In line with the methodology set by Babenko et al. (2012), we conduct a t-test to compare the mean of the abnormal returns around share repurchase announcements pre-Covid-19 (control) and during Covid-19 (treatment). We are using Welch's t-test, which is commonly used for testing if the means of two populations are equal when the sample sizes and variations are different. The t-test is executed by calculating the t statistic based on information from Newbold et al. (2013), where x is the sample mean of the treatment period, y the sample mean of the control period, s the sample variance and n is the number of observations in the sample.

$$t = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{s_x^2}{n_x} + \frac{s_y^2}{n_y}}} \qquad (2)$$

We can analyze the significance level of each t-test by calculating the probability value (p-value). The p-value gives us the smallest significance level where the null hypothesis can be rejected. First, we make a t-test for all share repurchase announcements by comparing the control and treatment period. As stated in our hypothesis section, we expect higher abnormal returns during Covid-19 compared to our control period. Therefore, we will perform a one-sided t-test with the following null and alternative

hypotheses, where R_c (R_t) represents average abnormal returns in the control period (treatment period):

$$H_0 = \overline{R}_c - \overline{R}_t > 0 \quad (3)$$

$$H_1 = \overline{R}_c - \overline{R}_t < 0 \quad (4)$$

Secondly, we perform separate t-tests for each industry to investigate if the difference in abnormal returns during Covid-19 varies across industries, which is one of our hypotheses. Since the difference in abnormal returns are expected to vary in size and direction, we will perform two-sided Welch's t-tests, with the following null and alternative hypotheses:

$$H_0 = \overline{R}_c - \overline{R}_t = 0 \quad (5)$$

$$H_1 = \overline{R}_c - \overline{R}_t \neq 0 \quad (6)$$

5.3 Time Series Regression

Following the methodology set by Babenko et al. (2012), we perform an ordinary least square (OLS) linear regression to determine correlations between the dependent variable 3-day BHAR, and the independent variables presented in section 4.4.2. However, in contrast to the execution by Babenko et al. (2012), we perform a time-series regression due to the characteristics of our data set; containing multiple firms that announce repurchases during different fiscal years. The model of the OLS regression can be expressed as follows:

$$\begin{aligned} R = {} & \beta_0 + \beta_1 \text{Covid} + \beta_2 \text{ Repurchase Program Size} + \beta_3 \text{ Share Price Run Up} + \\ & \beta_4 \text{ On Report Date} + \beta_5 \text{ Firm Size} + \beta_6 \text{ Tobin's Q} + \beta_7 \text{ Cash to Assets} + \\ & \beta_8 \text{ Insider Purchase} + \beta_9 \text{ Insider Sale} + \beta_{10} \text{ Firm with Recurring Programs} + \\ & \beta_{11} \text{ Reason: Employee Benefit Plans} + \beta_{12} \text{ Reason: Enhance Shareholder Value} + \\ & \beta_{13} \text{ Reason: General Corporate Action} + \beta_{14} \text{ Reason: Offset Dilution Effects} + \\ & \beta_{15} \text{ Reason: Undervaluation} \end{aligned} \quad (7)$$

5.4 Placebo Test

As our data span over a longer period of time, there is a risk of capturing underlying time trends in our data that are not related to Covid-19. Thereby, a placebo test is performed in order to test the robustness of the regression results.

The test is conducted by creating a subset of the announcement data, only including announcements in the control period. These are then divided into two symmetric and sequential groups based on the number of announcements, and this equal split occurs on 2018-05-08. Thereafter, the period prior to this date is labeled as the new control period, receiving a placebo dummy variable obtaining the value 0. However, the

subsequent period is labeled as the placebo period, where the placebo dummy variable received the value 1. Subsequently, the main regression model, explained in section 5.4, is employed again using this data subset. If the coefficient received for the placebo period obtains the same coefficients and significant results as during the true treatment period (Covid-19), we can conclude that we have captured unwanted effects.

5.5 Permutation Test

In order to further test the robustness of our main regression, a permutation test is performed. Specifically, the test investigates if general noise was captured in our regression by coincidence. This is particularly likely during periods when multiple significant events occur at the same time, making it nearly impossible to draw clear causal relationships between market reactions and specific events. Additionally, as abnormal returns are calculated using the 3-day BHAR surrounding the announcement, it is plausible that stock price reactions stemming from other events were captured.

The permutation test is performed by running the same regression model as in section 5.4, however only using data on share repurchases in the control period (2017-01-01 to 2020-02-04). The test randomly assigns a value (0 or 1) on the Covid-19 dummy variable for all announcements, thereby creating false Covid-19 dummy variables. Thereafter, the regression is performed hundreds of times until a close-to-normal distribution of the Covid-19 coefficient is found. If the observed coefficient for the Covid-19 dummy in our main regression is outside or in the tails of this normal distribution, we can conclude that our findings do not capture noise.

5.6 Fixed Effects Regression

The main regression performed in section 5.4 does not consider heterogeneity across industries and companies. However, if neglecting to control for fixed effects, there is an increased risk of omitted variable biased. Thereby, to further address the robustness of our results, we employ a fixed effects regression for both industry- and firm-fixed effects.

Due to the panel data outline, the regression can only be performed on a subset of our data, namely entities repurchasing in both the control and treatment period. This represents 41.7% of the companies repurchasing shares during Covid-19. Since companies in this data subset by definition announce repurchases frequently, it should however be noted that literature has found that firms with recurring announcements generate lower abnormal announcement returns (Andriosopoulos and Lasfer, 2015). Moreover, the regression model is identical to our main regression described in section 5.4, except for removing the independent variable Recurring Announcements since all firms in this sample will be considered recurring firms, according to the definition in the section 4.4.2.4.

