The behavior of stock prices around the ex-day during a dividend shortage ♣

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Abstract

This paper investigates the behavior of stock prices around the ex-dividend date in Europe over the period 2018-2022. In the early months of the COVID-19 pandemic in 2020, an important fraction of firms cut, suspended or reduced their dividend payments, leading to a shortage. We find that the magnitude of abnormal returns around the ex-dividend date is significantly larger during this period compared to regular times as dividend-seeking investors searched for the remaining payers. This pattern is amplified for high-yield dividends and in countries that have imposed a short-selling ban. Our results are consistent with a price pressure explanation and contrast from standard explanations derived in an efficient market framework.

JEL: G12; G14; G35

Keywords: dividend capture; price pressure; ex-dividend date; event study

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1 Introduction

"Dividends are quite important to me […] My problem is that companies cut dividends not because they couldn't pay them but because of political correctness in the current climate. That is troubling. It has real consequences." (Wigglesworth et al., 2020). Anecdotal evidence such as this is abundant as many investors, in this case, a Scottish retiree, rely on dividend streams to access stable returns and are left in distress when the stream stops flowing.

During the recent COVID-19 pandemic, many companies decided to cancel, cut or postpone dividend payments due to political pressure or fiduciary duties amid strong global economic uncertainty. Janus Henderson (2021) reports that global payouts fell by 12% in 2020 (representing a decrease of more than 200 billion USD in cash distributions). This phenomenon was especially salient in Europe. This had real consequences for investors who had to find quick fixes to a drop in steady money streams and issues implementing common dividend investment strategies.

This paper exploits this unprecedented event to examine the impact of a dividend shortage on the behavior of stock prices around the ex-dividend date. The literature has devoted much attention to the abnormal returns observed on the ex-dividend date, as the price drop is usually inferior to the amount of dividend paid (e.g., Elton and Gruber (1970), Kalay (1982)). The recent literature has widened the observation window and considers explicitly stock returns a few days before and after the ex-date. It has concluded that returns are predictable before (with significant positive abnormal returns) and after (with significant negative returns) the ex-date (e.g., Lakonishok and Vermaelen (1986)). Based on these observations, Hartzmark and Solomon (2013) document the presence of a so-called dividend-month premium as risk-

adjusted returns are positive in months when the dividend is issued. These results challenge market efficiency as there is no specific release of information about the dividend around the ex-day. Hartzmark and Solomon (2013) attribute these results to the price pressure generated by dividend-seeking investors who buy the stock to obtain some income. They could be unsophisticated investors, such as the Scottish retiree in the initial quote, or more qualified investors, such as equity mutual funds that follow dividend capture strategies to increase their dividend yield (Harris et al., 2015). Dividend capture (also known as dividend harvesting or dividend scalping) is a short-term investment technique involving the purchase of a stock just before its ex-dividend date and its sale just thereafter. This strategy allows investors to get an immediate cash payout regardless of the long-term stock price performance. Moreover, Hartzmark and Solomon (2019) also show that investors tend to consider dividends as a free source of income and ignore the associated price drop on the ex-date. This behavioral bias, called the free dividend fallacy, is likely to strengthen the demand for dividends before the ex-dividend date.

During the recent COVID-19 pandemic, firms suddenly cut, reduced, or postponed their dividend payments because of the uncertainty associated with future revenues and/or regulatory or government pressures. This led to a shortage of dividend payments in 2020, and more specifically, between March and June of that year. We find that, in 2020, 35% of European firms suspended their dividend payments, while 24% reduced the amount of dividends paid. As some investors saw their possible revenues suddenly disappear, they were forced to invest in other dividend-paying firms to obtain revenues. If the demand for dividends is constant, this situation will naturally lead to a stronger price pressure before the ex-day for the firms that continued paying dividends. This paper exploits this setting to investigate the importance of increased investors' demand for dividends to explain the price behavior around the ex-dividend date. The

sudden and unpredictable nature of the shortage allows us to isolate the impact of increased price pressure.

In this study, we investigate the effect of the dividend shortage on the behavior of stock prices around the ex-dividend date using a sample of 3,040 dividend-paying companies from 17 European countries over the period 2018-2022 and 14,059 payments. We first document a strong decrease in the number of companies paying a dividend in 2020 compared to the previous years, followed by a return to relative normality in subsequent years. Moreover, in 2020, we observe an unusual delay of about one month for companies paying a dividend. Second, we estimate cumulative abnormal returns (CAR) around the ex-dividend dates and find a price pattern during the shortage period about twice as large as in previous and subsequent years. The limited amount of dividends available has pushed investors toward remaining payers and inflated prices more than usual before the ex-date, followed by a stronger decrease thereafter. This price pressure is also observed in higher than usual volumes around the ex-date and in a stronger decline of the price after the ex-date for the stocks having experienced a higher upward pressure before the ex-date.

In additional analyses, we show that the CARs in countries that have imposed a short-selling ban during the shortage period are significantly higher before the ex-date. This result can be explained by the arbitrageurs not being able to absorb the excess demand for these stocks. We also show that investors did not rush only for high-yield dividends during the shortage period—although the CARs for these stocks are around twice higher—but were interested in any stocks paying dividends at that time. Finally, our results show that the scarcity effect still remains highly significant after controlling for liquidity and dividend yield, which both positively impact the CARs before the ex-date.

Our main contribution to the literature is to identify a setup where the impact of an imbalance between dividend supply and demand on stock prices around ex-dividend dates can be

unambiguously observed. We exploit it to show several important facts. We observe that additional price pressure during the shortage increases abnormal returns on the ex-date by 0.2% as well as cumulative abnormal returns over a 5-day window before the ex-date by 1.2%. We find that the sudden shortage of dividends creates more dividend capture than before. Investors tend to sell quickly their stocks after the ex-date during the shortage while they tended to keep the stocks in their portfolios before. This induces a -1.5% lower cumulative abnormal return over a 5-day window after the ex-date during the shortage period. This indicates that the scarcity of dividends has altered the behavior of investors. We also find that, after the shortage, investors persist to sell quickly their stocks after the ex-date since cumulative abnormal returns in 2021 and 2022 are lower by 0.6% compared to years 2018 and 2019. Finally, our research is one of the first to document ex-dividend date price behavior in several European countries in light of the recent pandemic.

This paper is structured as follows. Section 2 reviews the literature on stock price changes around ex-dates and presents the hypotheses investigated in the paper. Section 3 describes the dataset and characterizes the dividend shortage period from March to June 2020. It also provides methodological details. Section 4 presents our empirical findings, while section 5 concludes.

2. Literature review and testable hypotheses

The stock price behavior on ex-dividend days has attracted the attention of researchers since the seminal paper of Campbell and Beranek (1955). In perfect capital markets, the stock price drop should equal the amount of the dividend paid out on the ex-dividend day. Over the past fifty years, many studies have shown that this is not the case and that the ratio of price decline to dividend is consistently below one, thus generating positive returns (e.g., Elton and Gruber,

1970 or Eades et al., 1994). Over time, several reasons have been offered to explain this phenomenon without reaching a consensus.[1]

Studies investigating the behavior before and after the ex-date are less common. As no specific information is released around that date, market efficiency postulates that there should not be any abnormal price movement over that timespan. However, Lakonishok and Vermaelen (1986) document the presence of significant positive (negative) abnormal returns five days before (after) the ex-date for a large sample of US stocks over the period 1970-1981. More recently, Hartzmark and Solomon (2013) expand the observation window and consider the returns from 30 days before the ex-date until 60 days after over the period 1927-2011 in the US. They find significant positive (negative) abnormal returns before (after) the ex-dividend date. Hartzmark and Solomon (2018) and Eugster et al. (2022) find similar evidence on shorter windows for samples covering international markets. Hartzmark and Solomon (2013) investigate the performance of a simple investment strategy based on these results. It involves buying stocks in the months they are predicted to issue a dividend to take advantage of the dividend month premium. As their strategy yields positive and significant abnormal returns -as large as those of the value premium- it can be considered a new asset-pricing anomaly. Its existence has been corroborated internationally by Ainsworth and Nicholson (2014), Koo and Chae (2020), and Kreidl and Scholz (2020). Hartzmark and Solomon (2013) attribute the existence of abnormal returns around the ex-date to the price pressure generated by dividend-seeking investors. They claim that supply and demand for dividend-paying stocks are likely to

