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# **Informational Efficiency in the Corporate Bond Market**

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**von**  
**Sonja Lisa Buschulte, M.Sc.**

Erstgutachter: Prof. Dr. Dirk Schiereck  
Zweitgutachterin: Prof. Dr. Britta Hachenberg

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## **Abstract**

This dissertation examines the informational efficiency in the corporate bond market. More precisely, it shows how new information stemming from announcements of bond-issuing firms impacts the prices of these bonds. While the equity market efficiency is well examined, historically limited data quality and the complexity of bonds leave research gaps in the corporate bond market. Composed of three studies, this dissertation uses a comprehensive sample of US corporate bond trading data to close these gaps further.

The first study examines the power of event studies in corporate bond markets and thus sets the basis for testing informational efficiency in the bond market around any event. It shows that two market phenomena negatively impact the informative value of results: Test power decreases rapidly in the presence of event-induced variance. Moreover, bond market illiquidity is problematic with samples focused on above-average maturities and credit risks.

The second study specifically tests informational efficiency around dividend announcements that imply dividend payout ratio changes. It provides insights into significant, negative reactions that bondholders exhibit and highlights the complex effects that drive these bond market reactions. Additionally, it shows the explanatory power of signaling and wealth transfer hypotheses, while the information content hypothesis is refuted.

The third study analyzes the interaction effect between earnings and dividend announcements. The results of this study suggest that a strong interaction effect is present in the corporate bond market and that it is robust across several specifications. Consequently, the interaction effect of dividend and earnings announcements has to be considered when evaluating the overall contained information for the bond market.

## Zusammenfassung

Diese Dissertation untersucht die Informationseffizienz (informational efficiency) im Markt für Unternehmensanleihen. Konkret wird gezeigt, wie neue Informationen aus Ankündigungen der Emittenten sich auf die Preise dieser Anleihen auswirken. Während die Informationseffizienz des Aktienmarktes bereits umfassend erforscht ist, bestehen im Bereich des Anleihemarktes aufgrund historisch begrenzter Datenqualität und der hohen Komplexität von Anleihen weiterhin Forschungslücken. Die vorliegende Dissertation besteht aus drei Studien und analysiert einen umfangreichen Datensatz mit Handelsdaten von US-Unternehmensanleihen, um diese Lücken zu reduzieren.

Die erste Studie untersucht die Teststärke von Ereignisstudien auf dem Markt für Unternehmensanleihen. Damit legt sie die methodische Grundlage für die Analyse der Informationseffizienz um verschiedene Ereignisse. Es wird aufgezeigt, dass zwei Marktfaktoren die Aussagekraft der Ergebnisse negativ beeinflussen: Die Teststärke nimmt bei ereignisinduzierter Varianz deutlich ab. Außerdem ist die Illiquidität des Anleihemarktes problematisch, insbesondere bei Datensätzen, die Anleihen mit überdurchschnittlich langen Laufzeiten und hohen Kreditrisiken umfassen.

Die zweite Studie prüft explizit die Informationseffizienz im Kontext von Ankündigungen mit Änderung der Dividendenausschüttungsquote. Sie liefert Erkenntnisse über signifikante negative Reaktionen von Anleihegläubigern und beleuchtet die komplexen Mechanismen, die diese Reaktionen beeinflussen. Darüber hinaus zeigt die Studie die Erklärungskraft der Signalisierungs- und Vermögenstransferhypothesen (signaling and wealth transfer hypotheses), während die Informationsgehalt-Hypothese (information content hypothesis) widerlegt wird.

Die dritte Studie analysiert den Interaktionseffekt zwischen Gewinn- und Dividendenankündigungen. Die Ergebnisse zeigen einen signifikanten Interaktionseffekt im Markt für Unternehmensanleihen, der über verschiedene Spezifikationen hinweg robust ist. Folglich muss der Interaktionseffekt von Gewinn- und Dividendenankündigungen berücksichtigt werden, um die Gesamtheit der enthaltenen Informationen für den Anleihemarkt adäquat bewerten zu können.

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## List of Abbreviations

ABR	Abnormal bond returns
ABSR	Abnormal standardized bond returns
ABSR-Pre	ABSR calculated with pre-event period standard deviation
ASR	Abnormal stock returns
bp	Basis points
CRSP	Center for Research in Security Prices
CAR	Cumulative abnormal returns
EBITDA	Earnings before interest, taxes, depreciation and amortization
EPS	Earnings per share
FISD	Fixed Income Securities Database
RC	Roundtrip costs
IRT	Imputed roundtrip trades
M	Million
MTN	Medium term note
NASD	National Association of Securities Dealers
OLS	Ordinary least squares
PCA	Principal component analysis
ROA	Return on assets
ROE	Return on equity
S	Sign test
SABR	Standardized abnormal bond returns
SD	Standard deviation
SL	Significance level
SR	Signed-rank test
t	t-test
TRACE	Trade Reporting and Compliance Engine
US	United States of America
USD	US dollar
vs.	Versus

# **1. Synopsis**

## **1.1 Motivation**

Understanding how competitive capital markets process (new) information is central to explaining the dynamics of investment prices. An investment market is informationally efficient if prices always reflect all publicly available information (Fama, 1970). Events such as earnings announcements introduce new information to the market, which should immediately be reflected in prices as all investors strive to exploit any information to their own advantage. As a result, abnormal returns should not persist beyond the moment of the announcement. This reflects the semi-strong form of market efficiency, which can be probed using event study methodology.

The event study methodology applies to various asset classes, including the corporate bond market, which is the focus of this dissertation. Historically, the US bond market has been among the least transparent markets (Goldstein et al., 2007). Thus, unlike the equity market, studies on the informational efficiency in the bond market are still comparatively scarce. However, understanding how new information affects the corporate bond market is crucial as bonds represent claims on the cash flows of firms, yet with different payout profiles than stocks. For bondholders, having fixed-income claims, a firm's expected future profitability and financial stability are particularly important. Hence, if events affect these factors, bondholder wealth effects may diverge from shareholder wealth effects. Consequently, studying abnormal bond returns (ABR) around events provides deeper insights into investors' perceptions of event-induced changes in firm-level risk.

Overall, this dissertation provides an extensive overview and multifaceted insights into the informational efficiency of the corporate bond market.

## **1.2 Dissertation Design**

This dissertation is organized in three self-contained chapters.

First, the chapter titled "Corporate Bond Market Event Studies: Event-Induced Variance and Liquidity" examines the power of event study methodology in corporate bond markets. I apply a simulation experiment for parametric and non-parametric tests with static and variable shocks to simulate events including noise. Furthermore, I analyze the impact of liquidity measures, bond rating and maturity on the test's statistical power. I find that under standard bond market conditions an approach using standardized abnormal returns is well specified. However, two market phenomena negatively impact the informative value of the

event study results. First, test power decreases rapidly in the presence of noise, i.e., event-induced variance. Second, illiquidity becomes a material concern when samples are geared towards above-average maturities and credit risks. The primary contribution of this chapter is to lay the foundation for effectively testing informational efficiency in bond markets by presenting a robust and powerful bond event study methodology.

Second, the chapter “The Impact of Dividend Payout Ratio Changes on Bond Market Efficiency” applies a corporate bond market event study as analyzed in the previous chapter. First, I investigate the impact of unexpected dividend payout ratio changes on the bond market. Second, I analyze the information content of dividend payout ratio changes for future earnings and profitability changes of the bond-issuing firm. By jointly conducting the analyses of the immediate bondholder reaction and the long-term impact on the firm, I evaluate the explanatory power of the signaling and wealth transfer hypotheses. Furthermore, I show that bondholders react pessimistically to dividend payout ratio changes, irrespective of the sign of the change. Moreover, I cannot confirm the signaling hypothesis since dividend payout ratio changes do not comprise information for future performance changes of the firm. This chapter contributes to bond market research by analyzing the individual informational content of dividend payout ratio changes, a more precise measure in cash flow considerations, compared to those used in earlier research.

Third, the chapter “Interaction Effect in the Corporate Bond Market” analyzes the existence of an interaction effect in the corporate bond market between earnings announcements and dividend announcements. I am the first to show that an interaction effect is present in the corporate bond market. Thus, unexpected dividend and earnings changes contain joint information for the corporate bond market. Further, I demonstrate that the interaction effect is robust across several specifications, e.g., the sequence of the announcements, their timing as well as firm characteristics. As both dividend and earnings announcements carry informational content for the corporate bond market, it is crucial to acknowledge that they hold joint information to not over- or underestimate their informational impact when evaluating the informational efficiency in the bond market. Consequently, this chapter highlights that the interaction effect must be considered when evaluating the overall contained information of these announcements for the bond market.

### **1.3 Literature Contribution**

This dissertation makes significant contributions to the corporate bond event study literature.

First, I contribute to the literature that examines the validity of the event study methodology in the corporate bond market following foundational work by Bessembinder et al. (2009) and Ederington et al. (2015). Moreover, by incorporating simulation experiments following Brown and Warner (1985), I am the first to analyze the empirical phenomena of event-induced variance in the bond market as suggested by Boehmer et al. (1991) and Marks and Musumeci (2017) for the equity market.

Second, by examining the impact of unexpected dividend payout ratio changes on the bond market, I enhance work on dividend announcements effects by Chen (2016), Tsai and Wu (2015) and Wei et al. (2020), amongst others. Additionally, analyzing the predictive power of dividend payout ratio changes for future firm performance changes I expand the work of Nissim and Ziv (2001), Grullon et al. (2002) and Grullon et al. (2005).

Finally, I provide the first robust evidence of interaction effects between dividend and earnings announcements in the corporate bond market. Previous work by Kane et al. (1984), Easton (1991) and Datta and Dhillon (1993) shows the existence of the interaction effect in the equity market. Datta and Dhillon (1993) also strive to determine it in the bond market, however, they do not reach a meaningful conclusion due to the very low number of events considered.

Overall, this dissertation investigates the informational efficiency of the corporate bond market through a detailed examination of ABR around key events. By advancing event study methodology, analyzing the informational content of dividend payout ratio changes and identifying robust interaction effects between earnings and dividend announcements, this dissertation provides a framework for more accurate assessments of informational efficiency in the corporate bond market. The findings enable researchers and practitioners to better understand how bond prices react to new information.

## 2. Corporate Bond Market Event Studies: Event-Induced Variance and Liquidity

*This chapter is based on a working paper jointly written with Dr. Lukas Mueller, Kevin Riehl and Dr. Patrick Weiss. The working paper is available online on SSRN:*

Mueller, L., Riehl, K., Buschulte, S., & Weiss, P. (2024). Corporate bond market event studies: Event-induced variance and liquidity, *SSRN Working Paper No. 4859838*. <http://dx.doi.org/10.2139/ssrn.4859838>.

### 2.1 Abstract

This study addresses the power of event studies in corporate bond markets. We find that an approach using standardized abnormal returns is well-specified under standard conditions. Overall, non-parametric test statistics achieve sufficient power beginning at 100 firm\*day observations for event-induced shocks of 15bp. However, we also identify two market phenomena negatively impacting the results' informative value. In particular, we show that test power decreases rapidly in the presence of event-induced variance. Moreover, illiquidity becomes a material concern when the samples are geared towards above-average maturities and credit risks. In addition, we provide open-source tools to implement corporate bond event studies.

### 2.2 Introduction

A common approach to measuring wealth effects in financial markets is to conduct an event study where researchers examine the residuals between realized returns and returns that are expected in the absence of the event. Naturally, any such approach is subject to the so-called joint hypothesis problem (Fama, 1970), i.e., it is empirically impossible to test whether abnormal returns truly reflect market efficiency or are the result of flawed asset pricing models and biased estimates. Yet existing research establishing event methods' viability has focused primarily on shareholder wealth as a proxy for the overall economic impact. This equity focus neglects the importance of non-equity claims on the same underlying cash flows. As bonds have payout profiles that differ from equity, the event-induced wealth effects for bondholders might be opposite to effects measured exclusively from equity markets. Therefore, studying bond returns is necessary to understand events' effects in general and provides more granular insights into investors' perceptions of the event, which can significantly alter the

overall economic inference, e.g., when firm-level risks change.

In this study, we provide a comprehensive look at suggested approaches and explore issues in event studies using US corporate bond data. While corporate bond markets are historically among the least transparent markets (Goldstein et al., 2007), data availability and quality increased dramatically with the introduction of the Trade Reporting and Compliance Engine (TRACE) system in the early 2010s. This introduction fueled growth in empirical studies on corporate bonds, but event studies are still comparatively scarce. Notably, existing studies are largely based on early TRACE data, i.e., data up to at most 2011, which put a large weight on the extreme outcomes of the financial crisis. However, the corporate bond data availability and its quality have further improved thereafter. Therefore, questions arise about the external validity of earlier results following these changes. Initially, we establish the baseline power of event studies for corporate bonds under general conditions. As a first contribution, we conduct artificial event studies with simulations using 10,000 iterations. Here, we draw from a new time period starting in 2013 to assess the validity and reliability of the existing approaches in the most recent data. We find that the test power has increased substantially vis-à-vis earlier samples (e.g., the sample used in Ederington et al., 2015). Moreover, our results suggest that for non-parametric tests and a shock of 15 basis points (bp), a minimum sample size of about 100 firm\*day observations is required to achieve sufficient test power, ceteris paribus. However, two common empirical phenomena in corporate bond markets negatively impact the power of this standard approach and have not received the necessary attention yet.

First, we find the power threshold to be sensitive to an increase in variance. On the one hand, we document that employing weekly returns, calculated as the price change between the first and the last available trading day of a week, results in lower test power despite an increase in sample size by 50%. On the other hand, extending the event window and, therefore, increasing the likelihood of contaminating returns with confounding information is not the only source of noise. It is well-documented in event studies from equity markets that certain events also increase residual variance, commonly referred to as event-induced variance (see, e.g. Boehmer et al., 1991). A key contribution of this article is to assess the power of the bond event study methodology under the presence of event-induced variance. For this purpose, instead of imposing a static shock of 15bp on abnormal returns to simulate events, we draw a random number from a normal distribution with a mean of 15bp and a standard deviation equal to the factorized standard deviation of the respective bond's return (similar to Marks & Musumeci, 2017, for equity markets). We progressively increase the

disturbance factor from zero to three and find that test power decreases rapidly with increasing event-induced variance. While standardized abnormal returns appear to be the most robust, the test power drops to about 75% when the variance is doubled.

Second, bonds are traded much less frequently than equities, and illiquidity is a major concern of empirical bond research. Bessembinder et al. (2009) acknowledge that liquidity could be a potential source of misspecification but do not address this issue further. Although there is evidence that investors favor larger issues (see, e.g., Bao et al., 2011), the issue volume per se is a fairly crude indicator of corporate bond liquidity. Against this backdrop, we stratify test power conditional on bonds' liquidity, credit rating, and maturity. We employ various liquidity measures and confirm the effect for price impact and transaction cost measures, specifically the measure  $\lambda$ , as proposed in Dick-Nielsen et al. (2012). Our results show that liquidity has a considerable impact on test power, especially when the samples are geared toward securities with higher credit risk and longer maturities. The effect, however, is most pronounced for the most illiquid bonds (i.e., the lowest liquidity quintile). We conclude that researchers may want to consider eliminating the most illiquid bonds from the sample to reduce noise and consequently improve test power.

Methodologically, this study is related to the simulation-based studies that examine the validity of the event study methodology. Brown and Warner (1985) conduct a simulation experiment in equity markets to assess the validity of asset pricing models and the probability of rejecting the true null hypothesis as well as the ability to detect abnormal performance. On the topic of variance, Boehmer et al. (1991) find that even with small increases in variance, the tests reject the true null hypothesis too often. The authors suggest standardizing abnormal returns to counter this issue. Marks and Musumeci (2017) show that the approach in Boehmer et al. (1991) is also robust to event-induced variance. Following the approaches in the equity-based literature, Bessembinder et al. (2009) conduct an initial simulation to assess the test power of studies of bond events based on daily and monthly bond returns. Subsequently, Ederington et al. (2015) propose a refinement to the existing approach. Inter alia, the study finds that standardization of abnormal returns, as it has become common practice in equity-based event studies, significantly increases reliability. This is the starting point for the research at hand. We apply the methods of Boehmer et al. (1991) and Marks and Musumeci (2017) to assess the validity and reliability of existing approaches for corporate bond event studies based on the most recent data and to evaluate their sensitivity to an increase in variance (e.g., due to retail-sized trades, illiquidity, confounding information, limited sample sizes, and event-induced variance, among others). As an additional insight

and in contrast to the common convention of excluding retail-sized transactions (i.e., trades with a total trading volume of less than USD 100,000), we recommend excluding only the most illiquid bonds from the sample instead.

Additionally, we provide an open-source implementation of the presented methodology on Github<sup>1</sup>, with detailed instructions on how to calculate various event-study-related abnormal return tables. This allows for easy replication of our work and, additionally, for a convenient utilization of the corporate bond event study methodology.