5.7 Probit Regression

To establish a causal relationship between Covid-19 and abnormal announcement returns, it is crucial to study if firms with different types of characteristics repurchased shares

during Covid-19 compared to the control period. Hence, a probit regression is employed, studying the likelihood of announcing share repurchases based on certain firm characteristics, described in section 4.5.1. Separate panel probit regressions are conducted for each period (control and treatment).

This is particularly interesting to investigate due to the low overlap in firms repurchasing in both periods, restrictions on share repurchases placed on firms receiving financial aid (U.S Department of the Treasury, 2022), and the pro-cyclical characteristics of buybacks (Lintner, 1956). If significant distinctions are found, it would neglect the effect of Covid-19 and rather imply that differences in abnormal returns stemmed from variations in firm characteristics.

The model of the probit regression is as follows:

$$\begin{aligned} R = {} & \beta_0 + \beta_1 \text{Firm Size} + \beta_2 \text{ Tobin}'\text{sQ} + \beta_3 \frac{\text{Cash}}{\text{Assets}} \\ & + \beta_4 \frac{\text{Debt}}{\text{Assets}} + \beta_5 \text{ Dividend Payout Ratio} + \beta_6 \text{Current Ratio} + \beta_7 \text{ ROCE} \\ & + \beta_8 \frac{\text{Free Cash Flow}}{\text{Operating Cash Flow}} \end{aligned} \tag{8}$$

6. Empirical Results

6.1 Results

6.1.1 Statistical T-Tests

Table 2. T-Test Results for All Announcements

Change in Return
1.04%***

The table presents the results a one-sided Welch's t-test for all share repruchase announcements in our sample. The value presented is the difference in average abnormal returns between the control and treatment period. A positive value means that the average abnormal returns during Covid-19 was higher compared to the control group. The test is conducted on the data presented in section 4. Values with a significance level at 10% are bolded.
*** p-value<0.01, ** p-value<0.05, * p-value<0.1

Table 2 presents the results of Welch's t-test, testing the difference in 3-day BHAR following share repurchase announcements. The test results show a highly significant increase in average abnormal returns of 1.04%, at a p-value<0.01. Consequently, this finding is in line with our hypothesis that share price reactions to share buybacks will be higher during Covid-19, compared to the pre-Covid-19 period.

Table 3. Industry T-Test Results

Industry	Change in Return
Agriculture, Forestry, & Fishing	0.67%
Construction	-0.98%
Finance, Insurance, & Real Estate	**0.82%****
High-Tech	**1.76%***
Manufacturing (Excluding High-Tech)	0.48%
Mining	-3.06%
Retail Trade	0.02%
Services (Excluding High-Tech)	**3.56%****
Transportation & Public Utilities	0.78%
Wholesale Trade	**12.03%*****

The table presents the results from two-sided Welch's t-tests for each industry found in our sample (based on SIC codes). High-tech industry is defined by the SIC codes 3571, 3572, 3575, 3578, 3671, 3672, 3674–3677, 3661, 3678, 3679, 3875, 7371–7376, and 7379. The values presented are the difference in average returns between the control and treatment period. A positive value means that the average abnormal returns during Covid-19 was higher compared to the control group. The test is conducted on the data presented in section 6.1. Values with a significance level at 10% are bolded.
*** p-value<0.01, ** p-value<0.05, * p-value<0.1

Table 3 presents the results from the t-tests performed on different industries. The test results for three industries showed significant results. Finance, insurance and real estate showed 0.82% higher abnormal returns during Covid-19, at a significance level of 5%. This is slightly below the difference on an aggregate level, found in the t-test in table 2. At the same significance level, services, in line with our hypothesis show an increase in average abnormal returns of 3.56%. Wholesale trade obtained 12.03% higher average abnormal returns during Covid-19 at a significance level of 1%. Even though this is in line with our hypothesis, it is slightly surprising that the increase is immensely higher than the increase in average abnormal returns on an aggregate level. The industry high-tech had on average 1.76% higher abnormal returns during Covid-19, which is also higher than shown on an aggregate level but only at a significance level of 10%. The rest of the industries showed no significant results with high p-values. The results of these t-tests indicate that the magnitude of the impact Covid-19 had on abnormal returns varies across industries.

6.1.2 Time-Series Regression

Table 4. Regression Results

	Dependent Variable:
	Abnormal Returns
Covid-19 (Yes)	**1.3%*** **
	(0.4%)
Repurchase Program Size (%)	-0.0%
	(0.0%)
Share Price Run-Up	**-4.7%*** **
	(1.5%)
On Report Date (Yes)	**0.7%***
	(0.4%)
Firm Size	**-1.1%*** **
	(0.2%)
Tobin's Q	**-0.0%** **
	(0.0%)
Cash/Assets	0.7%
	(1.7%)
Insider Purchase (%)	15.6%
	(25.3%)
Insider Sale (%)	10.5%
	(7.3%)
Firm with Recurring Programs (Yes)	0.6%
	(0.4%)
Reason: Employee Benefit Plans	**6.4%***
	(3.5%)
Reason: Enhance Shareholder Value	**2.5%** **
	(1.3%)
Reason: General Corporate Action	1.4%
	(1.2%)
Reason: Offset Dilution Effects	-1.9%
	(3.9%)
Reason: Undervaluation	5.0%
	(3.5%)
Constant	**9.8%*** **
	(2.4%)
Observations	1,493
R^2	0.045
Adjusted R^2	0.036