[1] Elton and Gruber (1970) propose a tax clientele effect. The stock price and ex-dividend day behavior will depend on the difference in taxation between capital gains and dividends. Later studies (e.g., Frank and Jagannathan (1998) contradict this finding as the effect appears to remain in the absence of differential tax treatments. Kalay (1982) proposes that the insufficient price drop reflects the transaction costs of arbitrageurs trading such stock. These short-term traders will generate abnormal profit through dividend capturing. Michaely and Vila (1995), in a dynamic dividend clientele model, reconcile both explanations by examining all types of traders affecting the equilibrium price on the ex-dividend day. Finally, market microstructure may also explain the existence of this phenomenon. Bali and Hite (1998) and Frank and Jagannathan (1998) show that both price discreteness and a bid-ask bounce affect the ex-dividend price drop. More recently, Paudel et al. (2022) show that an important fraction of the ex-dividend price drop can be related to investor sentiment.

shift a few days before the ex-dividend day as some investors buy the stock to capture the dividend. This will attract arbitrageurs who will profit from offsetting price movements due to this dividend-motivated trading. Stock prices should increase if a demand overhang exists, and arbitrageurs cannot counterbalance it. A strong demand for dividends can exist for several reasons. They include catering theory (Baker and Wurgler, 2004), mutual funds' investments in dividend-paying stocks before the ex-dividend date to increase their dividend yield (Harris et al., 2015), or investors' lack of attention to the stock price reduction from the cum-dividend to ex-dividend dates (Hartzmark and Solomon, 2019). Hartzmark and Solomon (2013) claim that the existence of price pressure leads to several predictions about the evolution of returns around the ex-day: (1) Returns should be related to liquidity: the less liquid securities are likely to experience greater price movements from a given level of excess buying; (2) Price pressure should be higher on days closer to the ex-date as investors are not willing to hold the stock longer than necessary. Returns closer to the ex-date should be larger than those of dates that are more distant from the ex-date; (3) Price pressure is likely to lead reversals after the ex-date either due to tax arbitrage traders unwinding their position or catering investors having a lower preference for the stock. Moreover, one should observe a negative relation between the price evolution of a given stock before and after the abnormal ex-date.

Those predictions should be observed for the same level of demand. However, the strength of demand is also variable. Hartzmark and Solomon (2013) suggest that the demand for dividends is affected by two factors. The first is the level of dividend, and the demand should increase with the amount of dividend paid as dividend-seeking investors will prefer stocks of companies paying larger dividends, measured by the dividend yield. Therefore, those stocks should have larger abnormal returns around ex-dividend dates. The second factor affecting the demand for dividends is economic uncertainty. This is consistent with behavioral theories claiming that the dividend represents a safe payout. Therefore, the demand for dividends should be higher in

periods of aggregate uncertainty. Hartzmark and Solomon (2013) propose to quantify uncertainty with two measures: the level of the VIX index, which measures the stock market's expected future volatility, and the state of the economy, measured by periods of recessions defined by the NBER.

In this paper, we consider another situation that should create an imbalance between dividend demand and supply: a period of dividend shortage. More specifically, if a substantial fraction of listed firms decreases dividend payments and the number of dividend-seeking investors remains constant, the demand for stocks of remaining dividend-paying firms should increase. Consequently, we should observe the above-mentioned effect of price pressure with a stronger magnitude of abnormal returns. Such observations would be new evidence of the important role of price pressure generated by dividend-seeking investors on the behavior of stock prices around the ex-date. The COVID-19 pandemic offers an ideal setting to test this hypothesis as we document a large decline in dividend payments among European listed firms.

Several authors exploit the COVID-19 pandemic to develop the dividend literature. A number of papers report a drop in dividend payments in the US (Krieger et al., 2021); Pettenuzzo et al., 2023), in G-12 and G-7 countries (Ali, 2022; Ntantamis and Zhou, 2022) or China (Liang et al., 2023). Eugster et al. (2022) observe higher abnormal returns around the ex-dividend date during the COVID-19 pandemic. During the same period, Kumar et al. (2022) identify a peak in dividend sentiment, suggesting an increase in dividend demand. While most existing literature focuses on the pandemic outbreak, our paper exploits both the pandemic dividend drop and the post-pandemic dividend rebound. We define the period of shortage as March 2020-June 2020 since this corresponds to the dividend season of a large fraction of firms in Europe (note that most of them pay their dividend annually). The dividend disappearance has been the most pronounced in this period and can be considered a shortage period. We then test the different predictions regarding the impact of price pressure on returns around the ex-date.

We consider separately three periods: the shortage period and the periods before and after to investigate the impact of this change in the demand for dividends.

3 Data and methodology

3.1 Sample

European markets offer an ideal setting to examine the capturing behaviour of investors when confronted with a dividend shortage, as Europe was the most affected by dividend cuts during the year 2020 (Janus Henderson, 2021). Our sample covers all companies from 17 European countries[2] from January 2018 to December 2022. Financial and accounting data are retrieved from Refinitiv. We restrict the sample to companies traded in their own country (i.e., no cross-listings) with a minimum stock price of EUR 1.00 and a market capitalization above EUR 50 million.[3] This gives us an initial sample of 4,570 companies, covering a large portion of the total universe of publicly listed European companies. We further exclude companies that have never paid dividends over the five years and those that have distributed more than four dividends in a single year. We end up with a sample of 3,040 dividend-paying companies and 14,959 payments.

Table 1 presents the final sample by country with the distribution of the number of dividend payouts by company. The United Kingdom, Germany, Sweden and France dominate our sample in terms of the number of companies and payments, which is representative of the European market. Overall, around half of the dividends in our sample are paid on an annual basis and more than a third on a bi-annual basis. Higher payment frequencies, such as quarterly payments, appear relatively negligible in Europe.

[2] The list of countries selected for our study is based on the countries of companies included in the STOXX Europe 600 index, a leading index for Europe.

[3] We ensure that these three restrictions hold at the beginning of our sample period, just before the dividend shortage (January 2020) and at the end of our sample period.

The high number of payments in the United Kingdom is explained by a larger number of listed firms and by a higher payout frequency—as opposed to an annual payout frequency in most Continental European countries. While more than 95% of dividends are paid on an annual basis in our sample in Germany and Switzerland, this only holds for 11% of the dividends paid in the United Kingdom. There, around 75% of dividends are paid bi-annually. Bi-annual payments are also more frequent in our sample in the Netherlands, Ireland, Luxembourg, and Spain.

[Insert Table 1 here]

3.2 The dividend shortage

The COVID-19 pandemic has profoundly affected how companies were doing business. Regarding dividends, the health crisis and measures did not directly impact companies. However, the high economic uncertainty surrounding this novel type of crisis may have impacted profits and, consequently, dividends. Thus, companies decided to modify their payout policies out of fiduciary duties to be better equipped in case of a prolonged crisis with unknown consequences. At the same time, several European governments strongly discouraged or, in the case of the financial industry, outright forbade the payout of corporate profits.

For clarity, we focus on a subsample of firms with regular dividend distribution. Hence, Table 2 describes changes in dividend policy for firms that distributed a similar number of dividends per year during the two years preceding the COVID-19 pandemic—either one, two, or four dividends per year. Table 2 reports descriptive statistics on the payout behaviour of European companies over the period 2019 to 2022. Panel A compares 2020, the year the dividend shortage was especially present, to the benchmark year 2019. More than one in three companies cancelled its dividend payments in 2020. This holds for both companies with an annual and biannual payment frequency. Considering companies paying quarterly dividends, the cancellation rate drops to 7.6%. This can be explained by these companies omitting early

dividend payments when the economic uncertainty was the highest but refraining from doing so later in the year when uncertainty had eased.

Dividend payers, however, behaved differently. 27% increased the annual dividend amount in 2020, 24% decreased it, and 14% remained unchanged. It is also noticeable that a higher payment frequency led to relatively more dividend reductions. We further observe that 54% of payers did not modify their payment frequency in 2020. However, this is mitigated by results for higher frequencies for which payment reductions are more common. This can again be explained by companies omitting early payments in 2020 and keeping late payments intact. For annual payers, the decision was mainly to pay or cancel entirely instead of increasing frequencies (only 3.64%).

Next to cancelling dividends or playing around with payment frequencies, managers had a third choice of simply delaying the payment in the hope that the uncertainty would decrease the more the year advanced. Thus, we calculate the number of days the first dividend payment of 2020 was delayed compared to the first payment in 2019. For example, if in 2019, a company paid its first (and maybe only) dividend on March 1st, and in 2020, on March 31st, the payment was delayed by 31 days. The results show that, on average, companies paid their first dividend in 2020 32 days later than in 2019. This is especially true for annual payers (29 days), while bi-annual payers delayed more (43 days) and quarterly payers less (10 days).

[Insert Table 2 here]

Panel B and C perform an equivalent analysis by comparing 2021 and 2022 to the benchmark year 2019. Overall, the results show a return to relative normality for these two years. 86% to 97% of companies that paid dividends in 2019 were doing so in these two years. Over half also displayed an increase or unchanged dividend amounts, while around three out of four companies returned to the same payment frequency as in 2019. Finally, the delay in payments also strongly decreased to 5.6 and 1.8 days in 2021 and 2022, respectively.