## 2.3 Data and Methodology

### 2.3.1 Sampling

Our sampling procedure is aligned with the established literature on empirical corporate bond research using TRACE data (see, e.g., Dick-Nielsen et al., 2012). We proceed with the sampling as follows: First, we select all available bonds that are eligible for our analysis based on cross-sectional data provided in the Mergent Fixed Income Securities Database (FISD) and issued after 2000. We include bonds that are senior, unsecured, non-asset-backed, and non-defeased while excluding securities with secured lease obligations or security pledges. We limit the sample to the most common bond types: US Corporate Debentures, US Corporate MTN (Medium Term Note), US Corporate MTN Zero, US Corporate Zero, and US Corporate Bank Note. We exclude bonds issued by foreign (“yankee”) and Canadian issuers. The remaining bonds are exclusively USD-denominated with fixed or zero coupon types. Bonds under Rule 144A, private placements, defaulted bonds and those with given filing dates or settlement dates are excluded. We further remove puttable bonds along with convertible, pay-in-kind, exchangeable, preferred, and perpetual bonds from the sample. This procedure yields 67,537 bonds, of which 46,355 bonds have trades reported in TRACE. We source and clean this data as outlined in Dick-Nielsen (2009).<sup>2</sup>

In addition, we apply several filters to the TRACE data to mitigate the effects of outliers and reduce potential noise. Specifically, we include only trades with a volume of minimum USD 50,000 to exclude retail-sized trades<sup>3</sup> and remove any rows containing missing values

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<sup>1</sup> [https://github.com/DerKevinRiehl/bond\\_event\\_study](https://github.com/DerKevinRiehl/bond_event_study).

<sup>2</sup> We use the code provided by Scheuch et al. (2023) to filter Mergent FISD data and clean TRACE data.

<sup>3</sup> It has become common practice to exclude trades with a trading volume of less than USD 100,000 when working with TRACE data. However, this eliminates a considerable fraction of trades and, consequently, trading days. Although this certainly benefits computational efficiency, we propose a less restrictive threshold and include trades with a minimum trading volume of USD 50,000. Results for alternative thresholds are presented in Table 2-16.

in yield to maturity, reported price, or entered volume quantity. Subsequently, we focus on trades within the price range of USD 25 to USD 1,000. We further remove observations where the reported price deviates by more than 10% from the daily median. Finally, we keep all observations with maturities within the range of one year to a maximum of 50 years. We use the rating time series from Standard and Poor's, Moody's, and Fitch. If no rating from Moody's is available, we use ratings from Standard and Poor's if available and Fitch otherwise. We remove all observations where no rating of any of the three agencies is available. In the end, the final sample covers 6,777,096 unique bond\*day observations from 13,483 individual bonds and 1,275 individual firms in our sample period from 2013 until 2022.<sup>4</sup>

We also compute quarterly liquidity measures that are regularly used in corporate bond research, following Dick-Nielsen et al. (2012). In particular, we use the Amihud measure, Roll measure, firm and bond zero trading days, roundtrip costs (RC), turnover, and Amihud and RC risk. Their construction and descriptive statistics are detailed in Appendix A. We use  $\lambda$  as our main liquidity proxy, which is calculated as the standardized sum of the Amihud measure (Amihud, 2002), the RC measure (Feldhütter, 2012) and their respective standard deviations. Furthermore, we also consider a principal component decomposition of these individual liquidity measures to verify  $\lambda$ 's appropriateness (see Appendix A).

### 2.3.2 Abnormal Returns

We calculate the daily bond price  $P_{i,t}$  for bond  $i$  on day  $t$  as the trade-weighted average of the trade prices  $P_{i,t_i}$  of all trades  $t_i \in T_{i,t}$  on that day with the trade volume quantity  $N_{i,t_i}$  denoting the weights, i.e.,

$$P_{i,t} = \frac{\sum_{t_i \in T_{i,t}} P_{i,t_i} * N_{i,t_i}}{\sum_{t_i \in T_{i,t}} N_{i,t_i}} \quad (2-1)$$

We proceed with calculating unadjusted two-days returns  $R_{i,t}$  centered at time  $t$  as

$$R_{i,t} = \frac{P_{i,t+1} - P_{i,t-1}}{P_{i,t-1}} \quad (2-2)$$

For the sake of simplicity, we use the reported prices as Bessembinder et al. (2009) note that accrued interest has a negligible influence on the results. Table 2-1 reports descriptive

<sup>4</sup> We present tests on different sampling methods in Appendix B (e.g., varying the retail-size threshold, longer time series, and other liquidity proxies).

statistics of the bond- and firm-level returns.<sup>5</sup> Panel A reports descriptive statistics on raw returns, while Panel B reports winsorized returns. The additional sample statistics in Table 2-2 show that the sample's properties and the characteristics of our bonds are very similar to those of Ederington et al. (2015).

We calculate three different abnormal returns on the bond level  $i$ , following Ederington et al. (2015): (i) abnormal bond returns  $ABR_{i,t}$ , (ii) standardized abnormal bond returns  $SABR_{i,t}$ , and (iii) abnormal standardized bond returns  $ABSR_{i,t}$ . ABR are calculated as the residual between return  $R_{i,t}$  and benchmark return  $BMR_{i,t}$ , as outlined in Equation 2-3:

$$ABR_{i,t} = R_{i,t} - BMR_{i,t} \quad (2-3)$$

The benchmark return for bond  $i$  on day  $t$  is calculated as an equally-weighted average over all bond returns on day  $t$  that share the same rating and maturity group with bond  $i$  on this day. For forming the benchmark groups, we consider four maturity groups (i.e., zero to three, more than three to five, more than five to ten, and more than ten years) and six rating groups (i.e., Aaa and Aa, A, Baa, Ba, B, and below B). We determine benchmark returns only if the sample of bonds sharing the same rating and maturity on this day is greater than or equal to five. We compute firm-level abnormal returns  $ABR_{f,t}$  as the average over the respective bond-level abnormal returns available on a given day.

The standardized abnormal bond returns (SABR) are calculated by dividing the abnormal returns by their standard deviation, i.e.,

$$SABR_{i,t} = \frac{ABR_{i,t}}{\sigma_{i,t,ABR}} \quad (2-4)$$

where  $\sigma_{i,t,ABR}$  represents the standard deviation of (unshocked) abnormal returns over the period of  $(t - 55, t - 6)$  and  $(t + 6, t + 55)$ .

The abnormal standardized bond returns (ABSR) are calculated as the difference of standardized raw returns  $SRR_{i,t}$  and standardized benchmark  $SBM_{i,t}$  as outlined in Equation 2-6.  $SRR_{i,t}$  denotes standardized raw returns, meaning  $R_{i,t}$  divided by  $\sigma_{i,t,R}$ , where  $\sigma_{i,t,R}$  is the standard deviation of returns  $R_{i,t}$  over the period of  $(t - 55, t - 6)$  and  $(t + 6, t + 55)$ . The standardized benchmark  $SBM_{i,t}$  is the equally-weighted average of all  $SRR_{i,t}$  for all bonds that share the same rating and maturity group (applying the same group definitions as before) with bond  $i$  on that specific day  $t$ :

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<sup>5</sup> I use the term "firm", as commonly applied in finance literature (see, e.g., Bessembinder et al., 2009), to refer to a company throughout this dissertation. While I acknowledge its legal definition as the name of a business entity, I adhere to standard finance terminology.

$$SRR_{i,t} = \frac{R_{i,t}}{\sigma_{i,t,R}} \quad (2-5)$$

$$ABSR_{i,t} = SRR_{i,t} - SBM_{i,t} \quad (2-6)$$

Again, we determine the standardized benchmark returns  $SBM_{i,t}$  only if the sample of bonds sharing the same rating and maturity on this day is greater than or equal to five. Note, besides  $ABSR_{i,t}$  that is based on standard deviations over the period from  $(t - 55, t - 6)$  and  $(t + 6, t + 55)$ , we also calculate  $ABSR - Pre_{i,t}$  which considers standard deviations calculated only over the pre-event period  $(t - 101, t - 6)$ . This ensures that we only use available information and avoid a look-ahead bias. Finally, we consider  $ABSR_{f,t}$ ,  $SABR_{f,t}$ , and  $ABSR - Pre_{f,t}$  which are winsorized at the 1% level.

### 2.3.3 Size and Power Tests

We examine three statistical tests for the presence of an event effect: the standard parametric t-test (abbreviated t, Student, 1908), the non-parametric Wilcoxon signed-rank test (abbreviated SR, Wilcoxon, 1947), and the non-parametric sign test (abbreviated S, Conover, 1999). Results are reported at the 1% significance level (SL) (two-sided), and we also report some results additionally at the 5% SL.

To assess the accuracy of these three tests, we conduct simulations with 10,000 iterations. In particular, we select 300 firm\*date observations at random per trial. Where possible, we calculate the abnormal returns for the firms' traded bonds as outlined above. Based on this set, we evaluate the two accuracy measures.

**Size test:** Under the null hypothesis, each of the 300 abnormal returns (residuals) is normally distributed with a mean  $\mu = 0$  and variance  $\sigma^2$ . If a statistical test erroneously rejects the null hypothesis, it is classified as a type 1 error (false positive). Over our 10,000 iterations, the fraction of cases in which the tests incorrectly rejected the null hypothesis is referred to as the “size test”.

**Power test:** In the second test, we shock the 300 randomly drawn observations by inducing an event effect. In particular, we induce artificial shocks  $\xi_{i,t,R}$  to the returns  $R_{i,t}$ , with  $\xi_{i,t,R}$  representing a normally distributed variable  $\xi_{i,t,R} \sim N(\mu, \sigma^2)$ . These shocks come in two specifications. First, in the case of static shocks  $\sigma_i = 0$  and  $|\mu| = 15bp$ . Second, when testing for event-induced variance, we follow Marks and Musumeci (2017) and induce stochastic shocks, i.e.,  $\sigma_i = \sigma_{i,t,R}$  and  $|\mu| = 15bp$ , where  $\sigma_{i,t,R}$  is the standard deviation of raw bond returns  $R_{i,t}$  over the period of  $(t - 55, t - 6)$  and  $(t + 6, t + 55)$ . Cases in which a test does

not correctly detect an event (i.e., the test does not reject the null hypothesis) are referred to as type 2 errors (false negative). Overall, the fraction of cases in which the tests correctly rejected the null hypothesis is referred to as the “power test”.

## **2.4 Baseline Results**

In this section, we establish the baseline results for our subsequent conclusions. On the one hand, we show results for unstandardized abnormal returns. On the other hand, we provide insights into standardized returns based on the general heteroskedasticity of bond returns. While these results serve as the baseline for later estimates, they also contribute new evidence to the literature that is not dominated by the extreme outcomes of the financial crisis.

### **2.4.1 Abnormal Bond Returns**

The point of departure for bond event studies is based on abnormal returns. As defined in Equation 2-3, abnormal returns adjust returns by subtracting the respective benchmark's returns. The benchmark matches the bond's two main risk factors: credit and interest rate risk. We use this simulation to establish a baseline against which other specifications can be assessed to gain insights into the tests' size and power. Therefore, we also include financial firms and use a trade-volume cut-off of USD 50,000, below which a trade is excluded. Table 2-3 presents the first benchmark. Results obtained employing alternative thresholds are provided as robustness checks in Section 2.5.

We start with assessing the type 1 error rate (i.e., the size test) of the three statistical tests. A test is well specified based on the SL of 1% (5%) if the non-event null-rejection rate is below 0.5% (2.5%) in each tail. Based on a simulation of 10,000 trials, the true null hypothesis must not be rejected more than 100 (500) times. The results presented in Panel A of Table 2-3 suggest that the three tests (i.e., t-test, signed-rank test, and sign test) are well specified in terms of size. In most cases, the non-event null-rejection rates are below the respective SL. The only exception is the signed-rank test, which tends to provide false evidence of an event. In particular, the type 1 error rate reaches the critical level of 0.5% in the upper tail (positive events, 1% SL) and 2.52% at the lower tail (negative events, 5% SL). On the other hand, our findings provide a more favorable result for the signed-rank test, as the size test values are much closer to the critical threshold than results of Ederington et al. (2015), who documented a type 1 error rate of 3.12% for negative events.

Table 2-3's Panel B shows the results of the power tests. As described before, we induce artificial shocks of 15bp to simulate an event and check whether the tests correctly reject the null hypothesis. The test power for positive events (+15bp) and negative events (-15bp) is evaluated separately. The power of the t-test to correctly detect positive events at 54.43% (at the 5% SL) is insufficient, although it is considerably higher compared to the results of Ederington et al. (2015) (20.62%). Put differently, the null hypothesis of the t-test is only rejected in 5,443 out of 10,000 simulations based on 300 events. The power for identifying negative events is comparably low at 52.97%. Naturally, the results based on the 1% SL are considerably lower at approximately 30%. The non-parametric tests, on the other hand, perform substantially better in our sample. Even without further adjustments, these tests exhibit sufficient power in detecting events. Moreover, we document negligible differences in power between tests for positive and negative events. The power of both the signed-rank and the sign test rises well above 95% at the 5% SL, whereas Ederington et al. (2015) report much lower power ranging from approximately 50% to 70%.

In line with Marks and Musumeci (2017), we also examine whether winsorization substantially impacts our results. As shown in Panel B of Table 2-1, controlling for outliers considerably reduces the excess kurtosis and skewness. We document an increase in the test power of the t-test to approximately 40% (1% SL) while the test size still remains within the required threshold. Naturally, neither the size nor the power of the non-parametric tests are affected by winsorization.

#### **2.4.2 Standardized Abnormal Bond Returns**

This section addresses the issue of heteroskedasticity of bond returns. Bonds are primarily subject to credit and interest rate risk. Prior literature (see, e.g., Bessembinder et al., 2009) has shown that the variance of bond returns increases with higher levels of credit and interest rate. Therefore, we present the standard deviation of the ABR conditional on credit and interest rate risk in Table 2-4.

Higher credit and interest rate risk result in larger standard deviations, which confirms the presence of heteroskedasticity. The only exception is the class of non-investment grade bonds, although this is likely to be driven by the limited sample size (as reported in Panel B below). To encounter the issue of heteroskedasticity, Ederington et al. (2015) propose standardizing abnormal returns as it is common practice in equity-based event study methodology. Consequently, we establish a second baseline for standardized returns to

contrast the already reasonable test power we find, especially when applying the non-parametric tests.

Table 2-5 Panel A shows the return characteristics of the two main standardized abnormal return measures. The level of kurtosis obtained with ABSR and SABR demonstrates that standardization reduces the sample's heteroskedasticity beyond the effect of winsorization. The size tests performed in Panel B show that for standardized ABR, all three tests are also reasonably well specified. However, we also find that the tests exceed the thresholds in some cases, especially considering positive events and the signed-rank test. This is consistent with earlier results without standardization. The power tests in Panel C show that standardization of ABR substantially increases test power. This increase in power is robust across the three different ways of standardization, i.e., ABSR, SABR, and ABSR-Pre. However, based on these findings, we recommend using ABSR or SABR over ABSR-Pre. Standardization provides the greatest improvement in the power of the t-test, but non-parametric tests continue to be more powerful at power levels of 94% and above. Finally, Panel D illustrates that the improvement in explanatory power through standardization is more pronounced for moderate shocks of 10bp than for larger shocks of 25bp. We conclude that standardization of ABR is imperative in bond event studies, especially regarding events with potentially moderate effects.

In Table 2-6, we depict the test power of bivariate-sorted ABSR conditional on the level of credit and interest rate risk. The categories with higher credit quality bonds (basically all investment grade bonds) and maturity up to ten years exhibit superior test power of nearly 100% for all groups. While the test power remains close to 100% for AAA- to A-rated bonds with maturities over ten years, it drops to 91.36% for BAA-rated bonds and to 69.26% and 68.52% for BA- and B-rated bonds, respectively. Test power for non-investment grade bonds is relatively low across all maturity buckets. However, the sample sizes of these groups, as denoted in Panel B, are limited and, thus, inevitably also contribute to the reduction in test power.

## **2.5 Sampling and Sample Size**

In this section, we investigate whether the more restrictive sample selection drives the documented increase in test power. In addition, we examine the effects of sample size on test size and power. In the last section, we provide results based on weekly returns. We limit

ourselves to verbatim explanations to avoid excessive repetition of similar results and show tabulated results in Appendix B.

### 2.5.1 Alternative Sampling

There are two essential sampling decisions where researchers take different routes in bond event studies. On the one hand, the decision to exclude retail-sized trades differs. On the other hand, researchers sometimes exclude financial firms from the sample. We investigate the impact of those choices on test size and power.

In some cases, event studies do not exclude potentially noisy retail-sized trades from their main sample (prominently, e.g., Ederington et al., 2015). In contrast, we exclude trades with less than USD 50,000 in volume from our main sample, and other studies exclude trades below USD 100,000. Any filter like this results in a lower number of available firm\*day observations, potentially reducing test power due to the decrease in sample size. However, lower levels of noise should theoretically increase test power, ceteris paribus. We find that incorporating retail-sized trades decreases the size of the signed-rank test to 0.57. As expected, the test power (at the 1% SL) of the t-test decreases marginally by  $1 - \frac{31.78\%}{34.12\%} = 6.86\%$  ( $1 - \frac{29.27\%}{32.16\%} = 9.00\%$  for negative events). However, counter-intuitively, the power of non-parametric tests even increases. These results suggest that excluding retail-sized trades does not significantly improve the power of the test. Secondly, the effect of an increased sample size appears to outweigh the benefits of (potential) noise reduction. Nevertheless, the results show that excluding retail-sized trades does not drive the higher test power vis-à-vis Ederington et al. (2015). These implications are further substantiated when turning to the results for the sample based on trades with a volume above USD 100,000. As expected, the signed-rank test's size improves slightly, eventually dropping below the statistical threshold of 0.5%. There is, however, no considerable gain in power regarding the t-test, and, in line with the trend previously identified, the power of the non-parametric tests decreases slightly.