The table presents the results of the regression on all share repurchase announcements studied, both in the control and treatment period. Dependant variable is the 3-day BHAR in percent. Bolded values are significant at $\alpha<0.1$ and standard errors are shown in paranthesis.
*** p-value<0.01, **p-value<0.05, *p-value<0.1

Table 4 presents the outcome of the OLS regression performed on all share repurchases in the control and treatment periods. The results on the 3-day BHAR illustrate that the dependent Covid-19 dummy had a positive effect of 1.3% on abnormal returns with a significance level of 1%. Five of the independent variables included also show a significant correlation with abnormal returns. Share Price Run-Up has a relatively high correlation with abnormal returns, with a negative coefficient of -4.7% at the significance level of 1%. Firm Size is also negatively correlated with abnormal returns, though with a smaller coefficient of -1.1% at a significance level of 1%. In addition, the variables for stated reason, namely Reason: Enhance Shareholder Value and Reason: Employee Benefit Plans obtained significant results at a p-value<0.05 and p-value<0.1, respectively. The last independent variable with significant results is variable Tobin's Q, surprisingly with a coefficient of -0.0% at a significance level of 5%.

Moreover, the low R^2 value is expected since our model aims to capture only the incremental effect Covid-19 had on abnormal returns and not the total explanations for abnormal returns overall. We also perform a Breusch-Pagan test for heteroscedasticity, since it is one of the main assumptions in the OLS regression and find that we can reject the null hypothesis that residuals are homoscedastic. This means that the OLS regression is not the most efficient method for our model data. Although this does not mean that the coefficients in our model are biased, it can affect the standard errors presented which can result in biased inference. This can therefore limit the conclusions that can be drawn from the results.

Table 5. Heteroscedasticity Test

	Statistic
Regression	**99.58*** **

The table presents the result of a Breusch-Pagan heteroscedasticity test the regression model in table 5. Bold value means statistical significance at α<0.1.
*** p-value<0.01, **p-value<0.05, *p-value<0.1

6.1.3 Placebo Test

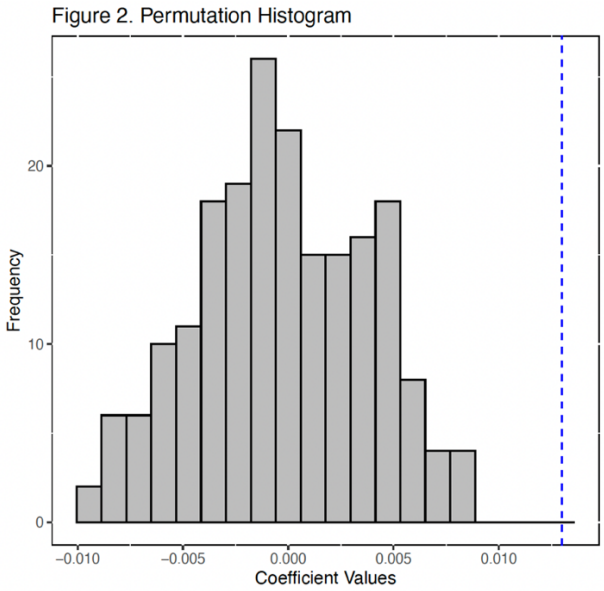
In line with the reasoning in 5.4, we perform a placebo test to determine if the time-series regression, described in section 5.3, potentially could have captured any overarching time trends, distorting our findings. Thereby, we would preferably obtain insignificant results for the placebo variable, since this implies that no general time trends were captured. As seen in table 6, the placebo variable was not statistically significant, receiving a positive coefficient of 0.5%, further strengthening the results in our main regression.

Table 6. Placebo Regression Results

Dependent Variable: Abnormal Return		
	Placebo	Covid-19
Placebo/Covid-19 (Yes)	0.5%	**1.3%*** **
	(0.4%)	(0.4%)
Repurchase Program Size (%)	-0.0%	-0.0%
	(0.0%)	(0.0%)
Share Price Run-Up	**-3.9%***	**-4.7%*** **
	(2.2%)	(1.5%)
On Report Date (Yes)	**1.0%** **	**0.7%***
	(0.4%)	(0.4%)
Firm Size	**-0.5%***	**-1.1%*** **
	(0.3%)	(0.2%)
Tobin's Q	-0.0%	**-0.0%** **
	(0.0%)	(0.0%)
Cash/Assets	0.8%	0.7%
	(2.2%)	(1.7%)
Insider Purchase (%)	-5.0%	15.6%
	(28.3%)	(25.3%)
Insider Sale (%)	3.7%	10.5%
	(7.5%)	(7.3%)
Firm with Recurring Programs (Yes)	0.7%	0.6%
	(0.5%)	(0.4%)
Reason: Employee Benefit Plans	**7.1%***	**6.4%***
	(3.8%)	(3.5%)
Reason: Enhance Shareholder Value	2.3%	**2.5%** **
	(2.0%)	(1.3%)
Reason: General Corporate Action	0.8%	1.4%
	(2.0%)	(1.2%)
Reason: Offset Dilution Effects		-1.9%
		(3.9%)
Reason: Undervaluation	2.5%	5.0%
	(4.5%)	(3.5%)
Constant	4.1%	**9.8%*** **
	(3.2%)	(2.4%)
Observations	876	1,493
R^2	0.028	0.045
Adjusted R^2	0.012	0.036