The change in firm dividend policy is likely to be reflected at a market level. Figure 1 shows the evolution of the number of dividends paid every day in our European sample. We observe that the number of dividend payments decreased from March 2020 to July 2020.

[Insert Figure 1 here]

A finer analysis reveals this fact more clearly. Figure 2 illustrates the dividend availability in terms of the number of payments (Panel A) and amounts distributed (Panel B) per month for the full sample from 2018 to 2022. We observe a dividend season between March and June with the highest number of payments and aggregated amounts. During the pre-COVID years, nearly 50% of payments (around 60% in terms of amount) happened during this season. In 2020, however, an apparent dividend shortage occurred. During these four months, the number of payments dropped by 54.2% and the amount distributed by 51% compared to 2019. This shortage is less visible over the remainder of the year and appears to somewhat reverse in the last quarter of 2020.

[Insert Figure 2 here]

Table 3 provides more specific findings on the delay in dividend payments. The table reports the number of payments per calendar month on the sub-sample of annual dividends. This allows us to precisely track companies without worrying about companies playing around with payment frequencies, thus biasing our results. Over the years 2018 to 2022 (except for 2020), 77% to 84% of the dividend payments occur between March and June. Only a few occur before or after that period. For 2020, however, we observe a modification in this pattern and can distinguish three distinct periods. The number of payments in January and February 2020 is higher than in 2018 and 2019. However, only 56% of dividend payments occurred from March to June compared to the usual 80%. A catch-up effect and an abnormally high number of payments happen from July to December. While in normal years, only around 14.0% of payments occur during this period, in 2020, this goes up to around 37.4%. This again hints that

companies delayed their dividend payments in 2020. Finally, as before, we find evidence that the usual monthly payment distribution reverts to the pre-crisis shape in 2021 and especially in 2022.

[Insert Table 3 here]

Our findings thus far strongly indicate that 2020 was a particular year and that as companies reacted to the economic uncertainty, disruption and shortage took place, especially from March to June 2020. This affected how investors could profit from a dividend capture strategy.

3.3 Methodology

In order to examine the dividend-capturing behaviour of investors during the dividend shortage period, we use an event study methodology. To calculate abnormal returns, we use the difference in returns for stock *i* and its corresponding national stock market index *m* (as defined in Table 1). The equation is as follows:

$$AR_{i,t} = R_{i,t} - R_{m,t} \quad [1]$$

where $AR_{i,t}$ is the abnormal return of company *i* at time *t*, $R_{i,t}$ the return of company *i* at time *t*, and $R_{m,t}$ the return of the stock's corresponding national stock market index *m* at time *t*. Returns are computed from closing prices at time *t*. An exception is the price on date *0* (the ex-date) which is the opening price on that day. $R_{i,0}$ is therefore computed as the overnight return in order to closely reflect the return on the ex-day. Consequently, $R_{i,1}$ represents the return from the opening price on the ex-date until the closing price at time *t*+1. Cumulative abnormal returns (CAR) before and after the ex-dividend date are then calculated as the sum of the abnormal returns over the event window *e*. The event window is defined as the period from 10, 5, or 1 day before the ex-dividend date to the ex-dividend date (0) or from the day after the ex-dividend date (1) to 10 or 5 days after the ex-dividend date. The equation for the cumulative abnormal returns is as follows:

$$CAR_{i,t} = \sum_{t=-e}^{t=0} AR_{i,t} \quad [2a]$$

$$CAR_{i,t} = \sum_{t=1}^{t=e} AR_{i,t} \quad [2b]$$

where $CAR_{i,t,}$ is the cumulative abnormal return of company i at time t. We use a t-test to determine if the CARs are significantly different from zero. We finally run a regression analysis to investigate the factors influencing the CARs. The regression takes the following form:

$$CAR_{i,t} = \alpha_{\square} + \beta_1 shortage + \beta_2 X_{i,t} + \beta_3 country + \beta_4 industry + \varepsilon_{i,t} \quad [3]$$

where *shortage* (*post-shortage*) is a dummy variable equal to one for the shortage (post-shortage) period and zero elsewhere. The shortage period is from March to June 2020, while the post-shortage period is from July 2020 to December 2022. $X_{i,t}$ denotes a vector of control variables, including firm size (natural logarithm of the market capitalization), beta (calculated over 250 days on the respective national stock index) and the book to market ratio (defined as the book value over the market value of equity). Those three control variables proxy for the standard asset pricing factors. All specifications include country and industry fixed effects and standard errors are robust and clustered at the firm level.

4 Empirical results

4.1 Baseline results

To examine the effect the 2020 dividend shortage had on price patterns around the ex-dividend day, we split the sample into a pre-shortage, shortage and post-shortage periods, as described in Section 3.

Figure 3 illustrates the evolution of cumulated abnormal returns around ex-dividend dates for the three periods. Consistent with the price pressure hypothesis, we observe that dividend scarcity exacerbates the price pattern around the ex-dividend date. In all three periods, cumulative abnormal returns computed from five days before ex-dividend dates increase until

the ex-date and decrease after.[4] While both pre- and post-shortage periods display a close evolution and a peak at around 1%, this does not hold for the shortage period. Here, cumulative abnormal returns increase much faster and peak at a higher level of more than 2%. On ex-dividend days, cumulative abnormal returns are twice as large as for the other two periods. As fewer dividends were available to implement dividend capture strategies, investors chased the dividends of those remaining payers, pushing stock prices firmly upwards.

As expected, the abnormal returns turn negative following the ex-dividend date as investors close their dividend-capturing positions. During the pre-shortage period, abnormal returns only drop slightly and remain relatively high after five days. This is consistent with the free dividend fallacy of Hartzmark and Solomon (2019), where investors buy the stock to obtain the cash payment but then keep the stock in their portfolio. However, we observe that cumulated abnormal returns revert to similar levels for both shortage and post-shortage periods and are absorbed after five days. This discrepancy suggests a change in investors' behaviour. During the pre-shortage period, investors preferred to keep paying stocks in their portfolios. However, since the shortage period, they have tended to follow a pure dividend capture strategy and sell them immediately.

[Insert Figure 3 here]

Table 4 provides additional findings on the visual evidence. We regress the cumulated abnormal returns around ex-dividend days on several event windows ranging from 10 days before to 10 days after the event date, accounting for company characteristics associated with stock returns. Overall, Table 4 and Figure 3 provide consistent results. The constant indicates that a reference company in the pre-shortage period led to positive (negative) abnormal returns before (after) the ex-dividend day due to dividend capturing. During the shortage period, the

[4] We also examine a large event window of up to 10 days before and after ex-dividend dates. Results remain very similar with a true evolution happening only between 5 day before and after the event date.

price pressure was significantly stronger both before and after ex-dividend days. With fewer dividends available, investors rushed on the remaining payers and drove prices higher than in regular times. This result holds but at a much lower magnitude for the post-shortage period. It could be partly explained by the fact that in 2021, the number of dividends available to investors did not recover completely to the pre-shortage levels and that some companies did not pay their dividends. Investors were, therefore, more prone to follow a pure dividend capture strategy.

[Insert Table 4 here]

We also consider trading volumes to corroborate our findings on stock returns. We follow Hartzmark and Solomon (2013) and Bali and Francis (2011) and compute the abnormal volumes for stock *i* at time *t* as the trading value of stock *i* on day *t* divided by the average trading value of stock *i* over the previous 250 days.[5] Average abnormal volume is then computed as the average of all dividend-paying stocks' abnormal volumes on that day. Figure 4 shows the average abnormal volumes observed each day around the ex-dividend date.

[Insert Figure 4 here]

We observe a similar pattern for the three subperiods. Volumes are abnormally higher before the ex-date—reflecting a higher trading activity—leading to positive abnormal returns. This indicates that there is a higher demand for those stocks before the ex-date. There is some high trading activity on the ex-date, most likely as dividend capture strategies are closed, and from day +1 onwards, volumes return to normal. This evolution of trading volume is consistent with the results found in the previous literature (e.g., Bali and Francis, 2011). We observe almost identical patterns for the periods before and after the shortage. However, the shortage period has two specificities. It is characterized by higher abnormal volumes, which can be related to the higher trading activity observed worldwide during the COVID-19 pandemic (Chiah and Zhong (2020)). Second, these higher trading volumes also reflect the fact that the remaining

[5] As there are no overnight volumes, here, t=0 corresponds to the abnormal volumes at the end of the ex-date.

dividend-paying stocks were targeted by a larger number of investors. The higher volumes can explain the larger higher abnormal returns observed over the period. Another specificity is that trading volume remains at high levels after the ex-date, which is related to the previous point. Nevertheless, we also observe abnormal volumes on date +1, which could reflect a higher trading activity related to the closing of the positions of dividend capture strategies.