Another potential criterion regarding sample selection is the in- or exclusion of an industry in which firms operate. It is, e.g., common practice to exclude financial firms from empirical analyses as these firms carry exposure to systemic risk and are subject to a complex regulatory environment (Fama & French, 1992). In addition, financial firms and the financial market often affect each other, and results could be distorted by effects of financial market change, e.g., interest rate factors, instead of clearly showing the response to a specific

event (Foerster & Sapp, 2005). Hence, we assess the impact of restricting the sample to non-financial firms. We exclude all stocks with a first-digit SIC code of 6, i.e., finance, real estate, and insurance firms. Excluding bonds issued by financial institutions reduces the sample size, eventually causing a marginally lower test power.<sup>6</sup>

Overall, the decision as to whether financial firms or retail-sized trades are included or excluded has no material impact on the results. If researchers run the risk of reducing the sample size excessively (e.g., due to the potential exclusion of illiquid assets, as shown later in Section 2.7), we advocate the inclusion of retail-sized trades based on our findings as opposed to the established convention of removing trades below USD 100,000.

### 2.5.2 Sample Size

The results of the previous section indicate that test power is relatively sensitive to changes in sample size. We conduct another series of simulations to answer the question of what the minimum sample size should be and how sensitive the results are to a reduction in sample size. Specifically, we run the simulations as specified before, but adjust the number of random draws from 100 to 1,500 bond\*day for each set of 10,000 rounds. Naturally, we see a steady increase in the effective sample size from approximately 25 to 400 actual returns. In particular, with 300 random draws, the average number of calculable abnormal returns is approximately 80, resulting in a coverage ratio of 26.67%. The ratio remains comparable for 25 out of 100 and 400 out of 1,500 draws. The result of this analysis is a graph of test size and test power as a function of sample size for each of the three considered tests, which we present in Figure 2-1.

The results of the size tests, shown in Panel A of Figure 2-1, are largely robust in showing no dependence on the sample size and, thereby, corroborate the tabulated results. Again, the signed-rank test shows a tendency towards type 1 errors, especially for negative events. On the other hand, the test power strongly depends on the sample size, as illustrated in Panel B of Figure 2-1. While the test power of the two non-parametric tests increases exponentially with sample size and eventually saturates in a range between 100 and 150 observations, the test power of the t-test increases much more slowly. In fact, the t-test's power remains well below a sufficient level, even at a sample size of 400. The graphs also illustrate that an average sample size of 80, on which the results of this study are based,

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<sup>6</sup> The average number of abnormal returns computable from a random draw of 300 bond\*day observations decreases slightly from 80.32 to 79.40.

approaches the minimum sample size required for bond event studies based on the estimated impact of 15bp. Overall, our results suggest that for non-parametric tests, a minimum sample size of about 100 firm\*day observations is required to achieve sufficient test power, *ceteris paribus*.

### **2.5.3 Alternative Event Window Length**

The length of the event window varies from study to study, and there is no uniform, generalized approach. While rather uncommon in equity studies, some fixed-income studies propose to use weekly returns to increase the sample of included firms. However, this comes at the cost of incorporating potentially confounding information, thereby increasing the noise level. Hence, we tackle this issue empirically and compute our results for returns calculated on a weekly basis. The calculation of returns is analogous to Equation 2-2 except that we calculate weekly returns between the first and last day of a week on which a bond was traded. An additional requirement is the existence of at least one trading day in between, such that we calculate at least the two-day returns as shown in Equation 2-2. We deliberately choose the maximum return period possible to demonstrate the impact of larger levels of natural noise on the test size and power. Arguably, in an actual event study, choosing the minimum return period could be advisable to reduce the likelihood of including potentially confounding information. However, as some information may be leaked or anticipated a priori, it is often necessary to expand the return period. To illustrate the effects of noise and to obtain conservative results, we use the former approach. We show the results of the size and power tests on weekly returns in Table 2-7.

While most return characteristics remain comparable, the total number of observations decreases when transitioning to weekly returns. However, despite that, the average sample size per draw increases by approximately 50% to 120. As our earlier results show, this should theoretically lead to an increase in test power. However, Panel C of Table 2-7 indicates that the three tests in our analysis exhibit considerably lower test power based on weekly returns. Furthermore, as shown in Panel D of Table 2-7, the reduction in test power is more pronounced for events with a moderate magnitude. In conclusion, it should be carefully balanced whether potential advantages, e.g., the inclusion of a larger number of firms in the sample and extending the event period, outweigh the potential downside, i.e., incorporating confounding information resulting in a higher level of noise. This is particularly concerning in the scenario of event-induced variance, which we explore in Section 2.6.

## 2.6 Event-Induced Variance

Overall, the previous results provide evidence that the existing methodology of event studies in corporate bond markets is reliable under standard conditions. However, our findings also indicate that these results are generally susceptible to increases in noise and variance. Hence, in this section, we address an issue prevalent in equity-based event studies that has yet to be addressed in bond-based event studies. In fact, several events are known to cause an increase in the variance of stock returns (see, e.g., Brown et al., 1988) and Marks and Musumeci (2017) tested equity-based event studies for event-induced variance. Following the equity-based literature, we thus extend the existing methodology for bond-event studies by testing whether the methodology is also robust to event-induced variance.

We repeat the simulations as specified above to investigate event-induced variance in bond-event studies with the necessary adjustments. Instead of adding a static shock of  $\pm 15\text{bp}$ , we follow Marks and Musumeci (2017) by adding a random number  $\xi$  drawn from a normal distribution with a mean of  $\pm 15\text{bp}$  and a standard deviation equal to the standard deviation of the returns used to calculate the ABSR, i.e.,  $\xi_{i,t} \sim N(\mu, \sigma_{i,t}^2)$ . For the size test, we add a number drawn from a similar distribution in terms of standard deviation, albeit with a mean of zero, i.e.,  $\xi_{i,t} \sim N(0, \sigma_{i,t}^2)$ . We choose the induced variance (i.e.,  $\sigma_{i,t}^2$ ) based on the available data instead of forcing an arbitrary number. Otherwise, we use the same procedure using 300 bond\*day draws for 10,000 trials with two-day returns.

Panel B of Table 2-8 shows that all three tests are comparably well specified in terms of size. However, the power of the applied tests decreases with the introduction of event-induced variance. For example, the test power of the t-test is diminished from approximately 90% to 57% for ABSR and to 68% for SABR, respectively. This reduction in test power comes despite the added standardization. Albeit still significantly reduced, the test power of the signed-rank test based on SABR stands out among the tests at around 75% for both positive and negative shocks. Turning to alternative magnitudes, as shown in Panel D of Table 2-8, we find that the ABSR-based test remains well specified for shocks with a magnitude of 25bp on average.

Following these findings, we illustrate a series of power curves to assess the sensitivity of the applied tests to event-induced variance. Figure 2-2 plots the test power conditional on the level of event-induced variance. Specifically, we run the experiments as above, but the level of event-induced variance is increased incrementally by a factor  $\gamma$ . The induced shock  $\xi$  is thus a number drawn from a normal distribution  $\xi_{i,t} \sim N(\mu, \sigma^2)$ , where  $\sigma^2 = \gamma * \sigma_{i,t}^2$ .

Figure 2-2 shows that the test power decreases with an increase in event-induced variance. A dramatic reduction in test power can be recognized consistently over all panels, even with small increases in variance. The vertical lines indicate  $\gamma = 0.5$  and  $\gamma = 1$ . Interestingly, SABR appear superior to the other approaches, especially under the signed-rank test, in line with the results presented in Table 2-8. We conclude from this analysis of event-induced variance that although the test power of ABSR and SABR differs only slightly under standard conditions, the experiment suggests the use of SABR when an event is expected to cause a substantial increase in variance.

## 2.7 Liquidity

It is a stylized fact that liquidity in corporate bond markets is substantially lower than in equity markets. Consequently, there is a wealth of empirical research on the impact of liquidity on bond prices and returns (see, e.g., Bektić et al., 2020; Goldstein & Namin, 2023, for overviews). Nevertheless, the effect of liquidity on test size and power in event studies has yet to be thoroughly addressed.<sup>7</sup> However, given its importance, we investigate liquidity's role explicitly.

In the analysis of liquidity's effects, we focus on  $\lambda$  (Dick-Nielsen et al., 2012) as the main liquidity measure.<sup>8</sup>  $\lambda$  is calculated as the standardized sum of the Amihud measure (Amihud, 2002), the RC measure (Feldhütter, 2012) and their respective standard deviations. In addition, we provide details on the construction in Appendix A.

To understand the liquidity's impact on returns, we first stratify the standard deviation and sample size of ABR by our primary liquidity proxy  $\lambda$  and both credit rating (see Table 2-10) and time to maturity (see Table 2-9), respectively. We find clear patterns between liquidity and the two other risk dimensions. Specifically, bonds with a remaining time to maturity of one to three years are much more liquid than bonds with a maturity of more than ten years, as indicated by the return variability and the number of observations per portfolio. This pattern also applies to portfolios sorted by credit rating and liquidity. Independent of the other dimensions, the standard deviation itself increases monotonically with decreasing liquidity, which is robust across all maturity ranges and rating categories. Overall, we clearly

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<sup>7</sup> In fact, Bessembinder et al. (2009) report that they formed alternative benchmark portfolios using issuance size as a proxy for liquidity risk but conclude that it does not improve test statistics. However, issuance size is only a crude liquidity proxy.

<sup>8</sup> Alternatively, we use the Roll measure and arrive at the same conclusions.

see that liquidity has a sizeable impact on the heteroskedasticity of bond returns, comparable to credit and interest rate risk.

Next, given the impact on heteroskedasticity, we investigate the impact of liquidity on inference from event studies using the same simulation protocol as before. However, we specifically focus on the most powerful test from our previous analyses, i.e., we use ABSRs with the signed-rank test. Indeed, Table 2-11 and Table 2-12 show that liquidity substantially impacts test power. In general, the test power decreases with lower liquidity, as well as with longer maturities and higher credit risk. In particular, the impact of liquidity is most pronounced for bonds with higher levels of interest rate and credit risk. For the most extreme portfolios, the test power reaches levels that are considered insufficient, e.g., 56.06% for the most illiquid bonds with a remaining maturity of more than ten years. Regarding the credit risk dimension, the results are also remarkable. For example, the test power for BA-rated bonds falls to 73% in the lowest liquidity quantile.<sup>9</sup>

One salient finding in this exercise is the implicit correlation between the liquidity of corporate bonds and credit risk, which is already well-established in the existing literature (see, e.g., Helwege et al., 2014). After stratifying by credit risk, sorting by liquidity does not substantially change the number of observations in each portfolio. This is in stark contrast to the bi-variate sorting by maturity and liquidity. However, although the sample sizes in the former cases remain relatively stable (or even increase), the test power is considerably lower for portfolios with low liquidity. This points to a non-linear moderating effect between liquidity spreads and credit spreads in line with the theoretical predictions in Ericsson and Renault (2006). Finally, these results imply that corporate bond liquidity should be considered in corporate bond event studies, especially when samples are geared towards above-average maturities and higher levels of credit risk.

## 2.8 Conclusion

In this study, we examine the validity and reliability of the event study methodology in corporate bond markets. We find that the empirical approach based on standardized abnormal returns jointly with non-parametric tests (popularized by Ederington et al., 2015) is

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<sup>9</sup> We arrive at virtually identical results if we use the Roll measure as a proxy for liquidity, which appears intuitive given a correlation of 0.619 between both measures (see Table 2-14 in Appendix A). For example, the test power for the least liquid bonds in the five- to ten-year maturity range falls to 83.47% and for bonds with maturities over ten years to 64.09%. When stratified by credit rating and liquidity, the results are similar. The test power for the least liquid falls to 81.70% and 69.73% for BAA- and BA-rated bonds, respectively. We do not observe such distinct patterns when using turnover as a proxy for liquidity. The results are tabulated in Appendix B.

well specified. Standardizing ABR and employing non-parametric tests are superior to the use of raw ABR and parametric tests in terms of test size and power. However, a sufficient sample size is crucial to obtain reliable results. Based on artificial shocks of 15bp, the non-parametric tests converge to a reasonable power level at a sample size of about 100, all else equal. Additionally, we find that constructing weekly returns (i.e., returns based on the first and last available trading day of the week) leads to an increase in noise, which in turn reduces test power substantially.

In our main empirical analyses, we assess the sensitivity of the methodology to a common problem in event studies, i.e., event-induced variance. In general, we document that the presence of event-induced variance reduces the test power notably. Similar conclusions are drawn when evaluating the test power based on longer event windows, thereby more likely including confounding information that affects bond prices.

Finally, illiquidity is a prominent issue in corporate bond markets. Thus, we evaluate the sensitivity of test power to bond liquidity. We show that liquidity effects are particularly pronounced for lower-rated bonds and bonds with longer maturities. From this, we conclude that researchers need to assess the characteristics of their sample carefully. Statistical inference is challenging due to severe power issues in samples with longer maturity bonds or higher credit risk. Therefore, we suggest excluding illiquid bonds from the sample, in contrast to the common convention of excluding retail-sized trades.

## 2.9 Tables

**Table 2-1: Descriptive statistics of the bond- and firm-level returns.** This table presents descriptive statistics on the bond- and firm-level returns. Panel A states descriptives of raw bond returns, abnormal bond returns (ABR), and firm-level ABR based on TRACE data from 2013 to 2022. Raw (two-day) bond returns are based on trade-weighted daily prices (see Equation 2-1), and ABR are defined as the two-day bond return minus the average return of all bonds in the same rating/maturity group. The firm-level ABR are calculated as the trade volume-weighted average of the firm's ABR. Panel B reports the statistics after winsorization at the 1% and 99% levels.

	Mean	Median	SD	Skew	Kurt	% positive	N	% days
Panel A - Returns								
Raw returns	-0.0014	0.0008	1.0659	-0.7352	160.37	49.7743	3,054,101	9.2261
ABR	0.0000	-0.0018	0.7778	-0.0368	267.88	49.6975	3,038,955	9.1796
Firm-level ABR	0.0004	-0.0002	0.8220	-1.4739	294.02	49.9636	857,451	25.8166
Panel B - Winsorized returns								
Raw returns	0.0003	0.0007	0.7732	-0.0674	3.4467	49.7743		
ABR	0.0005	-0.0018	0.5478	0.0411	4.0409	49.6975		
Firm-level ABR	0.0023	-0.0002	0.5473	0.0110	4.7398	49.9636		

**Table 2-2: Descriptive statistics of the bond sample.** This table presents descriptive statistics on the corporate bonds used throughout this study. Panel A shows additional bond characteristics (i.e., the time to maturity, the rating, the liquidity measure  $\lambda$ , the offering amount (in M), and the coupon). Panel B shows the distribution of the sample bonds based on credit rating and time to maturity.

Panel A - Sample statistics			
	Mean	Median	SD
Time to maturity	9.61	6.18	8.87
Rating	14.38	15.00	3.14
$\lambda$ (Liquidity)	0.14	-0.77	2.99
Offering amount ( $\times 10^6$ )	709	500	673
Coupon	3.45	2.60	3.78

Panel B - Share per rating and time to maturity			
Rating	Share	Maturity	Share
AAA to AA	7.42%	1-3 years	19.93%
A	30.38%	3-5 years	21.48%
BAA	41.81%	5-10 years	37.45%
BA	12.41%	> 10 years	21.14%
B	6.59%		
Below B	1.39%		

**Table 2-3: Size and power tests using unstandardized abnormal returns.** This table presents the size and power tests using firm-level abnormal bond returns (ABR) at a significance level (SL) of 1% and 5% (two-sided), respectively. The tests include the parametric t-test (t), the non-parametric signed-rank test (SR), and the sign test (S). For each test, we show rejection rates (in percent) from 10,000 simulations of 300 firm\*day draws. Panel A presents the size tests. In Panel B, we show the power tests for artificial positive and negative 15bp shocks.

Panel A - Size tests						
	t		SR		S	
SL	0.5	99.5	0.5	99.5	0.5	99.5
Size	0.19	0.24	0.47	0.50	0.43	0.33
SL	0.5	99.5	0.5	99.5	0.5	99.5
Size	1.86	2.22	2.52	2.39	1.89	1.91

Panel B - Power tests (15bp shocks)				
	SL	t	SR	S
Positive shock	0.5	34.96	85.5	90.26
Negative shock	99.5	32.16	83.68	89.31
Positive shock	2.5	54.43	95.24	97.33
Negative shock	97.5	52.97	94.59	97.02

**Table 2-4: Abnormal returns' standard deviations stratified by rating and maturity.** This table presents the standard deviations of bond-level abnormal returns (ABR) over six rating and four time to maturity cut-offs. Panel A states the standard deviation in percent. Panel B reports the corresponding number of observations.