Column 1 presents the results of the regression on all share repurchase announcements studied in the control, with a placebo variable for Covid-19. Column 2 shows the same results as in table 5 for comparison. Dependant variable is the 3-day BHAR in percent. Bolded values are significant at $\alpha<0.1$ and standard errors are shown in paranthesis. There was no data on the variable "Reason: Offset Dilution Effects" during the placebo period.
*** p-value<0.01, **p-value<0.05, *p-value<0.1"

6.1.4 Permutation Test



To further examine the robustness of the regression results, we perform a permutation test. The test is performed by randomizing the binary value of the Covid-19 dummy for each announcement. This is performed 100 times and plotted in a histogram to see the close-to-normal distribution. The x-axis is the coefficient values from each regression and the y-axis is the number of times each value was observed. Since the Covid-19 coefficient in our main OLS regression, with the value of 1.3%, is outside the tail, we can conclude that our model has not captured random noise. This is illustrated with the blue dotted line in Figure 2. Furthermore, this finding adds to the robustness of our findings and strengthens the conclusion that Covid-19 had an effect on abnormal returns.

6.1.5 Fixed Effects Regression

Since the OLS regression model does not consider heterogeneity across entities, we run a separate regression to control for this. As mentioned in section 5.6, this is done by adding fixed effects in a separate regression for all companies that made a repurchase in both the control and treatment period. Initially, we run the panel regression without any fixed effects to control that the Covid-19 effect on abnormal returns is still present. Then, we add industry fixed effects to the same model and compare. As indicated in the t-tests for industries, Covid-19 might have affected industries differently. Furthermore, we make a third regression with firm fixed effects. Lastly, we include a new version of the regression with firm fixed effects, where all firm-specific variables have been removed.

Table 7. Fixed Effect Panel Regression Results

Dependent Variable: Abnormal Return				
	Without FE	Industry FE	Firm FE	Firm FE (short)
Covid-19 (Yes)	**0.9%****	**0.9%***	0.1%	0.2%
	(0.5%)	(0.5%)	(0.6%)	(0.4%)
Repurchase Program Size (%)	**13.0%*****	**15.2%*****	10.1%	**10.7%***
	(4.5%)	(4.6%)	(6.1%)	(6.2%)
Share Price Run-Up	**-5.8%*****	**-5.7%*****	-3.0%	-3.4%
	(2.2%)	(2.2%)	(2.4%)	(2.4%)
On Report Date (Yes)	0.8%	0.8%	0.3%	0.5%
	(0.5%)	(0.5%)	(0.6%)	
Firm Size	**-1.2%*****	**-1.2%*****	0.3%	
	(0.3%)	(0.3%)	(2.9%)	
Tobin's Q	**-0.1%****	**-0.04%****	**-0.1%****	
	(0.0%)	(0.0%)	(0.0%)	
Cash/Assets	1.1%	1.3%	7.3%	
	(3.1%)	(3.2%)	(6.0%)	
Insider Purchase (%)	-21.5%	-14.5%	6.7%	5.2%
	(61.5%)	(61.7%)	(64.4%)	(66.3%)
Insider Sale (%)	-0.8%	0.3%	**64.2%*****	29.1%
	(9.6%)	(9.7%)	(22.7%)	(20.7%)
Reason: Employee Benefit Plans	-0.2%	-0.5%	-0.3%	-0.3%
	(6.1%)	(6.1%)	(7.3%)	(7.5%)
Reason: Enhance Shareholder Value	2.3%	2.0%	1.6%	1.7%
	(1.9%)	(1.9%)	(2.1%)	(2.1%)
Reason: General Corporate Action	0.8%	0.6%	1.1%	1.2%
	(1.9%)	(1.9%)	(2.1%)	(2.1%)
Reason: Offset Dilution Effects	-3.5%	-4.5%	-0.1%	0.1%
	(4.1%)	(4.2%)	(4.5%)	(4.6%)
Reason: Undervaluation	0.4%	-0.3%	1.8%	1.4%
	(5.8%)	(5.9%)	(7.1%)	(7.3%)
Observations	662	662	662	680
R^2	0.082	0.080	0.056	0.020
Adjusted R^2	0.062	0.048	-0.526	-0.558

The table presents the results of panel regressions on all share repurchase announcements made by companies that announced in both the control and treatment period. The variables are the same as in the regression presented in table 5 but excludes the variable "Firm with Recurring Programs (Yes)" since this applies to all companies in this sample. Column 1 shows the result without fixed effects. Column 2 includes industry fixed effects and column 3 includes firm fixed effects. Column 4 includes firm fixed effects but excludes firm-specific control variables (*Firm Size, Tobin's Q and Cash/Assets*). Dependant variable in all regressions is the 3-day BHAR in percent. Bolded values are significant at $\alpha<0.1$ and standard errors are shown in paranthesis.
*** p-value<0.01, **p-value<0.05, *p-value<0.1

Based on table 7, column 1 with fixed-effects illustrates that the Covid-19 coefficient is significant and in line with the findings in the main OLS regression. However, it has a slightly lower correlation with abnormal returns at 0.9%, instead of 1.3%. In addition, the significance level is 5% instead of 1%, which potentially could be explained by the smaller sample size. When adding industry fixed effects, the Covid-19 variable is no longer significant. Similarly, when solely adding firm fixed effects, the coefficient does not obtain statistical significance and slightly increases to 0.1%. Consequently, when including both industry- and firm-fixed effects, the Covid-19 variable is no longer significant. This indicates that there are industry and firm fixed variables that are not observed and controlled for in the main regression, which can explain the increase in abnormal returns.