Dividend capture is also expected to exert abnormal upward pressure on prices leading up to the ex-dividend date and, conversely, result in a decline in the subsequent days as investors dispose of their stock. Thus, we anticipate a negative relationship between the cumulative abnormal returns before and after the ex-dividend date. The findings in Table 5 validate this relationship and are consistent with the predictions of Hartzmark and Solomon (2013) regarding the existence of price pressure. Generally, returns were significantly more pronounced in the shortage and post-shortage periods, as described in Table 4. However, above that, we find that higher cumulated abnormal returns before the event lead to a proportionally stronger response after the event. Furthermore, this relationship appears more pronounced during the shortage period, indicating a heightened intensity of dividend capture activity during such periods.

[Insert Table 5 here]

4.2 The role of arbitrageurs

Standard finance theory postulates that an excess demand related to dividend-seeking investors should attract arbitrageurs who profit from offsetting movements and absorbing this excess demand, notably by short-selling stocks in the period before the ex-date. During the initial phase of the COVID-19 pandemic, aggregate stock prices experienced a quick decline in February and March 2020. Six market authorities in Europe responded to this situation by introducing market-wide short-selling bans in the hope of stabilizing prices and reducing

volatility (Spolaore and Le Moign, 2023). The bans were simultaneously introduced by Austria, Belgium, France, Greece, Italy and Spain over the period March 18 to May 18, 2020.[6]

Since this event takes place in our shortage period, we create a dummy variable equals to one for the stocks of dividend-paying firms located in one of those six countries during the short-selling ban period. We therefore estimate equation (3) with an additional dummy for the ban. Since short-sellers are particularly useful to absorb part of the excess demand before the ex-day, we expect that their disappearance should lead to higher abnormal returns for the stocks located in those countries over that period. The results are presented in Table 6.

[Insert Table 6 here]

We observe that the CARs for the firms affected by the ban are significantly higher for the five days before the ex-date and particularly on the day before. The results for the shortage period are unaffected and remain significant. The CARs after the ex-day are not significant, but short-sellers are less important for price formation after the ex-day when investors sell their stocks. This result provides additional evidence that price pressure plays an important role as the driver of abnormal returns before the ex-day.

4.3 The effect of dividend intensity

All dividend payments are not created equal. Due to the presence of search and trading costs and the risks associated with price volatility, it is reasonable to expect that investors may choose dividend capture strategies primarily targeting securities with high dividend yields to maximize profits. For this reason, Hartzmark and Solomon (2013) posit that the level of dividends is one of the main drivers of the demand for dividends and, therefore, stronger abnormal returns should be observed for those stocks.

[6] Italy and Spain started their short-selling bans one day earlier on March 17, 2020.

In Figure 5, we test this hypothesis by splitting the sample depending on the level of dividend yield. Panel A reports cumulated abnormal returns for companies with a dividend yield of more than 3% while Panel B shows the cumulated abnormal returns of stocks of firms with a dividend yield of less than 3%.[7]

In line with the results in Figure 3, cumulated abnormal returns are always positive before ex-dividend days. However, the magnitude differs relatively strongly amongst the different groups. Regardless of dividend yields, the highest cumulated abnormal returns appear for the shortage period. Thus, not only did investors rush for high-yield dividends in this period, but any company paying dividends was of interest. However, those in the high-yield category display cumulated abnormal returns around twice as high as these are the most profitable and, thus, the most purchased stocks.

For the event windows following the ex-dividend day, it appears that, once again, stock prices drop but remain in most cases at a cumulated abnormal return level of around 1% after five days. Panel B shows that the lowest-yielding stocks were less sought after as their returns were the lowest and, in some cases, did not even allow for a positive return.

[Insert Figure 5 here]

Table 7 deepens the analysis of Figure 5. The dummy indicating observations for which the dividend yield is above 3% is highly significant and in line with the hypothesis of price pressure and preference for high dividend yield stocks. However, it is worth noting that the shortage period indicator also remains strongly significant, suggesting a dividend scarcity effect above the dividend yield effect. The interaction term between the shortage and high dividend dummies shows a moderate relationship between these two dimensions at a very narrow event window

[7] Incidentally, these cut-offs are in line with the top and bottom quartiles of the dividend yield distribution. We prefer fixed cut-offs as investors a priori do not exactly know the distribution of dividend yields. They are probably more inclined to have a certain yield in mind above which a trade is deemed interesting.

around the ex-dividend date only. This indicates that, due to the limited availability of dividends, investors displayed an interest in all companies that continued to pay dividends.

[Insert Table 7 here]

4.4 Robustness tests

One may legitimately wonder whether the scarcity effect is not explained by other factors known in the literature to drive dividend capturing, such as stock liquidity or dividend yields. We might have a sample bias across these two dimensions in the shortage period if only a specific type of company continued paying dividends. In Table 8, we run our analysis, including continuous variables for dividend yields and stock liquidity (proxied by Amihud's illiquidity measure). We find that both liquidity and dividend yield have a significant positive effect on cumulative abnormal returns before the ex-date. These results are consistent with the prediction of Hartzmark and Solomon (2013) regarding the existence of a price pressure effect. However, we find that the scarcity effect remains highly significant even after controlling for liquidity and dividend yield. This indicates that scarcity has a specific impact and that it has increased the price pressure effect around ex-dividend dates.

[Insert Table 8 here]

We also investigate if our results are sensitive to the definition of the shortage period. First, we extend the shortage period to the whole year 2020, as it can be argued that there were differences in dividend payments throughout the whole year. Second, since most dividend payments take place over the period March-June in Europe, we compare the shortage period of 2020 to the dividend payments in other years over the period March-June only. Results are presented in Table 9 and Table 10, respectively.

[Insert Tables 9 and 10 here]

In both tables, the coefficients for the shortage period are significant and have a similar magnitude to our baseline results. Therefore, we are confident that our initial findings are not caused by the way we have defined the shortage period.

Finally, in unreported results, we find that our results are similar if we: (1) compute the return on the ex-dividend date using closing prices for both the cum and ex dates (instead of overnight returns); (2) compute abnormal returns using a market model to adjust raw returns; and (3) cluster the standard errors at the firm and day levels to account for some days with clustering of events.

5 Conclusion

The assumptions of perfect capital markets and market efficiency postulate that investors are rational and fully aware of the price drop that should occur on the ex-dividend date. Since no specific information is released on ex-dates, one should not observe abnormal returns on days surrounding this date. The empirical evidence provided in this paper contributes to the literature showing that stock prices behave differently from what is expected in the standard theoretical framework.

We first identify a period where the dividends became suddenly scarce. In the period March 2020-June 2020, 35% of European firms suspended their dividend payments because of the uncertainty generated by the outbreak of the COVID-19 pandemic. This forced investors in need of dividends to purchase stock of firms that continued to pay dividends over that period. This situation increased the demand for those stocks and magnified the usual price patterns observed around the ex-date. The rush manifested not only in high-yield dividends but also in any kind of payment and translated into higher-than-normal volumes. It was also amplified in countries in which a short-selling ban was imposed. Finally, we document that the scarcity of dividends has led more investors to use dividend-capture strategies. Our evidence is consistent

with a price pressure explanation for the abnormal returns observed around the ex-date and with behavioural finance theories. Our results also provide interesting insights on the impact of regulation on stock prices. First, they show that marketwide short-selling ban have a detrimental impact on the pricing, since they induce larger abnormal returns before the ex-date. They also highlight the possible impact of a restriction on dividend payments, as did the European Central Bank in May 2020.