Panel A - Standard deviation				
	1-3 years	3-5 years	5-10 years	> 10 years
AAA to AA	0.2094	0.2894	0.4149	0.6998
A	0.2186	0.3104	0.4379	0.7807
BAA	0.3937	0.4957	0.6589	1.0350
BA	0.7011	0.8791	0.9188	1.3149
B	1.7895	1.4452	1.3421	1.9983
Below B	2.5697	2.4344	2.2795	1.9799

Panel B - Number of observations				
	1-3 years	3-5 years	5-10 years	> 10 years
AAA to AA	53,944	47,866	68,481	55,894
A	242,491	206,695	268,560	209,840
BAA	230,547	246,898	466,972	332,057
BA	52,701	87,841	200,493	37,242
B	19,965	51,496	119,653	5,037
Below B	3,930	12,691	17,559	102

**Table 2-5: Size and power tests of standardized abnormal returns.** This table presents size and power tests of firm-level abnormal standardized returns (ABSR), standardized abnormal returns (SABR), unstandardized abnormal returns (ABR, raw), and ABSR with pre-event period ( $t - 101, t - 6$ ) standard deviation (ABSR-Pre). The tests include the parametric t-test (t), the non-parametric signed-rank test (SR), and the sign test (S). For each test, we show rejection rates (in percent) from 10,000 simulations of 300 firm\*day draws. Panel A shows descriptive statistics of returns in percent. Panel B presents the test size using a two-sided significance level (SL) of 1%. Panel C shows the power tests for artificial positive and negative 15bp shocks. Panel D repeats the power tests for alternative shocks of 10bp and 25bp.

Panel A - Return characteristics						
	Mean	Median	SD	Skew	Kurt	N
ABSR	0.0003	-0.0036	0.8093	0.0478	2.5283	2,860,243
SABR	-0.0021	-0.0064	1.0682	0.0432	1.9244	2,862,094

Panel B - Size tests						
SL (%)	t		SR		S	
	0.5	99.5	0.5	99.5	0.5	99.5
ABSR	0.40	0.51	0.41	0.54	0.37	0.30
SABR	0.41	0.51	0.55	0.62	0.56	0.36
ABR (raw)	0.19	0.25	0.47	0.50	0.43	0.33
ABSR-Pre	0.42	0.65	0.39	0.69	0.26	0.43

Panel C - Power tests (15bp shocks)						
	t	Negative SR	S	t	Positive SR	S
ABSR	89.97	96.97	94.77	91.97	97.70	95.38
SABR	91.07	96.93	93.99	92.23	97.35	93.94
ABR (raw)	32.16	83.68	89.31	34.96	85.50	90.26
ABSR-Pre	75.74	89.69	85.67	78.51	91.30	87.13

Panel D - Power tests (10bp and 25bp shocks)						
	t	Negative SR	S	t	Positive SR	S
10bp - raw	12.37	46.44	56.18	14.18	49.96	56.41
10bp - stand.	55.00	75.56	71.24	58.87	77.45	71.50
25bp - raw	71.27	99.53	99.81	73.31	99.65	99.88
25bp - stand.	99.91	99.98	99.91	99.96	99.98	99.91

**Table 2-6: Test power stratified by bond rating and maturity for a 15bp shock.** This table reports the test power of the signed-rank test at the 1% significance level (SL) based on bond-level abnormal standardized bond returns. We group bonds by six rating and four time to maturity cut-offs. The test power in Panel A is the average test power across positive and negative 15bp shocks (i.e., we show rejection rates (in percent) from 10,000 simulations of 300 firm\*day draws). Panel B reports the corresponding number of observations.

Panel A - Power test (15bp shocks)				
	1-3 years	3-5 years	5-10 years	> 10 years
AAA to AA	100.00	100.00	100.00	99.29
A	100.00	100.00	100.00	98.04
BAA	100.00	100.00	100.00	91.36
BA	100.00	100.00	99.39	69.26
B	99.57	99.70	97.72	68.52
Below B	64.28	78.89	77.65	22.91
Panel B - Number of observations				
	1-3 years	3-5 years	5-10 years	> 10 years
AAA to AA	50,582	46,140	65,972	53,335
A	225,423	197,073	255,026	196,448
BAA	210,776	232,166	439,092	309,991
BA	49,503	84,092	192,095	35,476
B	18,382	48,745	113,723	4,721
Below B	3,340	11,558	16,496	88

**Table 2-7: Size and power tests based on weekly returns.** This table presents size and power tests of firm-level abnormal standardized returns (ABSR), standardized abnormal returns (SABR), unstandardized abnormal returns (ABR, raw), and ABSR with pre-event period ( $t - 101, t - 6$ ) standard deviation (ABSR-Pre). The tests include the parametric t-test (t), the non-parametric signed-rank test (SR), and the sign test (S). For each test, we show rejection rates (in percent) from 10,000 simulations of 300 firm\*day draws. Panel A shows descriptive statistics of returns in percent. Panel B presents the test size using a two-sided significance level (SL) of 1%. Panel C shows the power tests for artificial positive and negative 15bp shocks. Panel D repeats the power tests for alternative shocks of 10bp and 25bp.

Panel A - Return characteristics						
	Mean	Median	SD	Skew	Kurt	N
ABSR	0.0008	-0.0074	0.8628	0.0765	2.5927	510,428
SABR	-0.0111	-0.0161	1.2424	0.0429	1.6431	511,680

Panel B - Size tests						
SL (%)	t		SR		S	
	0.5	99.5	0.5	99.5	0.5	99.5
ABSR	0.25	0.34	0.49	0.36	0.35	0.34
SABR	0.52	0.21	0.66	0.26	0.45	0.17
ABR (raw)	0.24	0.29	0.45	0.44	0.42	0.38
ABSR-Pre	0.32	0.54	0.41	0.55	0.42	0.39

Panel C - Power tests (15bp shocks)						
	t	Negative SR	S	t	Positive SR	S
ABSR	75.42	87.53	82.17	77.31	87.97	80.49
SABR	81.91	89.38	80.49	78.22	86.37	75.85
ABR (raw)	20.51	71.93	82.21	23.04	75.69	82.62
ABSR-Pre	73.35	87.79	82.26	76.75	90.18	84.16

Panel D - Power tests (10bp and 25bp shocks)						
	t	Negative SR	S	t	Positive SR	S
10bp - raw	7.17	34.13	44.19	9.10	38.24	45.63
10bp - stand.	38.64	55.42	49.94	40.80	55.25	46.81
25bp - raw	55.65	98.63	99.61	57.18	99.07	99.55
25bp - stand.	98.98	99.67	98.89	99.15	99.68	98.70

**Table 2-8: Size and power tests with event-induced noise.** This table presents size and power tests of firm-level abnormal standardized returns (ABSR), standardized abnormal returns (SABR), unstandardized abnormal returns (ABR, raw), and ABSR with pre-event period ( $t - 101, t - 6$ ) standard deviation (ABSR-Pre). The tests include the parametric t-test (t), the non-parametric signed-rank test (SR), and the sign test (S). For each test, we show rejection rates (in percent) from 10,000 simulations of 300 firm\*day draws, where we introduce event-induced variance equal to the standard deviation used to scale ABSR. Panel A shows descriptive statistics of returns in percent. Panel B presents the test size using a two-sided significance level (SL) of 1%. Panel C shows the power tests for artificial positive and negative 15bp shocks. Panel D repeats the power tests for alternative shocks of 10bp and 25bp.

Panel A - Return characteristics						
	Mean	Median	SD	Skew	Kurt	N
ABSR	0.0003	-0.0036	0.8093	0.4780	2.5283	2,860,243
SABR	-0.0021	-0.0064	1.0682	0.0432	1.9244	2,862,094

Panel B - Size tests						
SL (%)	t		SR		S	
	0.5	99.5	0.5	99.5	0.5	99.5
ABSR	0.50	0.47	0.51	0.49	0.32	0.39
SABR	0.54	0.50	0.44	0.59	0.38	0.46
ABR (raw)	0.30	0.34	0.56	0.50	0.41	0.37
ABSR-Pre	0.36	0.43	0.33	0.48	0.24	0.36

Panel C - Power tests (15bp shocks)						
	t	Negative SR	S	t	Positive SR	S
ABSR	56.77	64.12	54.11	57.23	64.78	54.81
SABR	67.53	74.94	64.91	67.97	75.61	64.87
ABR (raw)	11.11	29.84	32.69	10.78	30.97	33.39
ABSR-Pre	39.26	46.18	37.10	42.41	50.00	40.70

Panel D - Power tests (10bp and 25bp shocks)						
	t	Negative SR	S	t	Positive SR	S
10bp - raw	4.08	11.73	12.63	4.24	12.22	12.63
10bp - stand.	22.80	28.23	22.74	24.77	30.32	23.75
25bp - raw	33.98	73.85	77.73	35.81	75.61	79.76
25bp - stand.	95.80	97.11	92.46	95.96	97.15	92.37

**Table 2-9: Abnormal returns' standard deviations stratified by liquidity and maturity.** This table presents the standard deviations of bond-level abnormal returns (ABR) over five liquidity and four time to maturity cut-offs. Panel A states the standard deviation in percent. Panel B reports the corresponding number of observations.

Panel A - Standard deviation				
	1-3 years	3-5 years	5-10 years	> 10 years
High	0.2032	0.3107	0.4003	0.6914
2	0.2906	0.3914	0.4952	0.6458
3	0.3858	0.5150	0.5922	0.7153
4	0.6195	0.7060	0.7924	0.9001
Low	1.7031	1.3337	1.2205	1.5439

Panel B - Number of observations				
	1-3 years	3-5 years	5-10 years	> 10 years
High	240,883	147,370	190,021	52,603
2	148,469	146,278	219,339	116,953
3	115,543	130,976	229,788	154,567
4	84,838	147,245	240,439	158,218
Low	33,095	114,294	312,038	171,428

**Table 2-10: Abnormal returns' standard deviations stratified by liquidity and rating.** This table presents the standard deviations of bond-level abnormal returns (ABR) over five liquidity and six rating cut-offs. Panel A states the standard deviation in percent. Panel B reports the corresponding number of observations.

Panel A - Standard deviation						
	AAA to AA	A	BAA	BA	B	Below B
High	0.2305	0.2762	0.3582	0.4857	0.5995	0.8059
2	0.3222	0.3724	0.4562	0.5449	0.7248	1.1035
3	0.4137	0.4495	0.5703	0.6853	0.8757	1.5025
4	0.5301	0.5531	0.7597	0.9323	1.2279	1.7292
Low	0.6644	0.7788	1.2184	1.3047	2.1980	3.2007

Panel B - Number of observations						
	AAA to AA	A	BAA	BA	B	Below B
High	43,443	224,474	278,847	56,073	23,700	4,340
2	46,048	207,127	247,757	86,274	38,403	5,430
3	51,391	197,900	249,010	89,655	38,352	4,566
4	48,445	176,798	260,970	96,556	40,909	7,062
Low	34,713	107,378	293,044	117,854	62,998	14,868

**Table 2-11: Test power stratified by liquidity and maturity for a 15bp shock.** This table reports the test power of the signed-rank test at the 1% significance level (SL) based on bond-level abnormal standardized bond returns. We group bonds by five liquidity and four time to maturity cut-offs. The test power in Panel A is based on positive 15bp shocks (i.e., we show rejection rates (in percent) from 10,000 simulations of 300 firm\*day draws). Panel B reports the corresponding number of observations.

Panel A - Power test (15bp shocks)				
	1-3 years	3-5 years	5-10 years	> 10 years
High	100.00	100.00	100.00	73.69
2	100.00	100.00	99.96	92.40
3	100.00	100.00	99.88	90.63
4	100.00	100.00	99.43	83.54
Low	100.00	98.78	93.76	56.06

Panel B - Number of observations				
	1-3 years	3-5 years	5-10 years	> 10 years
High	235,539	153,166	199,605	54,641
2	152,539	150,718	226,129	116,520
3	122,888	136,508	233,988	150,889
4	95,494	149,134	244,082	152,793
Low	48,169	117,939	308,043	164,496

**Table 2-12: Test power stratified by liquidity and rating for a 15bp shock.** This table reports the test power of the signed-rank test at the 1% significance level (SL) based on bond-level abnormal standardized bond returns. We group bonds by five liquidity and six rating cut-offs. The test power in Panel A is based on positive 15bp shocks (i.e., we show rejection rates (in percent) from 10,000 simulations of 300 firm\*day draws). Panel B reports the corresponding number of observations.

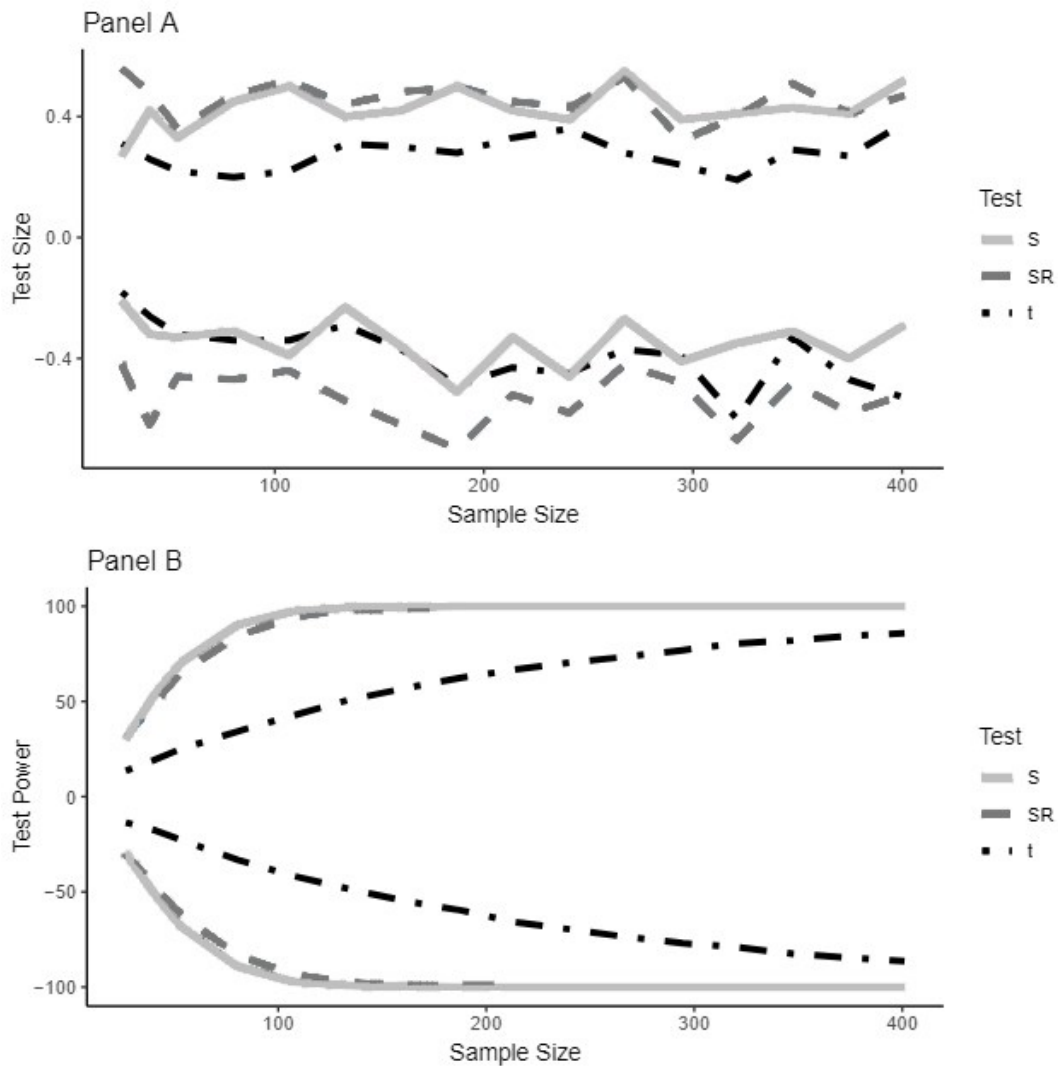
Panel A - Power test (15bp shocks)						
	AAA to AA	A	BAA	BA	B	Below B
High	100.00	100.00	100.00	99.84	98.18	99.78
2	100.00	100.00	100.00	99.69	97.64	81.18
3	100.00	100.00	100.00	96.45	87.11	12.79
4	100.00	100.00	99.95	89.18	63.30	22.65
Low	99.97	100.00	93.25	73.00	42.12	12.70