Since the fixed effects control for unobserved firm-specific variables that are constant over time, we perform a second regression for firm fixed effects but exclude the

firm-specific variables Firm Size, Tobin's Q and Cash to Assets. The aim is to identify if the decrease in the Covid-19 coefficient is solely due to time-invariant unobserved heterogeneity, or the combination with added firm-specific control variables. The results are presented in column 4 and we find that the Covid-19 coefficient is 0.2% with firm fixed effects and without firm-specific control variables. While the coefficient is not significant, it is higher than in the combined version presented in column 3.

6.1.6 Probit Regression

Table 8. Probit Regression Results

Dependent Variable: Repurchase Announcement (Yes/No)		
	Pre-Covid-19 (Control)	Covid-19 (Treatment)
Cash/Assets	6.2%	5.8%
	(21.4%)	(5.5%)
Current Ratio	**-2.9%****	**0.3%***
	(1.4%)	(0.2%)
Debt/Assets	2.9%	2.2%
	(13.2%)	(3.8%)
Dividend Payout Ratio	-0.1%	**-0.1%****
	(0.6%)	(0.1%)
Firm Size	**38.7%*****	**-25.8%*****
	(3.7%)	(5.1%)
Free Cash Flow/Operating Cash Flow	**4.5%***	-0.0%
	(2.5%)	(0.0%)
Market/Book	0.0%	-0.0%
	(0.0%)	(0.0%)
Return on Capital Employed	1.6%	-0.0%
	(1.4%)	(0.3%)
Sales/Assets	**8.1%****	**-11.3%*****
	(3.5%)	(3.4%)

The table presents the results of two panel probit regressions on all companies listed on NYSE or Nasdaq. The binary dependent variable takes the value 1 if a firm did a share repruchase announcement during the year and o if they did not. Column 1 shows the results of the probit regression for the control period and column 2 for the treatment period. Bolded values are significant at $\alpha<0.1$ and standard errors are shown in paranthesis.
*** p-value<0.01, **p-value<0.05, *p-value<0.1

In line with the reasoning in section 5.8, we perform a probit regression to identify how company characteristics correlated with the decision to repurchase, and how this differs between the control and treatment periods. To compare the difference, a panel probit regression is conducted separately for the control and treatment period. The variables are in line with the reasoning in section 4.7.1.

Table 8 presents the results from the probit model. Firm size is strongly negatively correlated with share repurchase announcements during Covid-19, obtaining a coefficient of -25.8% and a p-value<0.01. This implies that during Covid-19, smaller firms were more likely to announce a share repurchase. However, opposite significant results are found for the control period, indicating that large firms were more prone to repurchase shares. Dividend payout ratio had the same coefficient in both periods, but it was only significant during Covid-19. This shows that for each unit increased in dividend payout ratio, the likelihood of share repurchase announcement decreased. The variable Sales/Assets was significant in both periods but showed contrasting effects. In the control period, companies with higher Sales/Assets were more inclined to announce, while they were less likely to do so during Covid-19. Lastly, pre-Covid-19, the current ratio showed a negative effect on the likelihood of announcement, with a significance level of 5%. However, current ratio showed opposite effects during Covid-19, but only with a significance level of 10%.

7. Discussion

7.1 Implications of Abnormal Returns Following Share Repurchase Announcements during Covid-19

The findings from the t-test on abnormal returns had a statistically significant correlation with abnormal returns of 1.04% at a p-value<0.01, in line with our hypothesis. The time-series regression performed on abnormal returns obtained a positive correlation with abnormal returns of 1.3%, at a significance level of 1%. Hence, this finding, combined with the t-test, illustrates that abnormal returns were obtained following share repurchase announcements during Covid-19. This finding thereby confirms our hypothesis and contributes to literature studying firm-specific announcements during times of uncertainty (e.g., Schmalz and Zhuk, 2019; Anolick et al., 2021).

The regression results also showed that Tobin's Q correlated slightly negatively to abnormal returns with a coefficient of -0.0%, at a significance level of 5%. While the coefficient is quite small, this finding is largely in line with prominent repurchase literature stating that one of the main objectives of share repurchases is to signal undervaluation (Vermaelen, 1981; Dittmar, 2000).

Additional highly significant independent variables (p-value<0.01) included Share Price Run-Up and Firm Size, which both had a negative correlation with abnormal returns. This is in line with prior literature, stating that a weak stock price performance prior to announcements results in higher positive market reactions following the announcements (Schultz, 2003; Stephens and Weisbach, 1998; Lie and Lie, 1999). Likewise, previous studies have found a negative relationship between firm size and information asymmetry, and that smaller firms experience higher abnormal returns following announcements (Vermaelen, 1981; Ikenberry et al., 1995; Comment and Jarell, 1991).

Lastly, the stated Reason: Enhance Shareholder Value correlated with abnormal returns by 6.4%, obtaining significant results at a p-value<0.05. While no prior literature elaborates on the motive to enhance shareholder value, it seems plausible that the market reacts positively to the statement. In addition to this, the independent variable Report on Announcement Day positively correlated with abnormal returns with 0.7%, at a slightly low significance level (p-value<0.1).

7.2 Causality

While the findings in the t-test and time-series regression are at the highest significance level (p-value<0.01), these cannot identify causality. Thus, further tests are required in order to draw informed conclusions regarding if Covid-19 gave rise to increased abnormal announcement returns. Thereby, we aim to capture if the abnormal returns were a consequence of general time trends and noise, omitted variable bias or selection bias.

To begin with, the placebo test did not indicate that the abnormal returns during Covid-19 stemmed from capturing general time trends or noise. By the same token, the permutation test showed that the probability that our results had captured random noise is very small as the Covid-19 coefficient was outside the tail of the close-to-normal distribution of the results from all randomized regressions. Thus, the findings from the placebo and permutation tests provide a strong indication that we did not capture general time trends or random noise.