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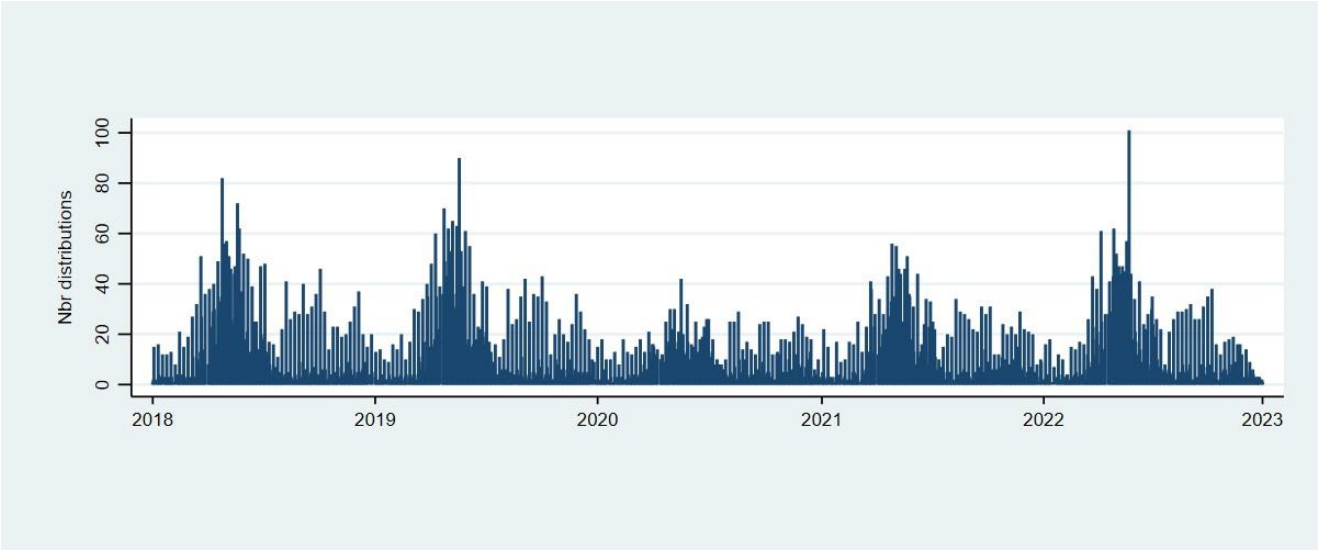
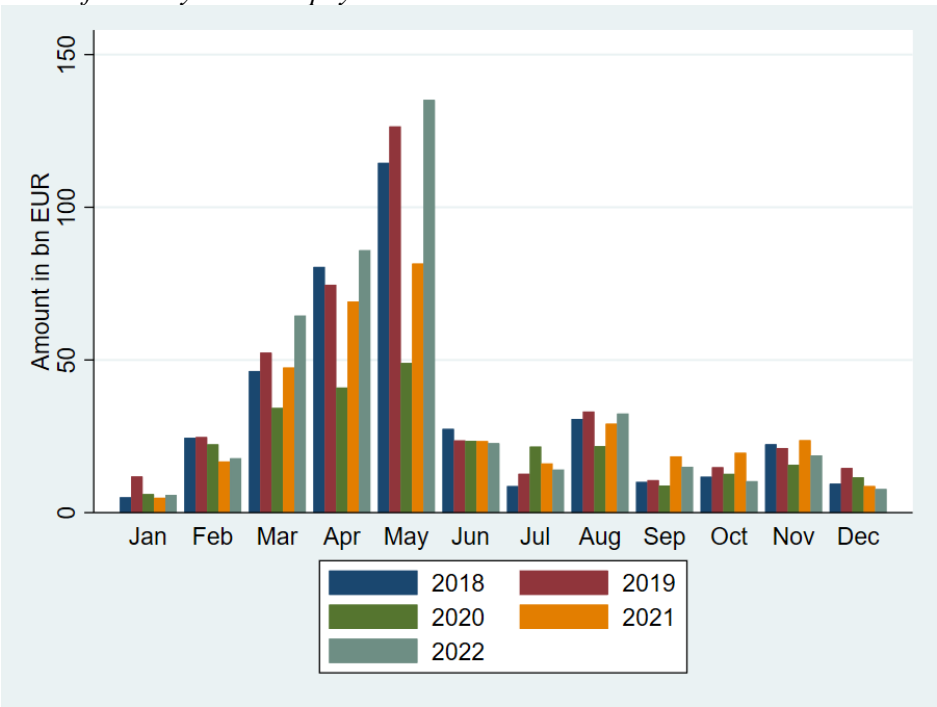
Figure 1
Daily dividend payments



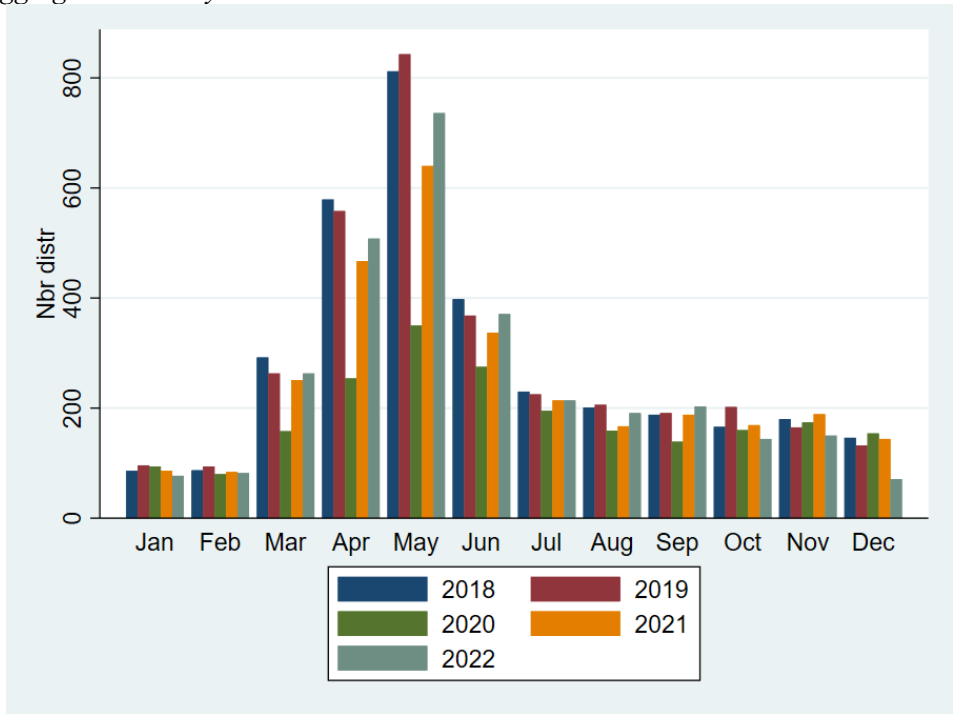
The figure reports the daily number of dividend payments from 2018 to 2022 for all sample firms.

Figure 2
Evolution of dividends by month

Panel A: number of monthly dividend payments



Panel B: aggregated monthly amount distributed



The figure reports the monthly number of dividend payments (Panel A) and the monthly aggregated euro amount of dividends paid (Panel B) from 2018 to 2022 for all sample firms.

Figure 3
Cumulated abnormal return around ex-dividend dates

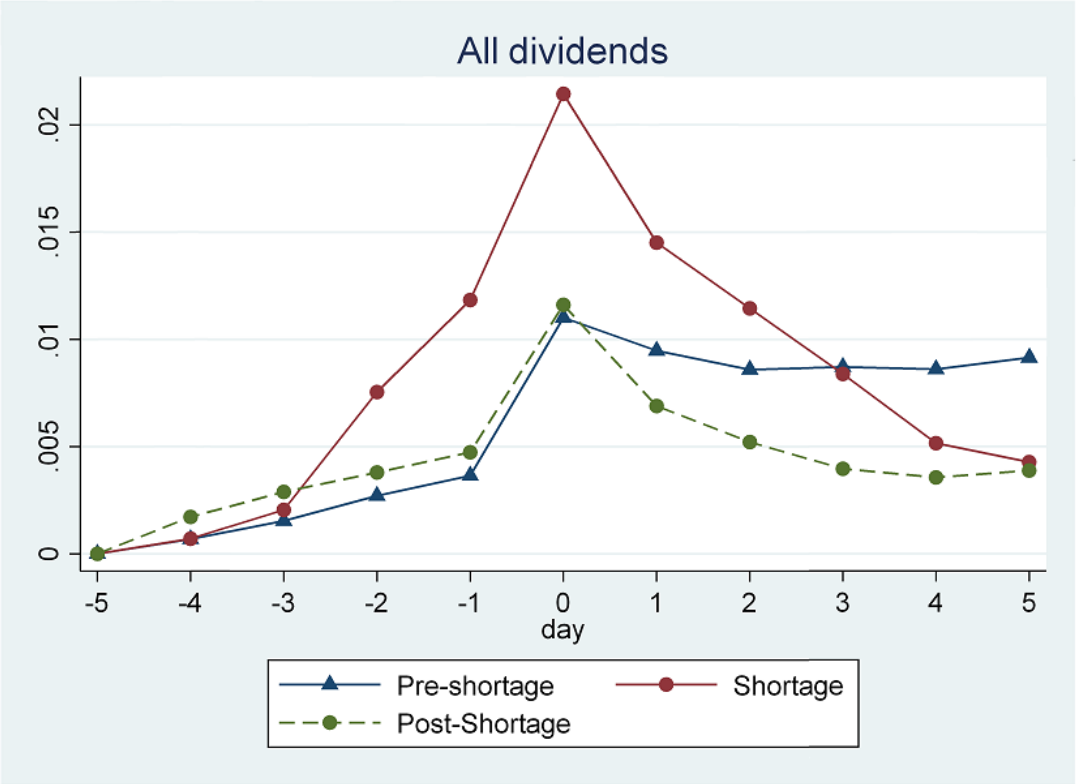


Figure 3 reports the evolution of abnormal returns from 5 days before to 5 days after ex-dividend dates for all dividends paid. The period before the shortage is from January 2018 to February 2020, the shortage period is between March and June 2020 and the post-shortage period is between July 2020 and December 2022.