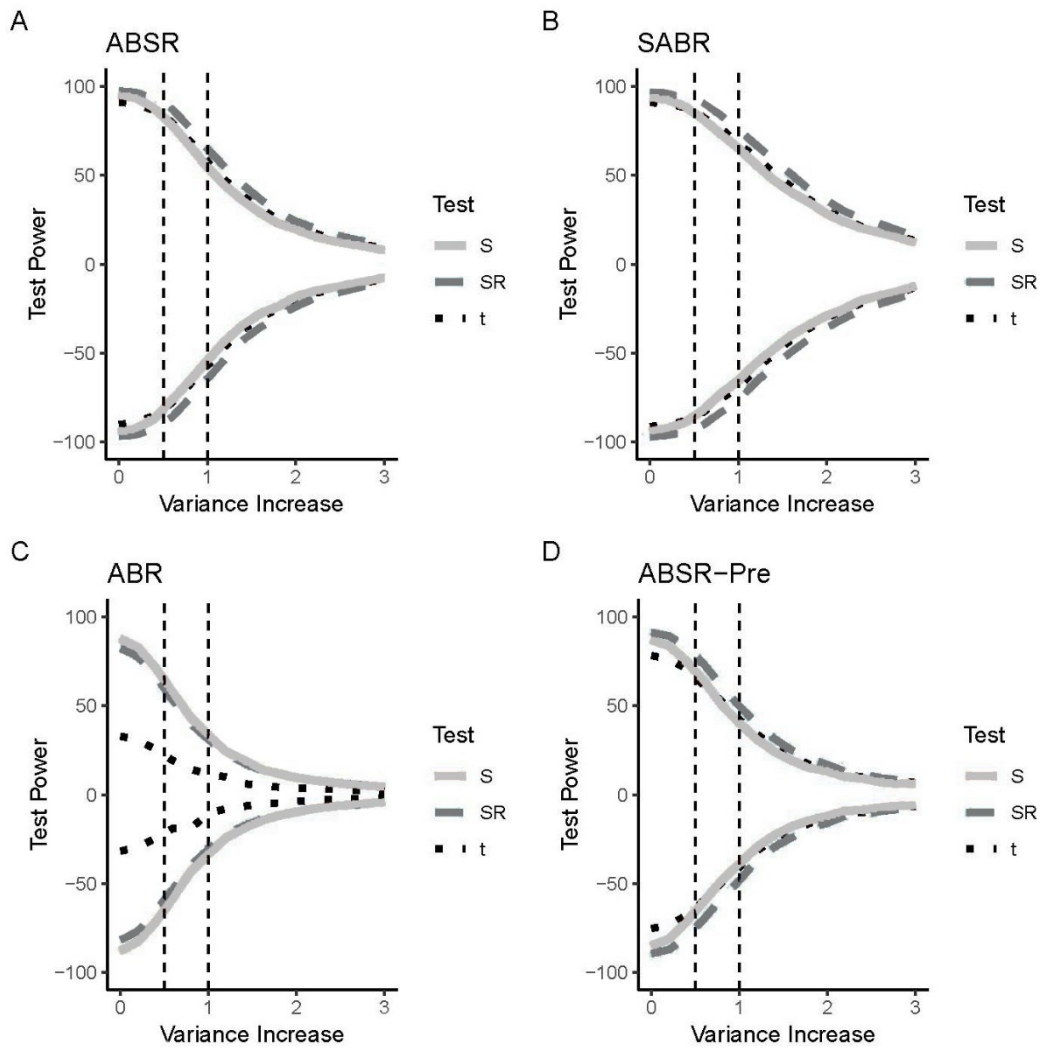
Panel B - Number of observations						
	AAA to AA	A	BAA	BA	B	Below B
High	44,307	224,463	281,098	61,881	26,133	5,069
2	46,923	210,276	254,065	88,795	40,038	5,809
3	51,893	200,621	254,356	91,550	40,754	5,099
4	49,396	180,731	264,759	97,954	41,297	7,366
Low	35,616	115,133	293,836	118,016	62,138	13,908

## 2.10 Figures

**Figure 2-1: Test size and power conditional on sample size.** This figure displays the results of 16 simulations (10,000 repetitions each) based on ABR with increasing sample size from 100 random firm\*day draws until 1,500 draws. For the power tests, we induce static, positive shocks (i.e.,  $\xi_{i,t,R}$ ) with  $|\mu| = 15bp$  and  $\sigma = 0$ . With 100 (1,500) firm\*day observations drawn at random, the average sample yields 25 (400) available returns. Panel A reports the results of the size tests, and Panel B reports the results of the power tests. We present the results of the standard parametric t-test (t), the non-parametric Wilcoxon signed-rank test (SR), and the non-parametric sign test (S).



**Figure 2-2: Test power conditional on event-induced variance.** This figure shows the results of 60 simulations (10,000 repetitions of 300 firm\*day random draws each). We incrementally increase the standard deviation (i.e.,  $\sigma$ ) of the positive shock (i.e.,  $\xi_{i,t,R}$ ) with  $|\mu| = 15bp$ . Formally,  $\sigma$  is calculated as  $\gamma * \sigma_{i,t,R}$ , where  $\sigma_{i,t,R}$  is the standard deviation of raw bond yields (i.e.,  $R_{i,t}$  during the periods  $(t - 55, t - 6)$  and  $(t + 6, t + 55)$ ) and  $\gamma$  ranges from zero to three. Panel A shows results for ABSR, Panel B for SABR, Panel C for ABR, and Panel D for ABSR-Pre. We present the results of the standard parametric t-test (t), the non-parametric Wilcoxon signed-rank test (SR), and the non-parametric sign test (S).



## 2.11 Appendix

### A Liquidity Measures

In this section, we outline the calculation of the individual corporate bond liquidity measures drawing on the procedure of Dick-Nielsen et al. (2012). We also provide some descriptive statistics on the derived liquidity measures as presented in the original article. We follow the structure of the original paper to maintain comparability. We also reproduce the descriptive statistics, the correlation matrix, and the principal component analysis as presented in the original paper.

The first measure of (il-)liquidity we consider is the Amihud measure (Amihud, 2002), which is defined as the price impact of a trade per unit traded. Formally, the Amihud measure is derived by calculating the daily average of the absolute returns  $R_j$  divided by the trading volume  $Q_j$  of the consecutive transactions of a given bond per day:

$$Amihud_t = \frac{1}{N_t} \sum_{j=1}^{N_t} \frac{|R_j|}{Q_j} = \frac{1}{N_t} \sum_{j=1}^{N_t} \frac{\left| \frac{P_j - P_{j-1}}{P_{j-1}} \right|}{Q_j} \quad (\text{A-1})$$

Conceptually, it is necessary for a bond to trade at least twice per day to calculate the Amihud measure. We derive quarterly measures by taking the median of all daily observations in a quarter.

The bid-ask spread refers to the difference between the highest price a buyer is willing to pay (bid price) and the lowest price a seller is willing to accept (ask price) for a particular financial instrument. For bid-ask spreads, we employ two distinct proxies: the Roll measure (Roll, 1984) and Imputed Roundtrip Trades (IRT) as defined by Feldhütter (2012). Roll (1984) finds that, given certain assumptions, the percentage bid-ask spread is equal to two times the square root of the negative covariance between successive returns:

$$Roll_\tau = 2\sqrt{-cov(R_t, R_{t-1})} \quad (\text{A-2})$$

where  $\tau$  is the period for which the measure is calculated. If the covariance is positive, the observation is discarded. The underlying rationale is that the bond price bounces between the bid and ask prices and that higher percentage bid-ask spreads lead to higher negative covariance between successive yields (Dick-Nielsen et al., 2012). We define a monthly Roll measure if a bond trades at least ten times in this month. We then define a quarterly rolling measure by taking the mean of the daily measures within the quarter.

Feldhütter (2012) presents an alternative method for assessing transaction costs, which he terms “IRT”. In corporate bond markets, it is not uncommon to observe a bond being

traded multiple times in quick succession after a prolonged period of inactivity. This typically occurs when a dealer facilitates a transaction between a buyer and a seller and collects the bid-ask spread as compensation. When a match is found, two trades take place - one between the seller and the dealer and another between the buyer and the dealer. In some cases, if the matching involves a second dealer, there may also be a transaction between the two dealers. When two or three trades of the same bond with identical trade sizes occur on the same day, and there are no other trades with the same size, we consider these transactions as part of an IRT. For an IRT, the roundtrip costs (RC) are defined as follows:

$$RC = \frac{P_{max} - P_{min}}{P_{max}} \quad (A-3)$$

where  $P_{max}$  represents the highest price within the IRT, and  $P_{min}$  is the lowest price within the IRT. To estimate daily roundtrip costs, the average of roundtrip costs for different trade sizes on that day is calculated. Quarterly RC measures are the average of all daily estimates per bond and quarter.

Friewald et al. (2012) differentiate between trading activity measures and liquidity measures. Three volume-based activity measures that are considered are quarterly turnover of bonds as well as bond and firm zero trading days. The former is calculated as the cumulative trading volume of a bond per quarter divided by its issue size, both measured in USD. The latter is calculated as the number of actual trading days per bond or firm and quarter relative to the total number of trading days per quarter.

Dick-Nielsen et al. (2012) argue that investors are likely to consider not only the absolute level of bond liquidity but also the possible future level and, consequently, the variability of the liquidity. Similar reasoning applies to returns of corporate bonds, as risk premia may depend on both level and risk of a bond's liquidity. Hence, we follow Dick-Nielsen et al. (2012) and also include the quarterly average standard deviations of the daily Amihud measure and the assumed round-trip costs.

In the initial paper, the authors conduct linear correlation analysis and principal component analysis of all liquidity proxies to see if most of the relevant information in the liquidity proxies can be captured by a few factors. Based on their results, they then construct a factor that loads equally on all four variables, i.e., Amihud, RC, and their standard deviations, which they call  $\lambda$ . In Table 2-13, we exhibit the results of the same analysis based on our sample. The results are virtually identical to the results presented in the original study. The cumulative explained variance of the first three components is 39.8%, 58.1%, and 71.2%, respectively. Dick-Nielsen et al. (2012) report very similar values of 39%, 59%, and 72%,

respectively. The loadings of the first component also paint a very similar picture as in Dick-Nielsen et al. (2012). The first component is dominated by Amihud, RC, and Roll, whereas the second component is driven by volume-based measures such as Bond Zero and Turnover.

Based on these findings, we proceed with calculating our primary liquidity variable  $\lambda$ , formally denoted as:

$$\lambda_t = \sum_{j=1}^4 \tilde{L}_t^j \quad (\text{A-4})$$

We provide descriptive statistics of all liquidity proxies in Table 2-14. The results are virtually identical to Dick-Nielsen et al. (2012). Percentiles of the liquidity variables (Panel A) as well as their correlation (Panel B) are comparable in magnitude for the recent period of 2013 to 2022. Furthermore, we plot the liquidity variables' time series in Figure 2-3.

**Table 2-13: Principal component analysis of liquidity measures.** This table provides the results of a Principal Component Analysis (PCA) of the derived liquidity measures similar to Dick-Nielsen et al. (2012). The first principal component correlates with the Amihud, RC, and Roll (price impact) measures, whereas the second component represents a volume-based measure, i.e., turnover.

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8
Amihud	0.431	-0.133	0.146	0.052	-0.338	0.800	-0.022	0.132
Roll	0.409	-0.297	-0.002	-0.495	0.060	-0.250	-0.647	0.121
Firm Zero	-0.025	-0.292	-0.840	0.171	-0.416	-0.068	-0.025	-0.009
Bond Zero	-0.143	-0.657	-0.115	-0.121	0.593	0.229	0.301	0.161
TO	0.089	0.560	-0.470	-0.530	0.280	0.292	0.113	-0.030
RC	0.460	-0.005	-0.115	0.407	0.395	0.019	-0.112	-0.664
Amihud Risk	0.448	-0.144	0.106	-0.333	-0.261	-0.324	0.669	-0.190
RC Risk	0.454	0.209	-0.116	0.389	0.234	-0.224	0.129	0.682
CEV (%)	39.8	58.1	71.2	79.8	87.8	93.3	97.3	100.0

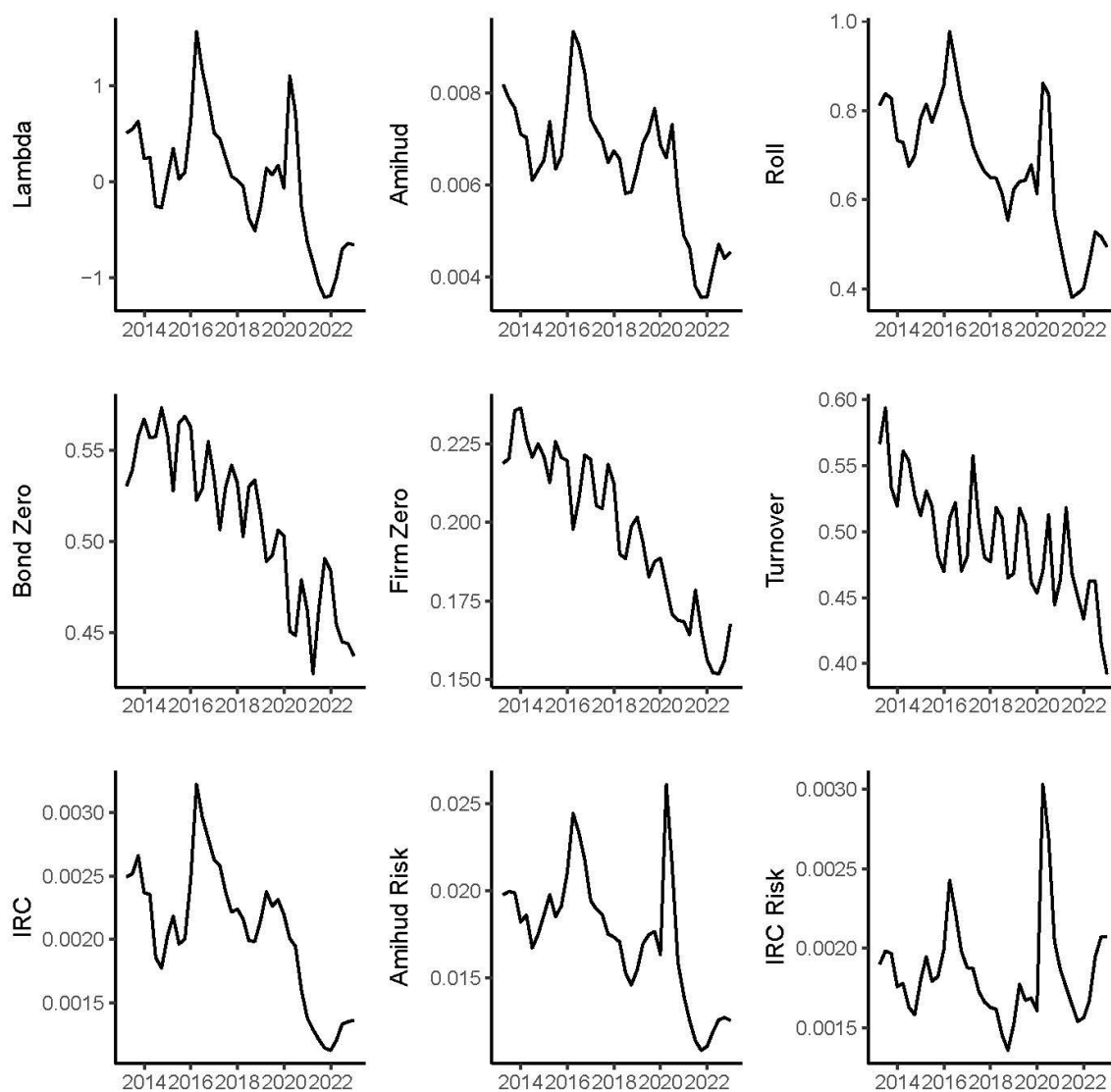
**Table 2-14: Statistics of liquidity proxies.** This table presents statistics of liquidity proxies for corporate bonds. The proxies are calculated quarterly for each bond. Panel A displays percentiles for the different proxies, while Panel B presents the correlations matrix.

Panel A - Liquidity percentiles									
	$\lambda$	Amihud	Roll	Firm Zero	Bond Zero	TO	RC	Amihud Risk	RC Risk
99th	12.314	0.069	2.599	1.000	0.984	0.770	0.012	0.088	0.011
95th	6.346	0.025	1.667	1.000	0.953	0.425	0.006	0.053	0.006
75th	0.839	0.006	0.851	0.194	0.766	0.180	0.002	0.023	0.003
50th	-0.997	0.003	0.521	0.000	0.516	0.092	0.001	0.011	0.001
25th	-2.046	0.001	0.312	0.000	0.254	0.040	0.001	0.005	0.000
5th	-2.879	0.000	0.140	0.000	0.033	0.004	0.000	0.001	0.000
1st	-3.184	0.000	0.073	-0.016	0.000	0.000	0.000	0.000	0.000

Panel B - Correlation									
	$\lambda$	Amihud	Roll	Firm Zero	Bond Zero	TO	RC	Amihud Risk	RC Risk
$\lambda$	1								
Amihud	0.768	1							
Roll	0.619	0.486	1						
Firm Zero	0.000	0.008	0.048	1					
Bond Zero	-0.130	0.042	0.159	0.241	1				
TO	0.095	-0.070	-0.039	-0.071	-0.500	1			
RC	0.853	0.565	0.509	0.052	0.020	0.064	1		
Amihud Risk	0.807	0.583	0.628	-0.015	-0.080	0.016	0.515	1	
RC Risk	0.821	0.369	0.401	-0.041	-0.302	0.234	0.638	0.518	1

**Figure 2-3: Time series of liquidity variables.** This chart shows the time series of liquidity variables across our sample from January 2013 to December 2022 following Dick-Nielsen et al. (2012). Liquidity variables are calculated quarterly for each bond as explained in Appendix A. The cross-sectional mean is plotted for each liquidity variable in each quarter.



## **B Alternative Sampling**

In this section, we present the results as outlined in Table 2-5 based on alternative samples. In Table 2-15, we do not apply any restrictions on trade size, i.e., we also include retail-size trades. For Table 2-16, we set the threshold for identifying retail-sized trades to USD 100,000 as it is common practice in empirical bond research. The results shown in Table 2-17 are based on a subsample of exclusively non-financial firms, that is, excluding firms with a first-digit SIC code of 6. Finally, Table 2-18 presents the results based on the 2004 time series. It should be noted that the sparse data in the earlier part of the sample translates into an average sample size of 47.74, which is much smaller compared to the later part of the sample, resulting in a much lower test power. Lastly, Table 2-19 to Table 2-22 exhibit the test power conditional on bond liquidity as displayed in Table 2-11 and Table 2-12 for alternative liquidity proxies, i.e., Roll and turnover.