In addition, various industries have inherent differences in terms of performance and risk. When employing a t-test on industries, we find that some industries obtain abnormal returns during Covid-19, namely wholesale trade, services, high-tech and finance, insurance and real estate. This was partly in line with our hypothesis. Further, the t-test acknowledged that differences in industries impact abnormal returns. Since this could potentially explain our documented increase in abnormal returns during Covid-19, further tests are required to find indications of causal relationships.

Further, we run regressions with both industry-and firm-fixed effects and find indications that unobserved heterogeneity in the data can explain parts of the result. This challenges our findings in our main regression and implies that the effects on abnormal returns most likely could be explained by differences in firm- and industry characteristics However, an interesting aspect is that the fixed effects regression using panel data could, by definition, only be performed on firms that repurchased both in the control and treatment period. As our repurchasing firm sample solely overlaps with 299 firms over the control and treatment period, the fixed regression is therefore only performed on a small sample. This could slightly indicate that the results from this regression might be impacted by biases, as literature for instance states that firms repurchasing shares regularly experience lower abnormal returns post announcement, as this is already expected by the market (Andriosopoulos and Lasfer, 2015). However, the implications from this are likely small and should not be considered to largely impact the fixed effects results, especially since the variable Recurring Announcement did not receive a significant result in our main regression.

Furthermore, the probit regression found that firms with different characteristics were more likely to repurchase during Covid-19, compared to the control period. Specifically, we found that Firm Size was negatively correlated with the likelihood to repurchase, at a significance level of 1%. This is somewhat in line with the reasoning that smaller firms experience more informational asymmetry and thereby repurchase shares to convey their true value (Vermaelen, 1981). Moreover, an interesting finding is that Firm Size is significant and negatively correlated to the dependent variables in both the time-series and probit regressions. In addition, Sales/Assets was negatively correlated to repurchasing, indicating that firms with low Sales/Assets ratios were more likely to repurchase shares. Lastly, Dividend Payout Ratio also obtained a negative coefficient and high statistical significance with a p-value<0.01. This strengthens the dividend substitution hypothesis, arguing that firms substitute dividends for repurchases when no constraints are prevalent (Brav et al, 2005). Moreover, these results, combined with the finding from the fixed effects regressions, sum up to the conclusion that the observed difference in abnormal returns likely can be attributable to differences in firm characteristics.

7.3 Limitations

This study has been designed to provide robust results and mitigate risks of capturing unwanted effects, but some challenges can limit the conclusions that can be drawn. To begin with, there are inherent limitations to our data sample. Since share repurchases are associated with signaling values and management often chooses the time of announcement strategically depending on motives and general market conditions, selection biases are prevalent. In addition, companies receiving financial aid in line with the CARES Act were restricted from repurchasing shares for 12 months after they repaid the loan, or until September 2022 (U.S Department of the Treasury, 2022). The selection bias is further strengthened and confirmed by our firm fixed effects- and probit regression. Ideally, in order to avoid selection bias, repurchasing firms should be completely randomized or alternatively, firms with identical characteristics should repurchase in both the control and treatment period. In an ideal experiment, we would also study multiple Covid-19 periods in history to find patterns, eliminate one-off effects and find evidence that the results are robust. However, since Covid-19 only happened once in history, we cannot perform the test on multiple shocks and compare the results. This challenges the conclusions that can be drawn from our study.

In addition, the average abnormal stock price returns are calculated using the 3-day BHAR during the days surrounding the announcement. This is in line with prior literature, in an attempt to capture the entire effect of the announcement. While both the placebo and permutation tests indicated that we did not capture noise, there is an apparent risk in capturing unwanted effects from other events happening in the studied timeframe. An ideal experiment would solely test announcements from firms with no conflicting events that could affect stock prices, although this is nearly impossible in reality. However, one potential way of more precisely capturing the abnormal announcement

returns would be by studying intraday data. Unfortunately, data availability limits this option since the SDC database only provides the date of each repurchase announcement and not the specific time. Hence, we cannot calculate the price reaction at the time of announcement, nor determine if it was done before, during or after market opening. However, we have tried to mitigate the risk of including unwanted effects by including a control variable for all financial reports being published during the three days surrounding the share buyback announcement. Controlling for the event of financial reporting means the study excludes one of the events where most information is provided to the market. Nevertheless, other informational events can affect the price reactions, such as M&A transactions, that are not taken into account.

Further, we study abnormal returns specifically since we aim to isolate each firm's stock market performance and remove macro effects. This is done by calculating abnormal returns adjusting for market returns, defined as the stock exchange index for each company. However, as Covid-19 affected various companies and industries differently, adjusting for the aggregate market return might not be optimal. For instance, adjustments with matching portfolio returns or industry index returns could have been used instead.

To isolate the effect that the treatment variable, Covid-19, had on abnormal returns, we included 13 control variables. In order to restrict time-invariant unobserved heterogeneity, we also perform separate regressions for both industry and fixed effects. Despite these efforts, one should acknowledge the risk of omitted variable bias, that is when the model specification is not exhaustive, for instance by having missing or correlating variables. This can result in a skewed model outcome. To mitigate this risk, the model specification is thoroughly anchored in evidence from previous literature on the subject. To avoid relying on one research result only and overlooking important variables, we have used multiple research papers as a foundation for the model specification. However, since there is not a lot of research on the effects of Covid-19, there could potentially be variables specifically needed for this study that would capture the change in dynamics. For example, if media attention surrounding certain companies or share repurchase announcements had increased due to Covid-19 effects, this could have affected our results. Hence the reader should be aware of this risk.