Figure 4
Average abnormal volumes around ex-dividend dates

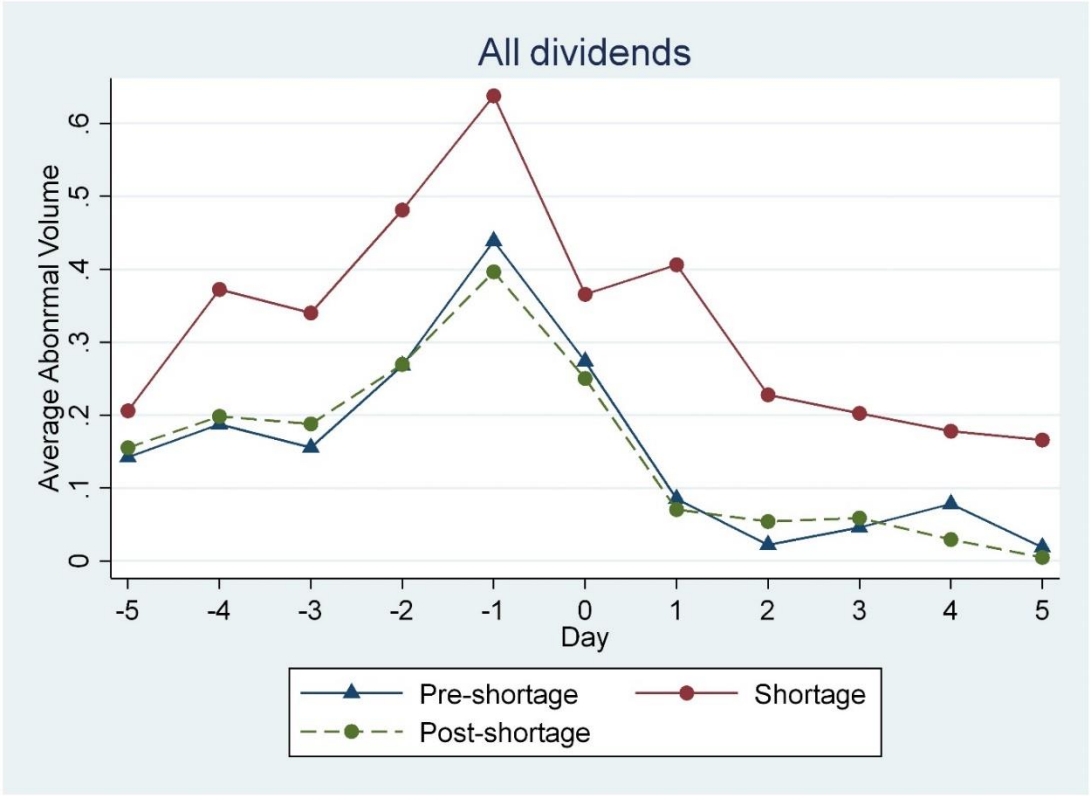
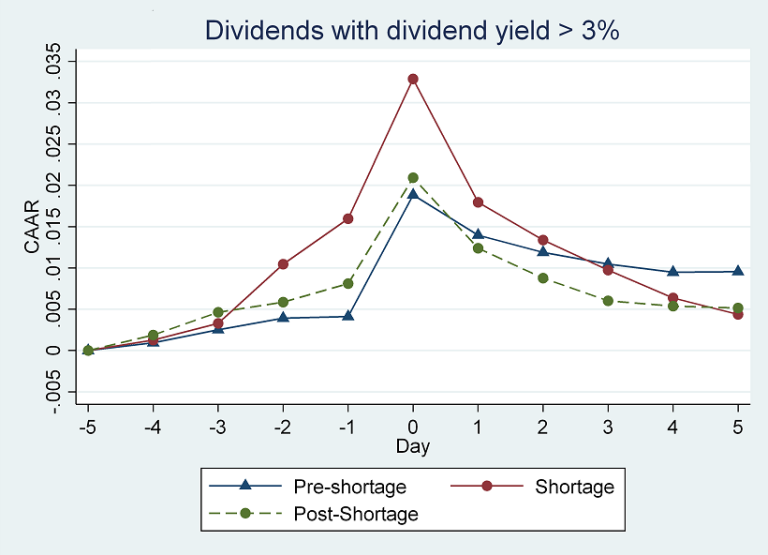


Figure 4 reports the evolution of average abnormal volumes from 5 days before to 5 days after ex-dividend dates for all dividends paid. The period before the shortage is from January 2018 to February 2020, the shortage period is between March and June 2020 and the post-shortage period is between July 2020 and December 2022. We follow Hartzmark and Solomon (2013) and Bali and Francis (2011) and compute the abnormal volumes for stock *i* at time *t* as the trading value of stock *i* on day *t* divided by the average trading value of stock *i* over the previous 250 days. Average abnormal volume is then computed as the average of all dividend-paying stocks' abnormal volumes on that day.

Figure 5
Cumulated abnormal return around ex-dividend dates by dividend intensity

Panel A: Dividend yields > 3%



Panel B: Dividend yield <3%

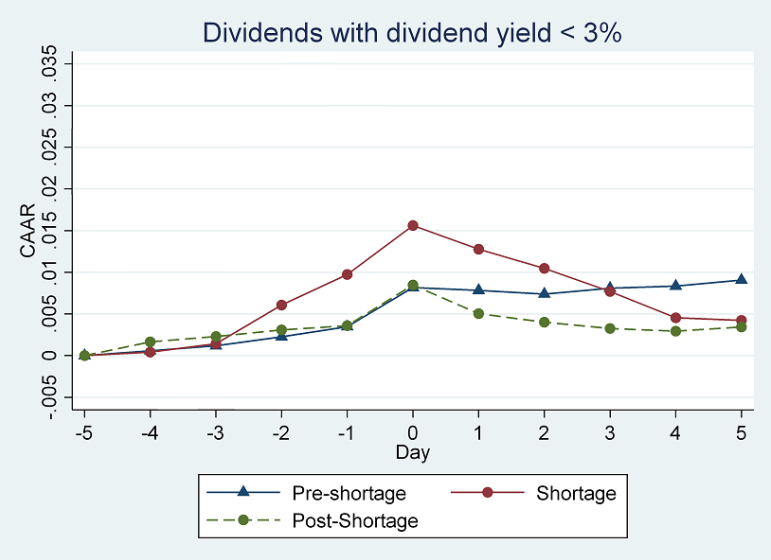


Figure 5 reports the evolution of abnormal returns from 5 days before to 5 days after ex-dividend dates. Panel A shows the cumulative abnormal returns of stocks with dividend yield larger than 3%, Panel B shows the cumulative abnormal returns of stocks with dividend yield less than 3%. The period before the shortage is from January 2018 to February 2020, the shortage period is between March and June 2020 and the post-shortage period is between July 2020 and December 2022.

Table 1
Number of payments by country

				Number of payments			
Market	Benchmark index	Firms	All	1	2	3	4+
Austria	ATX	49	189	166	10	9	4
Belgium	BEL All share	81	400	263	127	3	7
Denmark	OMX Copenhagen	87	360	274	65	6	15
Finland	OMX Helsinki	132	646	367	231	9	39
France	CAC All-tradable	351	1,410	1,142	218	6	44
Germany	XETRA Prime All-share	396	1,544	1,504	29	0	11
Ireland	ISEQ All-share	27	174	27	118	6	23
Italy	FTSE MIB	210	767	638	122	7	0
Luxembourg	Luxembourg SE General	4	20	6	14	0	0
Netherlands	AEX	79	461	165	226	10	60
Norway	Oslo SE OBX	140	756	321	189	49	197
Poland	Warsaw General Index 20	150	487	428	46	10	3
Portugal	PSI All-share	20	92	56	36	0	0
Spain	Madrid SE IGBM	118	635	181	258	80	116
Sweden	OMX Stockholm	337	1,631	888	432	78	233
Switzerland	Swiss Performance Index	215	899	870	14	3	12
United Kingdom	FTSE All-share	644	4,488	453	3,349	205	481
	Total	3,040	14,959	7,749	5,484	481	1,245

This table presents the different markets used in the study, their benchmark index, the number of dividend-paying companies, the total number of payments, and the number of payments by frequency (i.e., one, two, three, and four payments per year) for the period 2018-2022.