**Table 2-15: Size and power tests including retail-sized trades.** This table presents size and power tests of firm-level abnormal standardized returns (ABSR), standardized abnormal returns (SABR), unstandardized abnormal returns (ABR, raw), and ABSR with pre-event period ( $t - 101, t - 6$ ) standard deviation (ABSR-Pre). The tests include the parametric t-test (t), the non-parametric signed-rank test (SR), and the sign test (S). For each test, we show rejection rates (in percent) from 10,000 simulations of 300 firm\*day draws. Panel A shows descriptive statistics of returns in percent. Panel B presents the test size using a two-sided significance level (SL) of 1%. Panel C shows the power tests for artificial positive and negative 15bp shocks. Panel D repeats the power tests for alternative shocks of 10bp and 25bp.

Panel A - Return characteristics						
	Mean	Median	SD	Skew	Kurt	N
ABSR	-0.0008	-0.0037	0.8563	0.0151	1.8889	5,138,467
SABR	-0.0056	-0.0085	1.0511	0.0265	1.4911	5,141,945

Panel B - Size tests						
SL (%)	t		SR		S	
	0.5	99.5	0.5	99.5	0.5	99.5
ABSR	0.24	0.55	0.32	0.44	0.34	0.26
SABR	0.28	0.53	0.42	0.47	0.49	0.30
ABR (raw)	0.19	0.26	0.35	0.57	0.39	0.31
ABSR-Pre	0.25	0.58	0.33	0.60	0.20	0.43

Panel C - Power tests (15bp shocks)						
	t	Negative SR	S	t	Positive SR	S
ABSR	94.05	98.88	98.27	95.31	99.33	98.59
SABR	96.02	99.05	98.22	96.20	99.27	98.02
ABR (raw)	29.27	87.74	94.66	31.78	88.85	94.87
ABSR-Pre	84.47	95.03	93.94	89.28	97.30	95.96

Panel D - Power tests (10bp and 25bp shocks)						
	t	Negative SR	S	t	Positive SR	S
10bp - raw	10.90	51.94	66.10	12.59	54.09	65.46
10bp - stand.	60.59	82.36	81.55	65.03	84.41	82.76
25bp - raw	69.13	99.84	99.97	71.39	99.91	100.00
25bp - stand.	100.00	100.00	100.00	99.99	100.00	100.00

**Table 2-16: Size and power tests excluding trades below USD 100,000.** This table presents size and power tests of firm-level abnormal standardized returns (ABSR), standardized abnormal returns (SABR), unstandardized abnormal returns (ABR, raw), and ABSR with pre-event period ( $t - 101, t - 6$ ) standard deviation (ABSR-Pre). The tests include the parametric t-test (t), the non-parametric signed-rank test (SR), and the sign test (S). For each test, we show rejection rates (in percent) from 10,000 simulations of 300 firm\*day draws. Panel A shows descriptive statistics of returns in percent. Panel B presents the test size using a two-sided significance level (SL) of 1%. Panel C shows the power tests for artificial positive and negative 15bp shocks. Panel D repeats the power tests for alternative shocks of 10bp and 25bp.

Panel A - Return characteristics						
	Mean	Median	SD	Skew	Kurt	N
ABSR	0.0000	-0.0031	0.7908	0.0370	2.6550	2,116,300
SABR	-0.0006	-0.0052	1.0761	0.0467	2.0869	2,118,803

Panel B - Size tests						
SL (%)	t		SR		S	
	0.5	99.5	0.5	99.5	0.5	99.5
ABSR	0.30	0.46	0.39	0.51	0.30	0.34
SABR	0.36	0.50	0.45	0.47	0.31	0.38
ABR (raw)	0.23	0.42	0.35	0.46	0.35	0.38
ABSR-Pre	0.27	0.36	0.42	0.59	0.35	0.42

Panel C - Power tests (15bp shocks)						
	t	Negative SR	S	t	Positive SR	S
ABSR	85.38	94.11	89.92	86.78	94.68	90.23
SABR	84.92	93.70	88.75	86.07	94.22	89.32
ABR (raw)	32.31	78.07	84.78	34.22	81.03	86.17
ABSR-Pre	65.90	81.51	75.00	69.80	85.14	78.46

Panel D - Power tests (10bp and 25bp shocks)						
	t	Negative SR	S	t	Positive SR	S
10bp - raw	12.41	42.18	48.76	14.07	45.01	50.63
10bp - stand.	48.40	67.17	60.97	51.74	68.88	61.22
25bp - raw	70.70	99.11	99.64	70.85	99.23	99.61
25bp - stand.	99.77	99.98	99.63	99.86	99.96	99.78

**Table 2-17: Size and power tests without financial firms.** This table presents size and power tests of firm-level abnormal standardized returns (ABSR), standardized abnormal returns (SABR), unstandardized abnormal returns (ABR, raw), and ABSR with pre-event period ( $t - 101, t - 6$ ) standard deviation (ABSR-Pre). The tests include the parametric t-test (t), the non-parametric signed-rank test (SR), and the sign test (S). For each test, we show rejection rates (in percent) from 10,000 simulations of 300 firm\*day draws. Panel A shows descriptive statistics of returns in percent. Panel B presents the test size using a two-sided significance level (SL) of 1%. Panel C shows the power tests for artificial positive and negative 15bp shocks. Panel D repeats the power tests for alternative shocks of 10bp and 25bp.

Panel A - Return characteristics						
	Mean	Median	SD	Skew	Kurt	N
ABSR	0.0004	-0.0032	0.7986	0.0490	2.4339	2,057,489
SABR	-0.0010	-0.0060	1.0658	0.0486	1.8251	2,059,299

Panel B - Size tests						
SL (%)	t	SR	S	t	SR	S
	0.5	99.5	0.5	99.5	0.5	99.5
ABSR	0.40	0.51	0.52	0.53	0.41	0.49
SABR	0.45	0.45	0.49	0.44	0.50	0.43
ABR (raw)	0.26	0.29	0.45	0.52	0.47	0.37
ABSR-Pre	0.27	0.43	0.35	0.52	0.32	0.42

Panel C - Power tests (15bp shocks)						
	t	Negative SR	S	t	Positive SR	S
ABSR	85.96	95.15	92.26	86.85	95.24	91.83
SABR	86.17	94.64	90.01	86.87	94.69	89.72
ABR (raw)	28.83	77.38	83.46	29.14	78.01	83.90
ABSR-Pre	68.62	84.53	79.24	71.15	86.27	80.73

Panel D - Power tests (10bp and 25bp shocks)						
	t	Negative SR	S	t	Positive SR	S
10bp - raw	11.10	40.27	47.34	11.67	40.97	45.91
10bp - stand.	48.44	67.95	61.90	49.55	67.85	61.10
25bp - raw	66.96	99.02	99.55	66.90	99.25	99.64
25bp - stand.	99.87	99.97	99.85	99.91	99.98	99.78

**Table 2-18: Size and power tests from 2004 to 2022.** This table presents size and power tests of firm-level abnormal standardized returns (ABSR), standardized abnormal returns (SABR), unstandardized abnormal returns (ABR, raw), and ABSR with pre-event period ( $t - 101, t - 6$ ) standard deviation (ABSR-Pre). The tests include the parametric t-test (t), the non-parametric signed-rank test (SR), and the sign test (S). For each test, we show rejection rates (in percent) from 10,000 simulations of 300 firm\*day draws. Panel A shows descriptive statistics of returns in percent. Panel B presents the test size using a two-sided significance level (SL) of 1%. Panel C shows the power tests for artificial positive and negative 15bp shocks. Panel D repeats the power tests for alternative shocks of 10bp and 25bp.

Panel A - Return characteristics						
	Mean	Median	SD	Skew	Kurt	N
ABSR	0.0005	-0.0022	0.8225	0.0191	2.1295	4,348,794
SABR	-0.0033	-0.0057	1.0726	0.0191	1.7107	4,354,046

Panel B - Size tests						
SL (%)	t	SR	S	t	SR	S
	0.5	99.5	0.5	99.5	0.5	99.5
ABSR	0.43	0.47	0.51	0.56	0.31	0.32
SABR	0.60	0.42	0.52	0.50	0.38	0.27
ABR (raw)	0.22	0.32	0.45	0.53	0.35	0.43
ABSR-Pre	0.29	0.48	0.37	0.56	0.21	0.34

Panel C - Power tests (15bp shocks)						
	t	Negative SR	S	t	Positive SR	S
ABSR	62.68	75.97	66.69	65.02	77.50	67.93
SABR	63.60	75.58	64.79	63.99	75.63	64.25
ABR (raw)	17.58	49.84	56.74	19.34	52.00	57.70
ABSR-Pre	45.77	60.70	51.60	49.47	64.29	54.63

Panel D - Power tests (10bp and 25bp shocks)						
	t	Negative SR	S	t	Positive SR	S
10bp - raw	6.60	22.44	26.19	7.35	23.97	26.81
10bp - stand.	29.24	42.51	35.58	31.70	44.08	36.41
25bp - raw	48.81	88.07	91.35	51.31	89.69	92.35
25bp - stand.	96.04	97.90	94.13	96.48	98.15	94.69

**Table 2-19: Test power stratified by liquidity (Roll measure) and maturity for a 15bp shock.** This table reports the test power of the signed-rank test at the 1% significance level (SL) based on bond-level abnormal standardized returns. We group bonds by five liquidity and four time to maturity cut-offs. The test power in Panel A is based on positive 15bp shocks (i.e., we show rejection rates (in percent) from 10,000 simulations of 300 firm\*day draws). Panel B reports the corresponding number of observations.

Panel A - Power test (15bp shocks)				
	1-3 years	3-5 years	5-10 years	> 10 years
High	100.00	100.00	100.00	36.37
2	100.00	100.00	99.97	92.93
3	100.00	100.00	99.91	93.92
4	100.00	99.99	99.53	87.72
Low	100.00	78.50	83.47	64.09

Panel B - Number of observations				
	1-3 years	3-5 years	5-10 years	> 10 years
High	281,698	163,440	176,533	29,355
2	172,274	164,459	229,758	86,404
3	108,522	157,601	249,769	135,208
4	61,149	139,485	281,793	166,208
Low	37,218	88,610	286,949	231,846

**Table 2-20: Test power stratified by liquidity (Roll measure) and rating for a 15bp shock.** This table reports the test power of the signed-rank test at the 1% significance level (SL) based on bond-level abnormal standardized returns. We group bonds by five liquidity and six rating cut-offs. The test power in Panel A is based on positive 15bp shocks (i.e., we show rejection rates (in percent) from 10,000 simulations of 300 firm\*day draws). Panel B reports the corresponding number of observations.

Panel A - Power test (15bp shocks)						
	AAA to AA	A	BAA	BA	B	Below B
High	100.00	100.00	100.00	99.27	80.66	99.84
2	100.00	100.00	100.00	99.75	97.23	80.06
3	100.00	100.00	99.99	99.16	95.91	35.32
4	99.99	100.00	99.71	93.64	75.15	29.90
Low	98.18	98.19	81.70	69.73	43.58	10.41

Panel B - Number of observations						
	AAA to AA	A	BAA	BA	B	Below B
High	56,943	256,968	273,757	43,124	15,879	4,355
2	53,546	217,190	258,801	84,300	33,887	5,171
3	45,294	192,796	258,936	98,459	48,822	6,793
4	43,775	171,048	265,671	111,198	48,193	8,750
Low	30,358	106,744	308,721	123,055	63,694	12,051

**Table 2-21: Test power stratified by liquidity (turnover) and maturity for a 15bp shock.** This table reports the test power of the signed-rank test at the 1% significance level (SL) based on bond-level abnormal standardized returns. We group bonds by five liquidity and four time to maturity cut-offs. The test power in Panel A is based on positive 15bp shocks (i.e., we show rejection rates (in percent) from 10,000 simulations of 300 firm\*day draws). Panel B reports the corresponding number of observations.

Panel A - Power test (15bp shocks)				
	1-3 years	3-5 years	5-10 years	> 10 years
High	100.00	100.00	99.97	84.17
2	100.00	100.00	99.87	82.33
3	100.00	100.00	99.73	78.32
4	100.00	100.00	99.38	78.21
Low	100.00	99.99	98.87	78.93

Panel B - Number of observations				
	1-3 years	3-5 years	5-10 years	> 10 years
High	166,460	165,969	188,040	132,153
2	154,920	150,362	218,659	128,218
3	135,702	140,995	248,887	126,806
4	118,953	138,450	271,586	122,931
Low	86,245	119,973	302,089	143,833

**Table 2-22: Test power stratified by liquidity (turnover) and rating for a 15bp shock.** This table reports the test power of the signed-rank test at the 1% significance level (SL) based on bond-level abnormal standardized returns. We group bonds by five liquidity and six rating cut-offs. The test power in Panel A is based on positive 15bp shocks (i.e., we show rejection rates (in percent) from 10,000 simulations of 300 firm\*day draws). Panel B reports the corresponding number of observations.

Panel A - Power test (15bp shocks)						
	AAA to AA	A	BAA	BA	B	Below B
High	100.00	100.00	100.00	45.13	4.06	0.18
2	100.00	100.00	100.00	92.77	74.12	7.11
3	100.00	100.00	100.00	97.19	91.72	23.15
4	100.00	100.00	99.99	98.89	89.07	26.16
Low	100.00	100.00	99.95	97.53	85.27	89.65

Panel B - Number of observations						
	AAA to AA	A	BAA	BA	B	Below B
High	71,029	269,843	261,926	35,550	12,176	2,098
2	59,056	220,328	273,596	67,029	28,591	3,559
3	46,519	178,203	278,990	97,570	45,641	5,467
4	33,841	154,077	270,859	127,323	57,836	7,984
Low	19,821	125,900	287,772	133,805	66,669	18,173

### **3. The Impact of Dividend Payout Ratio Changes on Bond Market Efficiency**

*This chapter is based on a working paper jointly written with Prof. Dr. Britta Hachenberg and Prof. Dr. Dirk Schiereck. The working paper is available online on SSRN:*

Buschulte, S., Hachenberg, B., & Schiereck, D. (2024). The impact of dividend payout ratio changes on bond market efficiency, *SSRN Working Paper No. 5053307*. <https://dx.doi.org/10.2139/ssrn.5053307>.

#### **3.1 Abstract**

This study investigates the impact of unexpected dividend payout ratio changes on the bond market and their information content for the bond-issuing firm's future performance. Conducting these analyses jointly, we evaluate the explanatory power of wealth transfer, signaling, and information content hypotheses. Our findings show that bondholders react pessimistically to dividend payout ratio changes, irrespective of the direction, indicating sensitivity to firm risk shifts. However, we find no evidence that dividend payout ratio changes provide information on future earnings or profitability changes, challenging the signaling hypothesis. Thus, we provide insights into bond market efficiency, specifically its interpretation of dividend policy changes and associated risks.

#### **3.2 Introduction**

Dividend announcements are widely studied for their effects on market efficiency, as they provide new information that should be rapidly incorporated into security prices. While much of the research has focused on equity markets (e.g., Gordon, 1959; Miller & Modigliani, 1961), recent studies have extended this interest to bond markets (Chen, 2016; Tsai & Wu, 2015; Wei et al., 2020). Bondholders, having fixed-income claims, are particularly impacted by changes in a firm's cash flow allocation. Previous studies often focus on simple dividend changes, overlooking their relationship to the dividend-paying firm's financial stability. However, this perspective is essential for bondholders given their sensitivity to adjustments in firm-level risk. Specifically, unexpected dividend changes can signal shifts in a firm's liquidity and creditworthiness, directly impacting bondholders' risk exposure.

First, we ameliorate this shortcoming of previous research by analyzing bond market reactions to unexpected changes in the dividend payout ratio, which links the dividend distributions directly to earnings. In doing so, it offers a more precise measure of the dividend policy's impact on bondholders. Thus, unexpected dividend payout ratio changes provide a relevant context for examining how efficiently, i.e., accurately and fast, corporate bond markets incorporate information on payout policy changes. Additionally, we consider the degree to which dividend payout ratio changes offer meaningful insights, i.e., information content, about a firm's risk profile and financial stability.

We investigate three established hypotheses regarding investor reactions to dividend announcements: First, the wealth transfer hypothesis interprets an increase/decrease in the dividend payout ratio as a higher/lower cash outflow that disadvantages/advantages bondholders, resulting in negative/positive bond market reactions, while shareholder wealth is enhanced/reduced (Dhillon & Johnson, 1994; Merton, 1974). An increase in the dividend payout ratio can indicate a rise in liquidity and credit risk (Bai et al., 2019). Specifically, a reduced cash flow within the firm, due to a higher dividend payout ratio, can hinder bond principal and interest payments, reduce suitable investments and consequently increase the likelihood of default (Kalay & Loewenstein, 1986). In contrast, the free cash flow hypothesis predicts a positive correlation between dividend payout ratio changes and price changes for both bond- and stockholders as paid-out cash flows cannot be diverted by managers to poor investment opportunities for empire building (Jensen, 1986). Finally, according to the signaling hypothesis a dividend payout ratio increase/decrease is followed by a positive/negative reaction in the bond and stock price since it signals a positive/negative future performance of the firm overall (Woolridge, 1983). It inherently incorporates the reasoning of the information content hypothesis, suggesting that a firm's dividend changes convey information about its prospects (Grullon et al., 2002; Nissim & Ziv, 2001). Hence, we assess bond market reactions to dividend payout ratio changes, showing explanatory power of central hypotheses and offering in-depth insights into bondholders' sensitivity to firm-level risk shifts.