The risk of omitted variable bias can also be applied to the probit regression. The variables included aimed to investigate what company characteristics correlated with the decision to repurchase or not and if differences in characteristics in turn can affect the abnormal returns. The model specification was mainly based on literature on share repurchase announcements, but also included variables to capture financial distress and general company characteristics. However, capturing every variable potentially correlating with share repurchase announcements, while also giving insight into differences between companies, is difficult and therefore there is a risk of omitted variable bias.

Lastly, as mentioned in the Empirical Results section, heteroscedasticity was found in our data, which indicates that ordinary least squares (OLS) regression is not the

optimal method. This is because the OLS regression assumes a constant variance of all residuals drawn from a population, also called homoscedasticity. Although the coefficient estimates remain unbiased in OLS regressions with heteroskedasticity, the standard errors can be biased, which can lead to biased inference. This means that confidence levels and hypothesis tests can be incorrect. Therefore, heteroscedasticity does not mean that the results presented in this study are invalid, but the reader should be aware of the consequences and that for example a weighted least squares (WLS) regression might have worked better in this case.

8. Concluding Remarks

8.1 Conclusion

Covid-19 was an unprecedented event that largely impacted financial markets and economies, giving rise to business disruption and global uncertainty. In this study, we investigate whether Covid-19 gave rise to higher abnormal returns following share repurchase announcements. This is primarily done by building on the methodology used by Babenko et al. (2012) in their study "The Credibility of Open Market Share Repurchase Signaling". Our main hypothesis was that Covid-19 would result in higher abnormal returns post-buyback announcements, in line with prior literature studying firm-specific announcements during uncertainty.

Our t-test illustrates that abnormal announcement returns were on average 1.04% higher during Covid-19, with p-value<0.01. The industry t-test indicated that the increased abnormal returns during Covid-19 varied across industries, and significant results were obtained for the wholesale trade, services, high-tech and finance, insurance and real estate industries. In addition, the time-series regression analysis on the dependent variable abnormal returns showed Covid-19 correlated with average abnormal returns with 1.3%, at a significance level of 1%. It also found that Firm Size and Share Price Run-Up were highly correlated with abnormal returns, at a p-value<0.01, which was in line with literature.

While the findings in the t-test and time-series regression find a relationship between Covid-19 and increased abnormal returns, these cannot identify causality and thus, further robustness tests were conducted. To determine if abnormal returns could have been derived from capturing general time trends or market noise, a placebo test and permutation test was performed and neither generated any implications for this. The placebo variable was lower and not significant, while the permutation test found the Covid-19 coefficient from our time-series regression to be outside the tails.

When running fixed effect regressions we find that the abnormal announcement returns could be explained by unobserved heterogeneity. However, it is of relevance to note that this regression was performed on a sample of our data, including firms announcing in both the control and treatment period. Hence, there is a slight possibility that these results are skewed and not applicable to the complete data set.

Knowing that unobserved heterogeneity might have had an effect on the results, we further investigated whether different types of firms repurchased shares during Covid-19 compared to the prior period, as this could explain the difference in abnormal returns. The results from the probit regression indicated that the kind of firms repurchasing shares in the two periods largely differed. Specifically, smaller firms, firms with higher lower Sales/Assets ratios or firms with lower Dividend Payout Ratios were more likely to repurchase shares during Covid-19. These findings strongly contrast the results from the control period, where larger firms, firms with higher Sales/Assets ratios and lower current ratios were more likely to repurchase shares.

The main finding from our study is that while increased abnormal returns during Covid-19 were found, we cannot draw a causal relationship between Covid-19 and abnormal returns. Combining the findings from the fixed effect regressions and the probit regressions, we conclude that the observed difference in abnormal returns was likely attributed to the fact that different types of firms chose to repurchase shares during Covid-19, compared to the control period. As a result, we cannot conclude that the observed difference in abnormal returns was caused by Covid-19. Nonetheless, it is plausible that since Covid-19 largely impacted financial markets and businesses, this could have indirectly affected which type of companies were able to repurchase shares. However, while the decision of repurchasing could have been impacted by Covid-19, we cannot draw any conclusion regarding this since we have little to no information on the true motives behind the buybacks. In order to be able to draw any conclusion regarding if Covid-19 impacted firms' decisions to repurchase, either the sample selection would need to be completely random, or multiple periods of uncertainty should be studied.

8.2 Future Research

Since Covid-19 posed an unparalleled shock to financial markets, businesses and individuals worldwide, relatively much research has been conducted on the subject during a short period of time. However, the impact of Covid-19 on share repurchases in general, and specifically on abnormal announcements returns, is still relatively unexplored. Hence, this study largely contributes to a better understanding of share buybacks in general, as well as the subsequent market reactions. However, as previously mentioned, there are limitations to our study, as well as certain areas that would be interesting to further research.

Focusing on the latter, rather than solely determining the end and the beginning of the treatment period based on the extent of government restrictions, it would be interesting to relate the abnormal returns to a specific measure that captures the level of uncertainty during the specific time of announcement. This could for instance be done by using a proxy for market uncertainty, such as a volatility index. By doing this, the specific uncertainty effect stemming from Covid-19 would be easier to isolate and relate to abnormal returns.