Table 2
Dividend payment analysis

Panel A: 2020 vs 2019				
	All	1 payment	2 payments	4 payments
Cancellation	35.23%	36.06%	35.73%	7.55%
Continuation	64.77%	63.94%	64.27%	92.45%
Dividend amount				
Increase	27.05%	27.61%	25.41%	28.30%
Unchanged	13.60%	16.76%	5.89%	5.66%
Decrease	24.12%	19.57%	32.97%	58.49%
Dividend frequency				
Increase	3.17%	3.64%	2.21%	-
Unchanged	54.00%	60.30%	37.02%	54.72%
Decrease	7.60%	-	25.05%	37.74%
Delay 1st dividend (in days)	+32.00	+29.12	+42.71	+10.45
Nb. observations	2,052	1,456	543	53
Panel B: 2021 vs 2019				
	All	1 payment	2 payments	4 payments
Cancellation	4.38%	4.00%	5.45%	4.08%
Continuation	95.62%	96.00%	94.55%	95.92%
Dividend amount				
Increase	44.74%	41.92%	36.73%	43.80%
Unchanged	9.97%	12.41%	3.76%	6.12%
Decrease	28.15%	24.96%	34.40%	53.06%
Dividend frequency				
Increase	5.13%	6.24%	2.63%	-
Unchanged	73.29%	75.88%	66.35%	73.47%
Decrease	3.49%	-	11.09%	22.45%
Delay 1st dividend (in days)	+5.56	+2.81	+12.81	+8.28
Nb. observations	2,007	1,426	532	49
Panel C: 2022 vs 2019				
	All	1 payment	2 payments	4 payments
Cancellation	13.85%	13.73%	14.99%	4.55%
Continuation	86.15%	86.27%	85.60%	95.45%
Dividend amount				
Increase	55.25%	58.45%	48.52%	31.82%
Unchanged	6.59%	8.34%	1.97%	4.55%
Decrease	24.30%	19.48%	34.52%	59.09%
Dividend frequency				
Increase	4.12%	4.53%	3.35%	-
Unchanged	79.15%	81.88%	72.19%	72.73%
Decrease	3.14%	-	10.06%	22.73%
Delay 1st dividend (in days)	+1.81	+0.50	+4.83	+8.43
Nb. observations	1,942	1391	507	44

This table exhibits results on the payout behaviour of companies. Panel A compares the base year 2019 to 2020, Panel B to 2021 and Panel C to 2022. The table reports findings for the entire sample and according to payment frequency. Cancellation and continuation denote the percentage of companies that cancelled or continued dividend payouts. The following six rows indicate the proportion of dividend payers that increased, decreased or had unchanged dividend amounts or payment frequencies. Delay 1st dividend is the average calendar-day difference between the first dividend payment in a given year and the payment of the first dividend in 2019 by company.

Table 3
Monthly dividend payments

Year	January	February	March	April	May	June	July	August	September	October	November	December
2018	11	22	140	343	519	226	114	24	21	13	19	16
2019	17	23	132	311	568	206	117	28	24	13	16	15
2020	37	31	77	154	216	173	115	60	55	63	54	64
2021	12	14	113	249	415	198	113	32	34	30	31	22
2022	11	17	124	277	480	232	116	42	31	18	16	13

This table reports the number of monthly dividend payments for firms paying one dividend per year.

Table 4
Abnormal returns during and after the shortage

	(1) CAR(-10,0)	(2) CAR(-5,0)	(3) CAR(-1,0)	(4) AR(0)	(5) AR(+1)	(6) CAR(+1,+5)	(7) CAR(+1,+10)
Shortage Period	0.014***	0.012***	0.005***	0.002***	-0.005***	-0.015***	-0.017***
	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)
Post-shortage Period	0.004***	0.002**	-0.000	-0.000	-0.003***	-0.006***	-0.008***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Beta	-0.003*	-0.003**	-0.001*	-0.001	-0.002***	-0.004***	-0.003
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Size	-0.005***	-0.004***	-0.002***	-0.002***	0.001***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Book to Market	-0.000	-0.001*	-0.000	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.055***	0.041***	0.026***	0.021***	-0.008***	-0.019***	-0.022***
	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)
Country FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Observations	14,409	14,409	14,409	14,408	14,407	14,408	14,408
R2	0.035	0.040	0.051	0.075	0.019	0.024	0.020

This table reports regression results on cumulated abnormal returns around ex-dividend dates. 0 indicates the ex-dividend day, and the other figures are the number of days before (negative) and after (positive) the ex-dividend day. Shortage period denotes March to June 2020, while the post-shortage period covers the period after June 2020. Size is the natural logarithm of the market capitalization; beta is obtained by regressing stock returns on the respective national index over a 250-day windows and book to market is the book value over the market value of a given company. All specifications include country and industry fixed effects. Standard errors are robust and clustered at the firm-level. ***, **, * show significance at the 1%, 5%, and 10% levels, respectively.

Table 5
Effect of pre ex-date abnormal returns on post ex-date abnormal returns

	(1) AR(+1)	(2) CAR(+1,+5)	(3) CAR(+1,+10)	(4) AR(+1)	(5) CAR(+1,+5)	(6) CAR(+1,+10)
CAR(-10,0)	-0.033***	-0.045***	-0.048***			
	(0.008)	(0.012)	(0.015)			
CAR(-10,0) x Shortage	-0.045*	-0.011	-0.027			
	(0.024)	(0.035)	(0.042)			
CAR(-10,0) x Post-shortage	-0.016	-0.022	-0.039*			
	(0.011)	(0.017)	(0.021)			
CAR(-5,0)				-0.052***	-0.062***	-0.075***
				(0.011)	(0.016)	(0.021)
CAR(-5,0) x Shortage				-0.089***	-0.126***	-0.151***
				(0.030)	(0.043)	(0.049)
CAR(-5,0) x Post-shortage				-0.027*	-0.036	-0.030
				(0.016)	(0.024)	(0.030)
Shortage Period	-0.003**	-0.014***	-0.016***	-0.002	-0.011***	-0.013***
	(0.001)	(0.002)	(0.003)	(0.001)	(0.002)	(0.003)
Post-shortage Period	-0.003***	-0.005***	-0.007***	-0.002***	-0.005***	-0.007***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Beta	-0.002***	-0.004***	-0.003	-0.002***	-0.004***	-0.003*
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Size	0.001***	0.002***	0.003***	0.001***	0.002***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Book to Market	0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.005***	-0.016***	-0.018***	-0.005***	-0.016***	-0.018***
	(0.001)	(0.002)	(0.003)	(0.001)	(0.002)	(0.003)
Country FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Observations	14,407	14,408	14,408	14,407	14,408	14,408
R2	0.031	0.030	0.026	0.037	0.036	0.029

This table reports regression results on cumulated abnormal returns around ex-dividend dates. 0 indicates the ex-dividend day, and the other figures are the number of days before (negative) and after (positive) the ex-dividend day. Shortage period denotes March to June 2020, while the post-shortage period covers the period after June 2020. Size is the natural logarithm of the market capitalization; beta is beta is obtained by regressing stock returns on the respective national index over a 250-day windows and book to market is the book value over the market value of a given company. All specifications include country and industry fixed effects. Standard errors are robust and clustered at the firm-level.. ***, **, * show significance at the 1%, 5%, and 10% levels, respectively.

Table 6
Abnormal returns during and after the shortage considering short-selling bans

	(1) CAR(-10,0)	(2) CAR(-5,0)	(3) CAR(-1,0)	(4) AR(0)	(5) AR(+1)	(6) CAR(+1,+5)	(7) CAR(+1,+10)
Shortage Period	0.013***	0.011***	0.004***	0.002*	-0.004***	-0.015***	-0.016***
	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)
Post-shortage Period	0.004***	0.002**	-0.000	-0.000	-0.003***	-0.006***	-0.008***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Short-selling ban	0.011	0.012**	0.008**	0.004	-0.006	0.001	-0.009
	(0.008)	(0.005)	(0.003)	(0.002)	(0.004)	(0.006)	(0.007)
Beta	-0.005***	-0.004***	-0.002***	-0.002***	0.001***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Size	-0.003*	-0.003**	-0.001*	-0.001	-0.002***	-0.004***	-0.003
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Book to Market	-0.000	-0.001*	-0.000*	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.055***	0.041***	0.026***	0.021***	-0.008***	-0.019***	-0.022***
	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)
Country FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Observations	14407	14407	14407	14407	14407	14407	14407
R2	0.035	0.041	0.052	0.075	0.019	0.024	0.020

This table reports regression results on cumulated abnormal returns around ex-dividend dates. 0 indicates the ex-dividend day, and the other figures are the number of days before (negative) and after (positive) the ex-dividend day. Shortage period denotes March to June 2020, while the post-shortage period covers the period after June 2020. Short-selling ban is a dummy equal to one for dividends of firms from Austria, Belgium, France, Greece and paying dividends over the period March 18 to May 18, 2020, and firms from Italy and Spain over the period March 17 to May 18, 2020. Size is the natural logarithm of the market capitalization; beta is obtained by regressing stock returns on the respective national index over a 250-day windows and book to market is the book value over the market value of a given company. All specifications include country and industry fixed effects. Standard errors are robust and clustered at the firm-level. ***, **, * show significance at the 1%, 5%, and 10% levels, respectively.