Secondly, we examine the impact of dividend payout ratio changes on the firm's future development. Beyond immediate market reactions, such changes may affect long-term growth and risk profiles. This again is most relevant to bondholders focused on the long-term financial stability of dividend-paying firms. Thus, we investigate how dividend payout ratio changes forecast firm performance, providing bondholders with insight into future growth and stability, as suggested by the signaling hypothesis. Analyzing both, the immediate bond

market reaction around the change and the long-term firm performance, jointly offers a comprehensive perspective on the explanatory power of wealth transfer and signaling hypotheses. Moreover, it allows for a deeper understanding of bondholders' responses and risk assessments related to dividend policy changes.

We use a comprehensive US corporate bond dataset encompassing 2,538 events. While we confirm significant bond market reactions around dividend changes, we do not detect non-linear dividend size-dependent reactions. Analyzing dividend payout ratio changes, our research indicates slightly positive abnormal stock returns (ASR) and negative ABSR, irrespective of the sign of the dividend payout ratio change. Consequently, in the bond market, we observe signaling effects that outweigh wealth transfer effects around dividend payout ratio decreases, whereas wealth transfer effects prevail around dividend payout ratio increases. This underscores bondholders' sensitivity to firm-level risk shifts. Finally, we show that changes in the dividend payout ratio do not provide significant information content on the firm's future earnings or profitability changes, which contravenes the information content hypothesis. Thus, we find no evidence supporting the idea that dividend payout ratio changes signal future firm performance changes, i.e., that the signaling hypothesis is valid.

Overall, we provide an extensive insight into bond market efficiency around dividend announcements, demonstrating how effectively bond prices reflect dividend policy changes and their associated risks.

### **3.3 Related Literature**

In this study, we expand the literature of bond event studies around dividend announcements. The underlying and basic assumption of an event study is the efficient market hypothesis. It was introduced by Fama (1970) and in its semi-strong form describes a market as being efficient if prices reflect all publicly available information. One would expect the efficient market hypothesis to hold more closely for the bond market than for the stock market as fewer behavioral effects of private investors take effect (Barber & Odean, 2008; Brealey et al., 2014). A bond event study enables to determine whether ABR are present and can be gained by bondholders and therefore whether the market under consideration is informationally efficient. A comprehensive overview of bond event study methodology is provided by Maul and Schiereck (2017). An event study is the predominant method to determine whether a certain event causes a change in firm value (Marks & Musumeci, 2017). Miller and Modigliani (1961) show that for a given investment policy and in an efficient market,

a firm's market value is independent of the dividend decision. Thus, in an efficient market no effects are expected around dividend announcements. However, such effects, i.e., abnormal returns, have been shown to be present in the equity market (e.g., Gordon, 1959; Miller & Modigliani, 1961) as well as in the bond market (e.g., Chen, 2016; Tsai & Wu, 2015; Wei et al., 2020).

Three hypotheses exist to explain these effects around dividend announcements, specifically. All three hypotheses elucidate the positive relationship between unexpected dividend changes and stock returns. They differ in explaining a positive vs. negative relationship between unexpected dividend changes and bond returns. However, they are not mutually exclusive, i.e., the effects can dominate each other or cancel each other out for bond returns.

According to the wealth transfer hypothesis or wealth redistribution hypothesis a negative/positive bond price response, but positive/negative stock market response should follow an announcement of a dividend increase/decrease. Shareholders and bondholders are subject to opposing effects. It is supported by e.g., Dhillon and Johnson (1994). The hypothesis follows the prediction of Merton's (1974) option pricing theory stating that an unexpected dividend increase, which is paid out to the shareholders, leads to a reduced cash flow being available within the firm (Tsai & Wu, 2015). The reduced cash flow can hinder the payment of the bond principal and the interest, reduce suitable investments and consequently increase the likelihood of default (Handjinicolaou & Kalay, 1984; Kalay & Loewenstein, 1986). In short, money paid out is no longer accessible to creditors in a situation of financial distress. In contrast, an unexpected dividend decrease leads to more cash remaining in the firm, thus, is a positive change for bondholders. With a dividend increase/decrease riskier bonds, e.g., junior bonds, speculative bonds and bonds with longer maturities, suffer/profit more since the leverage ratio of the firm increases/decreases. Therefore bond returns should be positively correlated with bond seniority and rating, while being negatively correlated with bond maturity and the firm's financial leverage (Chen, 2016). The risk of bonds increases even more if new debt at equal or higher seniority is issued to finance the announced dividend payments (Handjinicolaou & Kalay, 1984). The wealth transfer hypothesis entails an agency conflict. The dividend payouts function as a mechanism of expropriation by shareholders and thus cause a conflict of interest between shareholders and bondholders (Black, 1976; Mathur et al., 2013). Ignoring transaction costs, any profits shareholders realize must be losses of bondholders and vice versa (Maxwell & Stephens, 2003).

Jensen (1986) introduced the free cash flow hypothesis. It stands in contrast to the wealth transfer hypothesis and contends that bond returns increase (not decrease)/decrease (not increase) following the announcement of an unexpected dividend increase/decrease. The free cash flow hypothesis therefore explains a parallel effect for shareholders and bondholders. It is interlinked with the agency theory conflict between managers and shareholders. A dividend that is paid out, reduces the free cash flow of the firm, and thus cannot be used by a manager in poor investment opportunities that might be invested in otherwise. Thus, a paid-out dividend can reduce the risk of empire building by a manager (Tsai & Wu, 2015). Consequently, a dividend increase keeps the firm's free cash flow limited and benefits both shareholders and bondholders, while a dividend decrease might keep more cash within the firm to both shareholders' and bondholders' detriment.

Finally, the signaling hypothesis explains why bond returns increase/decrease with an announced unexpected increase/decrease in the dividend. This finding is supported for the bond market e.g., by Woolridge (1983) and Handjinicolaou and Kalay (1984). A comprehensive overview on the dividend signaling hypothesis is published by Allen and Michaely (2003). The signaling hypothesis states that dividends signal the firm's prospect to their investors (Mathur et al., 2013). It contains the reasoning of the information content hypothesis (Ofer & Natarajan, 1987). Since the signal provides information on the firm as a whole, stock and bond prices will move in the same direction (Maxwell & Stephens, 2003). Dividends themselves contain information about the firm's future cash flow and its current fundamental performance (Miller & Modigliani, 1961). A dividend increase/decrease and signaled higher/lower future cash flow increases/decreases the likelihood that debtholders are paid and therefore carries positive/negative news for bondholders (Michayluk & Zhao, 2010). A dividend increase is interpreted as an optimistic outlook of the management that the firm will achieve higher future earnings and profitability (Grullon et al., 2002). At the same time, a dividend decrease is interpreted as a pessimistic outlook of the firm management on the firm's future performance. These positive/negative news become apparent in an increase/decrease in bond returns around the announcement. In contrast to the wealth transfer hypothesis, bond returns should be negatively correlated with bond seniority and rating and positively with bond maturity and the firm's financial leverage, since a dividend increase/decrease predicts a prosperous/unsuccessful future from which riskier bonds and higher leveraged firms should benefit/suffer more (Chen, 2016).

Reading the information content that the announcement of a dividend change carries, assumes that managers are more informed about the firm's performance than outside

stakeholders (Tsai & Wu, 2015). The information content hypothesis furthermore states that the dividend change implied by a dividend announcement will affect the market value of the firm, which contradicts a perfect capital market (Wei et al., 2020). Some literature confirms that current dividend increases/decreases or initiations/omissions lead to future earnings increases/decreases (e.g., Healy & Palepu, 1988; Nissim & Ziv, 2001). However, there is also literature that does not find evidence that dividend increases/decreases signal higher/lower future earnings and/or profitability (e.g., Benartzi et al., 1997; DeAngelo et al., 1996; Grullon et al., 2005; Watts, 1973). Thus, it is unclear from existent literature whether dividend changes contain information about the firm's future earnings and profitability.

### 3.4 Data and Methodology

#### 3.4.1 Sampling

We analyze stock and bond market efficiency around dividend announcements and thereby examine whether those announcements carry information content for the respective market, using data from January 2013 to December 2022. First, comprehensive data on US over-the-counter corporate bond trades as reported by the National Association of Securities Dealers (NASD) are retrieved from the TRACE database. Daily prices are used as this was shown to be more powerful (Bessembinder et al., 2009). Raw bond returns are defined as:

$$RR_{i,t} = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}} \quad (3-1)$$

with  $P_t$  being the trade-weighted average of all of a bond's prices on day  $t$ . Accrued interest is not considered as it has no significant impact on the results (Bessembinder et al., 2009; Ederington et al., 2015). The described data is sourced and cleaned following Dick-Nielsen (2009, 2014) to reduce potential noise: Solely trades with non-missing data on yield-to-maturity, reported price and entered volume quantity and a trade volume of minimum USD 50,000 are included. The latter serves to exclude retail investors from our sample. We focus on trades within the price range of USD 25 and USD 1,000 and we remove observations where the reported price deviates by more than 10% from the daily median. We further remove all observations with maturities outside of the range of one year to 50 years.

Next, cross-sectional bond characteristics are added from the Mergent FISD. The sample only consists of the most common and most basic bond types: US Corporate Debentures, US Corporate MTN, US Corporate MTN Zero, US Corporate Zero, and US Corporate Bank Note. Senior, unsecured, non-asset-backed and non-defeased bonds are included whereas bonds with secured lease obligations or security pledges are not. Bonds

issued by foreign issuers and Canadian bonds as well as bonds under Rule 144A, private placements and those with given filing dates or settlement dates are excluded. In addition, bonds that are in default or effectively in default, i.e., trading at less than USD 25 per USD 100 par value, are excluded. Furthermore, putable, convertible, pay-in-kind, exchangeable, preferred and perpetual bonds are excluded from the dataset. The retained bonds are all USD-denominated with fixed coupon types and make semi-annual coupon payments. (Scheuch et al., 2023)

Secondly, dividend announcement dates of the US firms that have bonds issued are retrieved from the Center for Research in Security Prices (CRSP) annual stock event file. We do not consider US firms that have a bond issued, however, do not pay a dividend to their shareholders. The following dividend announcement considerations are made to ensure having a meaningful dividend announcement dataset: Only ordinary dividends are considered. Thus, e.g., stock dividends are not investigated since stock dividend announcements often attract gambling retail investors while institutional investors reduce their bond portfolios (Hu et al., 2021). Non-regular dividends, i.e., dividends that are paid extra or special, in interim or non-recurring, as well as dividend announcements made by utility firms (SIC code 49\*\*) or financial firms (SIC code 6\*\*\*) are eliminated (Tsai & Wu, 2015; Woolridge, 1983). Financial firms are excluded since they generally hold a higher leverage, which in this case is not as likely to indicate financial distress as in other industries (Fama & French, 1992). Likewise, any dividend announcement is deleted that is made within three days of another earnings announcement of the firm (Tsai & Wu, 2015). The latter cleaning step eliminates announcements to which reactions of shareholders and bondholders might be confounded by other effects. We furthermore eliminate dividend announcements with a percentage change higher than or equal to 500% to exclude outliers from our sample (Grullon et al., 2002). In parallel to Chen (2016), we differentiate dividend change events into dividend increases and dividend decreases as well as dividend initiations and dividend omissions. Dividend initiations occur when a firm pays a dividend for the very first time or if a dividend is paid after the firm has not paid a dividend for at least five years. In contrast, dividend omissions occur when a bond-offering firm omits a dividend after having paid a dividend for at least three years.

Firm variables, e.g., earnings of the dividend-paying firm, are added from the Compustat annual data file. The annual dataset is used because dividends are usually determined on the basis of annual rather than quarterly earnings (Watts, 1973). Compustat data items are measured in the last fiscal year ending before the dividend announcement year. For the stock

event study, the CRSP daily stock return file from 2013 to 2022 is retrieved. Additionally, the Fama French five factors are added (French, 2024). A precise definition of all variables used throughout the study is provided in Table 3-1.

The final dataset consists of 5,650 distinct bonds which are offered by 573 firms. The firms account for a total of 2,600 dividend announcements that imply a dividend change over the period of 2013 to 2022 (11,982 dividend change events on the bond level). Table 3-2 and Table 3-3 provide an overview on firm characteristics as well as bond characteristics by portraying summary statistics.

The sample overall is comparable with Chen's (2016) sample, however, on average the firms in our sample hold higher assets. In our sample it is apparent that, on average, less firms announcing dividend increases are financially distressed or constrained than firms announcing dividend decreases. Additionally, firms with dividend increases, on average, pay a higher dividend at an average of USD 0.55 per share than firms announcing dividend decreases in the sample period, which pay a dividend of, on average, USD 0.36 per share. Knowing the loss aversion bias it is reasonable that the magnitude of a dividend decrease is larger than the one of a dividend increase and that dividend increases are a lot more numerous than dividend decrease announcements. In addition, Table 3-3 shows that the bonds in our sample have an almost twice as long time to maturity at an average of 14.85 years and that the issued proceeds are comparably higher than for Chen (2016). The sample only includes senior bonds. Bonds with dividend increase announcements have an on average lower coupon rate (3.89% vs. 4.66%) and a slightly higher rating (15.50 vs. 14.39) as compared to bonds with dividend decrease announcements. The reverse holds for bonds with dividend initiations vs. omissions.

Figure 3-1 provides further insights into our dataset by showing the frequency distribution of dividend announcements, which imply a dividend change, over time. As to be expected the downturn of US economic growth in 2015 and the uncertainty of the COVID-19 pandemic beginning in March 2020 is notable with a higher number of announced dividend decreases and slightly lower number of dividend increases as compared to other years of the sample. Generally, however, the announcements are spread out evenly over time. This also holds true over the annual (Panel A) as well as monthly (Panel B) distribution as portrayed in Figure 3-2. Consequently, no clustering problem of the dividend announcements exists. The research approach that applies the introduced dataset and which is used throughout this study is explained in the following.

### 3.4.2 Abnormal Returns

To be able to ascertain whether signaling, free cash flow or wealth transfer effects exist, one must first determine whether a dividend change event influences bond and stock returns. For this purpose, we implement a bond event study approach. To establish cumulative abnormal bond returns, we conduct the following steps: Following Bessembinder et al. (2009), ABR are constructed based on a benchmark approach of matching portfolios that accounts for the two primary bond return risks, credit risk, which inherently includes default risk (proxied by rating) and interest rate risk (proxied by time to maturity). The ABR of bond  $i$  on day  $t$  therefore is calculated as follows:

$$ABR_{i,t} = RR_{i,t} - MR_{i,t} \quad (3-2)$$

where  $MR_{i,t}$  is the return of the matched bond portfolio. This is constructed as the average return of all bonds within one of 13 rating and time-to-maturity classes on day  $t$ . The ratings are split into seven groups based on Moody's rating or if this is unavailable based on Standard & Poor's or Fitch's rating, respectively. The two time-to-maturity classes are chosen to have approximately the same amount of bond returns in each portfolio (May, 2010). Bonds rated "C" are not further subdivided based on maturity.<sup>10</sup> A bond is only included in a portfolio on a certain day if at least five bonds within each rating and time-to-maturity class exist for a matched portfolio to be created (Ederington et al., 2015). To avoid a bias towards larger firms, we apply the firm-level approach based on Bessembinder et al. (2009). Therefore, ABR of multiple bonds issued by a single firm are aggregated to the firm level by weighing each bond's trade volume:

$$ABR_{f,t} = \sum_{i=1}^k ABR_{i,t} * \omega_i \quad (3-3)$$

where  $k$  is the number of bonds issued by firm  $f$  and  $\omega$  is the ratio of bond  $i$ 's trade volume to the total trade volume of all bonds within firm  $f$  on the certain day  $t$ . We deliberately apply a value-weighted approach since equally-weighted approaches overestimate the price reaction of smaller bonds. Value-weighted approaches on the other hand tend to lead to downward shifted t-statistics since bonds from the same firm are not perfectly correlated (Eberhart & Siddique, 2002). Thus results are, if anything, more robust than shown based on the applied value-weighted firm level. Consequently, the following analyses are conducted on the firm level. To achieve more powerful and reliable results in the following statistic tests

<sup>10</sup> We deliberately choose a different, yet equally well-established, matched portfolio approach compared to Chapter 2.3 to enhance comparability within the dividend announcement bond event study literature.

as proposed by Ederington et al. (2015), ABR are standardized to reduce the bond return's cross-sectional heteroskedasticity:

$$ABSR_{i,t} = SRR_{i,t} - SMR_{i,t} \quad (3-4)$$

with  $SRR_{i,t}$  being the bond's  $RR_{i,t}$  divided by the bond raw returns' time-series standard deviation over the period of  $(t - 55, t - 6)$  and  $(t + 6, t + 55)$ . At least six return observations are required over this period to determine a standard deviation and consequently ABSR (Ederington et al., 2015).  $SMR_{i,t}$  is calculated as the average of the  $SRR_{i,t}$  of all bonds within each rating and time-to-maturity class (Ederington et al., 2015). ABSR are again aggregated to the firm level in the same way as the ABR.<sup>11</sup>

In addition, a stock event study analysis is conducted. ASR are estimated using the Fama French five-factor model with an estimation window of  $(t - 60, t - 31)$ , ending the day before the first event period day and following the equation:

$$ASR_t = a + b(R_{Mt} - R_{Ft}) + s * SMB_t + h * HML_t + r * RMW_t + c * CMA_t + \epsilon_t \quad (3-5)$$

with  $R_{Mt}$  being the return on the value-weighted market portfolio,  $R_{Ft}$  the riskfree return,  $SMB_t$  the difference in returns of diversified portfolios of small and big stocks,  $HML_t$  the difference in returns of diversified portfolios of high and low book-to-market value stocks,  $RMW_t$  the difference in returns of diversified portfolios of stocks with robust and weak profitability and  $CMA_t$  the difference in returns of diversified portfolios of stocks of low and high investment firms (i.e., conservative and aggressive firms). Finally,  $\epsilon_t$  is the zero-mean residual. (Fama & French, 2015)

Removing missing  $ABR_{f,t}$  and  $ABSR_{f,t}$  leads to a reduced data sample of 2,538 dividend change events.  $ASR_t$  are available for 3,000 dividend change events. Table 3-4 provides descriptive statistics for the three firm-level abnormal return measures  $ABR_{f,t}$ ,  $ABSR_{f,t}$  and  $ASR_t$ . All three measures have a mean close to zero over the total considered period of  $(t - 30, t + 30)$ . However, they all portray a very high kurtosis, which is why we winsorize them at the 1st- and 99th-percentile, respectively. Panel B shows that this, as anticipated, decreases the kurtosis significantly. As winsorizing likely increases the statistic power of the test (see Section 2.4), all further analyses are conducted based on the winsorized abnormal return measures.