Yet another interesting approach would be to break down Covid-19 into further periods such as “wave 1” or “vaccinations”. By doing this, it would be possible to capture

differences in abnormal returns during the pandemic and perhaps relate them to the market sentiment at that specific time. In addition, future research could also include additional exchanges or countries in order to make valuable comparisons. Specifically, it would be of high interest to compare the abnormal announcement returns during the pandemic in two countries with very different share repurchase regulations in order to capture the impact of legislative changes.

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Appendix

Appendix A. Correlation Matrix for Time-Series Regression

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Covid-19 (Yes)	1.0000														
2. Repurchase Program Size (%)	-0.0220	1.0000													
3. Share Price Run-Up	**0.090*** **	-0.0100	1.0000												
4. Report Date (Y)	-0.0450	-0.0180	0.0300	1.0000											
5. Firm Size	-0.0320	-0.0020	**0.151*** **	**-0.055***	1.0000										
6. Tobin's Q	0.0030	-0.0100	0.0230	0.0200	-0.0220	1.0000									
7. Cash/Assets	0.0270	-0.0170	0.0010	**0.074** **	**-0.059***	**0.122*** **	1.0000								
8. Insider Purchase (%)	-0.0090	-0.0020	-0.0020	0.0080	**-0.096*** **	-0.0290	0.0230	1.0000							
9. Insider Sale (%)	-0.0360	-0.0040	-0.0430	0.0410	**-0.054***	0.0070	0.0130	**0.113*** **	1.0000						
10. Firm with Recurring Programs (Y)	-0.0170	-0.0400	**0.074** **	-0.0200	**0.209*** **	-0.0110	**0.077** **	**-0.061***	-0.0320	1.0000					
11. Reason: Employee Benefit Plans	-0.0170	-0.0020	0.0190	0.0450	-0.0010	-0.0050	0.0090	-0.0030	-0.0080	-0.0210	1.0000				
12. Reason: Enhance Shareholder Value	**-0.103*** **	-0.0080	0.0130	**-0.076** **	0.0430	0.0070	-0.0140	-0.0180	0.0040	-0.0140	-0.0180	1.0000			
13. Reason: General Corporate Action	**0.082** **	0.0090	-0.0210	0.0450	-0.0360	-0.0010	0.0140	0.0160	-0.0060	**0.053***	**-0.101*** **	**-0.881*** **	1.0000		
14. Reason: Offset Dilution Effects	**0.053***	-0.0010	0.0090	0.0310	0.0010	0.0340	0.0440	-0.0040	-0.0060	-0.0020	-0.0020	**0.082** **	**-0.076** **	1.0000	
15. Reason: Undervaluation	0.0090	-0.0010	-0.0460	-0.0100	-0.0140	**0.070** **	0.0170	0.0160	0.0210	-0.0490	-0.0030	0.0240	**-0.141*** **	-0.0020	1.0000

The table presents the results from Pearson Product-Moment Correlation test on all variables included in regression model presented in table 5. Bold values are significant at α<0.1.
*** p-value<0.01, ** p-value<0.05, * p-value<0.1

Appendix B. Correlation Matrix for Probit Regression (Control Period)

Variables	1	2	3	4	5	6	7	8	9
1. Cash/Assets	1.0000								
2. Current Ratio	**0.449*** **	1.0000							
3. Debt/Assets	**-0.343*** **	**-0.518*** **	1.0000						
4. Dividend Payout Ratio	**-0.040** **	**-0.033** **	**0.026***	1.0000					
5. Firm Size	**-0.526*** **	**-0.373*** **	**0.427*** **	**0.064*** **	1.0000				
6. Free Cash Flow/Operating Cash Flow	-0.0100	-0.0170	0.0220	0.0030	0.0240	1.0000			
7. Market/Book	**0.060*** **	0.0030	-0.0020	-0.0030	**-0.031***	0.0000	1.0000		
8. Return on Capital Employed	**-0.122*** **	**-0.033** **	**0.025***	0.0080	**0.119*** **	0.0050	0.0140	1.0000	
9.Sales/Assets	**-0.104*** **	**-0.118*** **	**-0.045*** **	-0.0020	**-0.083*** **	0.0080	0.0010	**0.042*** **	1.0000

The table presents the results from Pearson Product-Moment Correlation test on all variables included in probit regression for the control period. Bold values are significant at α<0.1.
*** p-value<0.01, ** p-value<0.05, * p-value<0.1

Appendix C. Correlation Matrix for Probit Regression (Treatment Period)

Variables	1	2	3	4	5	6	7	8	9
1. Cash/Assets	1.0000								
2. Current Ratio	**0.423*** **	1.0000							
3. Debt/Assets	**-0.434*** **	**-0.485*** **	1.0000						
4. Dividend Payout Ratio	**-0.030***	**-0.0220**	**0.028***	1.0000					
5. Firm Size	**-0.556*** **	**-0.317*** **	**0.456*** **	**0.040** **	1.0000				
6. Free Cash Flow/Operating Cash Flow	-0.0150	0.0000	0.0050	0.0000	0.0180	1.0000			
7. Market/Book	**0.029***	-0.0030	0.076***	0.063***	**-0.0140**	0.0010	1.0000		
8. Return on Capital Employed	**-0.101*** **	**-0.054*** **	**0.077*** **	0.0040	**0.094*** **	0.0000	0.0020	1.0000	
9.Sales/Assets	**-0.178*** **	**-0.186*** **	**0.074*** **	0.0030	**-0.0100**	-0.0070	0.0210	**0.094*** **	1.0000

The table presents the results from Pearson Product-Moment Correlation test on all variables included in probit regression for the treatment period. Bold values are significant at α<0.1.
*** p-value<0.01, ** p-value<0.05, * p-value<0.1