Table 7
Dividend intensity effect

	(1) CAR(-10,0)	(2) CAR(-5,0)	(3) CAR(-1,0)	(4) AR(0)	(5) AR(+1)	(6) CAR(+1,+5)	(7) CAR(+1,+10)
High Dividend	0.008***	0.008***	0.006***	0.007***	-0.004***	-0.009***	-0.011***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Shortage Period	0.013***	0.009***	0.003**	0.001	-0.003	-0.012***	-0.016***
	(0.004)	(0.003)	(0.001)	(0.001)	(0.002)	(0.003)	(0.003)
Post-shortage Period	0.003**	0.002*	-0.001	0.000	-0.003***	-0.006***	-0.007***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
High Dividend x Shortage	0.004	0.008*	0.005*	0.001	-0.007**	-0.006	-0.004
	(0.006)	(0.005)	(0.003)	(0.002)	(0.003)	(0.004)	(0.005)
High Dividend x Post-shortage	0.006**	0.002	0.001	-0.002**	-0.001	-0.000	-0.002
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Beta	-0.003*	-0.003**	-0.001*	-0.001	-0.002***	-0.004***	-0.003
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Size	-0.005***	-0.004***	-0.002***	-0.002***	0.001***	0.002***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Book to Market	-0.000	-0.001**	-0.000**	-0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.051***	0.037***	0.023***	0.018***	-0.006***	-0.015***	-0.017***
	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)
Country FE	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES
Observations	14,409	14,409	14,409	14,408	14,407	14,408	14,408
R2	0.039	0.047	0.061	0.097	0.025	0.032	0.026

This table reports regression results on cumulated abnormal returns around ex-dividend dates. 0 indicates the ex-dividend day, and the other figures are the number of days before (negative) and after (positive) the ex-dividend day. High dividends designates companies which pay dividend yields above 3%. Shortage period denotes March to June 2020, while the post-shortage period covers the period after June 2020. Size is calculated as the natural logarithm of the market capitalization; beta is obtained by regressing stock returns on the respective national index over a 250-day windows and book to market is the book value over the market value of a given company. All specifications include country and industry fixed effects. Standard errors are robust and clustered at the firm-level. ***, **, * show significance at the 1%, 5%, and 10% levels, respectively.

Table 8
Illiquidity and dividend level effects

	(1) CAR(-10,0)	(2) CAR(-5,0)	(3) CAR(-1,0)	(4) AR(0)	(5) AR(+1)	(6) CAR(+1,+5)	(7) CAR(+1,+10)
Shortage	0.013***	0.012***	0.004***	0.002**	-0.005***	-0.014***	-0.017***
	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)
Post-shortage	0.004***	0.002**	-0.000	-0.000	-0.003***	-0.006***	-0.007***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Dividend Yield	0.002***	0.002***	0.002***	0.002***	-0.000	-0.001***	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Stock liquidity	0.794***	0.529***	0.434***	0.223**	0.097	0.128	0.341*
	(0.213)	(0.163)	(0.102)	(0.089)	(0.095)	(0.136)	(0.194)
Beta	-0.002	-0.003*	-0.001	-0.001	-0.002**	-0.004***	-0.002
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Size	-0.004***	-0.003***	-0.002***	-0.001***	0.001***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Book to Market	-0.000	-0.001**	-0.000**	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.041***	0.030***	0.017***	0.013***	-0.007***	-0.015***	-0.022***
	(0.003)	(0.003)	(0.002)	(0.001)	(0.002)	(0.003)	(0.004)
Country FE	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES
Observations	13,881	13,881	13,881	13,880	13,879	13,880	13,880
R2	0.045	0.054	0.080	0.136	0.020	0.029	0.021

This table reports regression results on cumulated abnormal returns around ex-dividend dates. 0 indicates the ex-dividend day, and the other figures are the number of days before (negative) and after (positive) the ex-dividend day. Shortage period denotes March to June 2020, while the post-shortage period covers the period after June 2020. Dividend yield is calculated as dividends over earnings per share, and stock liquidity is the Amihud illiquidity measure defined as the absolute return of a stock on a given day divided by its volume. Size is the natural logarithm of the market capitalization; beta is obtained by regressing stock returns on the respective national index over a 250-day windows and book to market is the book value over the market value of a given company. All specifications include country and industry fixed effects. Standard errors are robust and clustered at the firm-level. ***, **, * show significance at the 1%, 5%, and 10% levels, respectively.

Table 9
Abnormal returns during and after the shortage, using the whole year 2020 as the shortage period

	(1) CAR(-10,0)	(2) CAR(-5,0)	(3) CAR(-1,0)	(4) AR(0)	(5) AR(+1)	(6) CAR(+1,+5)	(7) CAR(+1,+10)
Shortage Period	0.013***	0.009***	0.002***	0.000	-0.003***	-0.010***	-0.011***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Post-shortage Period	0.003**	0.001	-0.000	-0.000	-0.003***	-0.006***	-0.007***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Beta	-0.005***	-0.004***	-0.002***	-0.002***	0.001***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Size	-0.004*	-0.003**	-0.001*	-0.001	-0.002***	-0.004***	-0.003
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Book to Market	-0.000	-0.001*	-0.000	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.054***	0.041***	0.026***	0.021***	-0.008***	-0.019***	-0.022***
	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)
Country FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Observations	14407	14407	14407	14407	14407	14407	14407
R2	0.036	0.041	0.050	0.074	0.018	0.023	0.018

This table reports regression results on cumulated abnormal returns around ex-dividend dates. 0 indicates the ex-dividend day, and the other figures are the number of days before (negative) and after (positive) the ex-dividend day. Shortage period denotes all dividends paid in 2020, while the post-shortage period covers the period after June 2020. Size is the natural logarithm of the market capitalization; beta is obtained by regressing stock returns on the respective national index over a 250-day windows and book to market is the book value over the market value of a given company. All specifications include country and industry fixed effects. Standard errors are robust and clustered at the firm-level.. ***, **, * show significance at the 1%, 5%, and 10% levels, respectively.

Table 10
Abnormal returns during and after the shortage, using only dividends paid from March-June

	(1) CAR(-10,0)	(2) CAR(-5,0)	(3) CAR(-1,0)	(4) AR(0)	(5) AR(+1)	(6) CAR(+1,+5)	(7) CAR(+1,+10)
Shortage Period	0.012***	0.010***	0.005***	0.001**	-0.005***	-0.014***	-0.017***
	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)
Post-shortage Period	0.002	0.000	-0.001	-0.001	-0.003***	-0.006***	-0.006***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Beta	-0.006***	-0.004***	-0.003***	-0.002***	0.001***	0.003***	0.004***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Size	-0.005**	-0.003*	-0.002*	-0.000	-0.004***	-0.006***	-0.007***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Book to Market	-0.001***	-0.001***	-0.000***	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.062***	0.047***	0.029***	0.022***	-0.008***	-0.019***	-0.024***
	(0.003)	(0.003)	(0.002)	(0.001)	(0.002)	(0.003)	(0.003)
Country FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Observations	8484	8484	8484	8484	8484	8484	8484
R2	0.048	0.052	0.063	0.086	0.024	0.030	0.026

This table reports regression results on cumulated abnormal returns around ex-dividend dates. 0 indicates the ex-dividend day, and the other figures are the number of days before (negative) and after (positive) the ex-dividend day. Shortage period denotes March to June 2020, while the post-shortage period covers the period after June 2020. Size is the natural logarithm of the market capitalization; beta is obtained by regressing stock returns on the respective national index over a 250-day windows and book to market is the book value over the market value of a given company. All specifications include country and industry fixed effects. Standard errors are robust and clustered at the firm-level. ***, **, * show significance at the 1%, 5%, and 10% levels, respectively.