<sup>11</sup> This chapter considers only ABSR to avoid unnecessarily lengthy explanations and large tables. However, the findings are not expected to differ significantly if SABR were used in the following analyses.

### 3.4.3 Unexpected Dividend Changes

Dividends serve as payout mechanism and multiple models have been proposed to infer the unexpected dividend change (Allen & Michaely, 2003; Fama & Babiak, 1968; Lintner, 1956). The naïve model states that the best prediction for a dividend in time  $t$  made at time  $t - 1$  is the dividend paid in  $t - 1$  (Aharony & Swary, 1980; Handjinicolaou, 1983):

$$\text{Unexpected dividend change}_{naive,t} = \text{dividend}_t - \text{dividend}_{t-1} \quad (3-6)$$

Another model approximates the unexpected dividend change as the simple percentage change between the current and previous dividend payment:

$$\text{Unexpected dividend change}_t = D_t^U = \frac{\text{dividend}_t - \text{dividend}_{t-1}}{\text{dividend}_{t-1}} \quad (3-7)$$

(Cooper & Lambertides, 2018; Grullon et al., 2002; Tsai & Wu, 2015).

Lastly, an expectation model proposes a dividend change which is standardized by the stock price at the month end prior to the announcement:

$$\text{Unexpected dividend change}_{standardized,t} = \frac{\text{dividend}_t - \text{dividend}_{t-1}}{\text{stock price}_{previous\ month\ end}} \quad (3-8)$$

(Wei et al., 2020). Alternatively, the unexpected dividend change can be calculated using the market's expectation of the dividend change e.g., a forecast made by Value Line shortly before a considered dividend announcement (Woolridge, 1983). The dividend declaration date is defined as event date. Event windows are constructed to capture effects in the pre-event period, in the two days leading up to the event, immediately surrounding the individual event and in the post-event period up to 30 days after the event. Cumulative abnormal returns (CAR) are calculated as the sum of the ABR or ABSR per firm or ASR, respectively, over the chosen event windows.

### 3.5 Bond Market Reaction to Dividend Changes

First, we analyze whether dividend announcement information is efficiently and quickly reflected in the bond market. This allows our sample to be placed in the context of previous studies. More specifically, it is tested whether abnormal returns exist on and around an announcement date of a dividend change, i.e., the semi-strong form of market efficiency (Fama, 1970). Univariate regressions are conducted using CAR of bonds and stocks, respectively, over the event windows as a dependent variable and the unexpected dividend change as explanatory variable, in parallel to Chen (2016). Thus, it is checked whether the mean of the CAR is different from zero within the event windows:

$$CAR = \alpha + \beta_1 * D^U + \epsilon_i \quad (3-9)$$

$D^U$  represents the unexpected dividend change and is defined as shown in Equation 3-7. Partitioned samples of dividend decreases vs. dividend increases as well as dividend omissions vs. dividend initiations are used. The samples are based on the economic model of the effects of the event (negative vs. positive) and thus can reduce return variances. Since this reduced variance can improve the reliability of the tests, the following regressions will be conducted in these subsamples. (Brown & Warner, 1985)

### 3.5.1 Dividend Changes

Table 3-5 shows the findings on bond returns for ABR and ABSR. While for ABR (Panel A) no ABR are noticeable in the three days on and around the dividend announcement date and most other periods under review, significant non-zero effects exist for ABSR (Panel B). Significant but close to zero ABR immediately around dividend increases in Panel A could be caused by signaling and wealth effects that cancel each other out. For both, dividend decreases and increases in Panel B, substantial and highly significant negative ABSR exist in the period  $(t - 30, t - 5)$  prior to the change announcement. Investors seem to anticipate negative information with the upcoming announcement of a dividend change, regardless of the sign of the change. For dividend decreases no relevant information seems to reach the market on the three days on and around the announcement. Contrary to this, we find a negative and highly significant CAR coefficient of -0.039 for dividend increase announcements. Thus, a dividend increase gives a negative but minor information to bondholders. This is consistent with the wealth transfer hypothesis and stands in contrast to the findings of Chen (2016) on ABR. After a dividend decrease announcement the ABSR are positive at 0.132, as predicted by the wealth transfer hypothesis, since a dividend decrease reduces the cash outflow which is positive news to the bondholder. After a dividend increase announcement the negative information content persists and is even higher and economically significant in magnitude. This indicates that some information content of the dividend decrease or increase announcement is only absorbed in the following days. Thus, the corporate bond market is not fully informationally efficient.

Overall, it appears that bond investors anticipate information of upcoming dividend announcements up to 30 days prior. A dividend change, independent of the sign of the change, is anticipated to be a negative event by the bond market. However, the bond market response immediately prior, around and after dividend announcements is consistent with the

wealth transfer hypothesis. This suggests that wealth transfer effects exist solely or at least outweigh signaling or free cash flow effects. Comparatively, Bernhardt et al. (2005) show that the signaling hypothesis cannot explain the dividend policy of firms. If these findings prove to be robust in the following analyses, the wealth transfer hypothesis seems to offer a suitable explanation of the bond market response just before, around and after a dividend change.

Table 3-22 shows that these findings are generally robust to the alternative  $D^U$  measures naïve unexpected dividend change and standardized unexpected dividend change as shown in Equations 3-6 and 3-8. Since the ABSR reduce heteroskedasticity of the bond returns and consequently offer more robust results, all following analyses will be conducted based on ABSR (Ederington et al., 2015).

### 3.5.2 Risk Characteristics

Bond price responses should be more pronounced with increased bond riskiness. For example, if the wealth transfer hypothesis holds, a riskier bond should suffer/benefit more from dividend increases/decreases. In the following, the sample is split by different bond characteristics determining riskiness, i.e., bond rating (Tsai & Wu, 2015; Wei et al., 2020), financial distress and financial constraint of the firm (Chen, 2016), and the previous analysis to check the wealth transfer and signaling effects is repeated.

The following dummy variables are used in Table 3-6 to define the respective sample split: Rating is a dummy variable set to one if the bond is investment-rated and zero otherwise. Financially unconstrained is a dummy variable set to one if the firm does not face restricted long-term leverage and zero otherwise (Chen, 2016). Finally, financially non-distressed is a dummy variable set to one if the modified Altman's (1968) Z-score of the firm is in the top tercile within a fiscal year and zero otherwise (van Binsbergen et al., 2010). We provide a precise definition of these variables in Table 3-1.

We find that for dividend decreases riskier bonds react more negative in the pre-event period of  $(t - 30, t - 5)$ , independent of the measure of riskiness applied. The difference is up to 0.494 in the coefficients between the riskier and less risky bonds. Likely, a closer monitoring of these riskier bonds especially in anticipation of a dividend decrease, i.e., potentially a signal of a struggling firm, leads to a greater magnitude reaction. For dividend increase announcements we find that less risky bonds mostly have stronger ABSR over the same period. Immediately around dividend decrease announcements riskier bonds have

significantly more positive ABSR. This effect amounts to 0.214 for speculative bonds, 0.149 for bonds issued by financially constrained firms and 0.121 for bonds issued by financially distressed firms. A dividend decrease appears to be a more positive signal for riskier bonds that face a higher risk of default. Thus, even though not significant in the overall sample, the finding of a significant and positive coefficient for riskier bonds around dividend decreases is consistent with the wealth transfer hypothesis. The effect is not as clear for dividend increase announcements. Speculative bonds suffer more from dividend increases, which again supports the wealth transfer hypothesis. For bonds issued by financially constrained or distressed firms we find the opposite effect or no significant effect.

### 3.5.3 Dividend Omissions and Initiations

More extreme reactions of bondholders should not only occur for riskier bonds, but also around more extreme announcements. Subsequently, bond market responses around dividend omission and initiation announcements are captured.

Comparable to dividend decrease and increase announcements, an effect preceding the actual announcement is evident in Table 3-7. In the period  $(t - 30, t - 5)$  positive and significant ABSR exist before dividend omissions, while negative and significant ABSR are visible before dividend initiations. This positive reaction of bondholders before a reduced spending of the firm and negative reaction of new cash outflows, i.e., a dividend initiation, is fully consistent with the wealth transfer hypothesis. In addition, the reaction around omission announcements is stronger than around initiations. An announced omission of dividends might be an indicator that the risk of default is increasing which is more critical information to bondholders than a dividend initiation.

This effect persists into the period of  $(t - 4, t - 2)$ , however, does not remain significant. Immediately around the announcement there is no significant ABSR for either omissions or initiations. The insignificant effect around dividend initiation announcements is consistent with findings of Dhillon and Johnson (1994) and Chen (2016). As already observed for dividend decreases and increases but reinforced by our findings for dividend omissions and initiations, a part of the reaction to dividend changes in the bond market precedes the actual announcement. Institutional investors appear to recognize changes before an announcement.<sup>12</sup> This is in line with findings of Fung et al. (2024) who show that institutions

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<sup>12</sup> The bond market is mainly invested in by institutional investors. In addition, we exclude trades of less than USD 50,000, which further eliminates impacts from the few retail investors.

possess advantages over individual investors in information acquisition and processing. An alternative explanation is that these investors receive information early from other sources or that announcements with interaction effects to the dividend announcement exist (Kane et al., 1984).

In the days following the announcement,  $(t + 2, t + 30)$ , a correction effect, i.e., economically relevant and highly significant negative ABSR, is visible for dividend omissions. The omission announcement itself potentially offers new information of which the full extent and impact is only then realized by investors and was not anticipated. For example, the information released at the omission could hint that the dividend is omitted due to liquidity issues of the firm. In line with the signaling hypothesis, this would provide negative information to bondholders about the firm's future performance. After dividend initiation announcements, the reaction of the bond market is not reversed but continues to be negative. Moreover, the magnitude is much larger with a coefficient of -0.697 as compared to -0.173 in the period of  $(t - 30, t - 5)$  preceding the announcement. Consequently, the dividend initiation announcement appears to include important additional or new information, compared to more than five days before the announcement, which is absorbed by the market afterwards. Again, the bond market is not fully informationally efficient. In contrast to dividend increase/decrease announcements, the majority of the bond market reaction for dividend initiations/omissions does not happen before the announcement but following it.

Table 3-23, Table 3-24 and Table 3-25 present all analyses conducted so far using the non-parametric Wilcoxon signed-rank test instead of the parametric t-test. The findings are slightly more significant, nevertheless, except for a few deviations around dividend decrease announcements the appendices show the same findings for ABSR. Thus, the findings are robust regarding the statistic test and the conclusion remains the same.

In summary, we find negative ABSR around dividend increase announcement and more positive ABSR for riskier bonds around dividend decreases. In addition, we find positive ABSR preceding dividend omission and negative ABSR preceding dividend initiation announcements. Consequently, if these findings prove robust, the wealth transfer effects seem to play a central role for bond returns around dividend changes. Nevertheless, our findings suggest that the wealth transfer hypothesis cannot be the all-explaining effect.

### 3.5.4 Stock Market Reaction

Table 3-8 compares the previous findings of the bond market to the stock market reaction around dividend changes. Panel B shows that the stock market reaction around dividend decreases is not negative, as would be expected and is shown e.g., by Chen (2016) amongst many others, but highly significant and slightly positive. Nevertheless, the reaction around a dividend increase announcement is highly significant as well and more positive. Around both change announcement types the reaction is consistently visible from the period  $(t - 30, t - 5)$  until  $(t + 2, t + 30)$ . We detect the smallest ASR just before and around the announcement, which is comparable to the bond market that also shows the reaction with the largest magnitude in advance and after the announcement. However, while the bond market most often does not portray a significant reaction at the announcement, yet only after the announcement, the stock market does. Potentially this is driven by the fact that the bond market, due to its illiquidity, is slower in responding to news than the stock market.

Around dividend omission and initiation announcements in Panel D the stock market response remains positive and more positive at the dividend initiation announcement. At the periods  $(t - 30, t - 5)$  and  $(t + 2, t + 30)$ , however, the stock market reaction is more positive around dividend omissions.<sup>13</sup> Notably, the magnitude of all ASR around the dividend announcements, that imply a dividend change, is very small. In contrast to bondholders, shareholders overall seem to view dividend changes as favorable news.

### 3.5.5 Bond and Firm Characteristics

Given the complex nature and various features of bonds, determinants of bond price reactions should be taken into consideration before reaching a final assessment and considering an explanation or a hypothesis as valid (Wei et al., 2020). Consequently, we ratify in how far CAR of bonds immediately around dividend changes can be explained by bond-specific and bond-issuing firm characteristics. Thus, multivariate regressions following Chen (2016) are established:

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<sup>13</sup> Our findings are robust to applying the Fama French three-factor model as done by e.g., Chen (2016), as opposed to the Fama French five-factor model which we use.

$$\begin{aligned}
 CAR = & \alpha + \beta_1 * D^U + \beta_2 * \text{Senior indicator} + \\
 & \beta_3 * D^U * \text{Senior indicator} + \beta_4 * \text{Investment indicator} + \\
 & \beta_5 * D^U * \text{Investment indicator} + \beta_6 * \text{Maturity} + \beta_7 * D^U * \text{Maturity} + \\
 & \beta_8 * \text{Financial leverage} + \beta_9 * D^U * \text{Financial leverage} + \\
 & \beta_{10} * \text{Financially unconstrained indicator} + \\
 & \beta_{11} * D^U * \text{Financially unconstrained indicator} + \\
 & \beta_{12} * \text{Non-distressed indicator} + \\
 & \beta_{13} * D^U * \text{Non-distressed indicator} + \epsilon
 \end{aligned}
 \tag{3-10}$$

The bond characteristics seniority, rating and maturity are considered. Next to that, financial leverage and financial distress as well as financial constraint are included to examine firm-specific effects with risk relevance. Again, we provide a detailed explanation of the construction of all variables in Table 3-1. Interaction terms between  $D^U$  and all bond as well as firm characteristics are added since changes of bond prices around dividend change events may be influenced by bond characteristics, e.g., the bond's rating. In order to check whether all of the explanatory variables can be used jointly, the correlations between them are examined. Therefore, Spearman's rank correlation coefficients are presented in Table 3-9.

As the individual bond and firm variables do not show high correlation coefficients, we should not face problems forthcoming due to multicollinearity even when using all variables in one regression. Some of the interaction variables are an exception. Besides as given by their nature being highly correlated with  $D^U$ ,  $D^U$ \*financially unconstrained is highly correlated with other interaction variables. Thus, all variables that represent the financial situation of the bond-issuing firm are added individually in consecutive regressions. Table 3-10 shows the results to these multivariate regressions for the event window  $(t - 1, t + 1)$ .

With an increasing number of explanatory variables included from Model 1 to Model 4, the coefficient of  $D^U$  tends toward being more positive around dividend decrease announcements and being increasingly negative around dividend increase announcements. The positive/negative  $D^U$  coefficient at dividend decreases/increases is consistent with the wealth transfer hypothesis. However, these coefficients are not significant. Additionally, none of the explanatory variables offers a significant coefficient in Model 4 around dividend decreases. On the other hand, the ABSR around dividend increase announcements are significant and when considering all examined control variables, three of them provide explanatory value. The significant negative coefficient of  $D^U$ \*investment indicator states that bondholders of investment-grade bonds will benefit less from a dividend increase compared

to bondholders of speculative bonds and thus react more negative to dividend increases as the size of the increase rises. This is consistent with signaling or free cash flow effects overweighing wealth transfer effects. In parallel, we find in Table 3-6 that bondholders of firms that are not in financial distress react more negative immediately around dividend increase announcements, which is consistent with the negative and highly significant coefficient of the non-distressed indicator. Again, this cannot be explained by the wealth transfer hypothesis in isolation.

In conclusion, we find a negative anticipation of the bond market up to five days before dividend announcements that imply a dividend change. Around dividend changes, we find a positive/negative bond market reaction to dividend decreases/increases which is consistent with prevailing wealth transfer effects. These findings can be confirmed for dividend initiations, however, dividend omissions show an unclear picture of effects. Riskier bonds show a significant and positive coefficient immediately around dividend decreases which is consistent with the wealth transfer hypothesis. The stock market shows a positive response for dividend decrease/omission announcements in our sample and a slightly more positive effect at dividend increase/initiation announcements. When controlling for bond and firm-specific variables,  $D^U$  turns insignificant for dividend increase and decrease announcements. Hence, no new information seems to be entailed in the dividend change for the three days immediately around the announcement or it is not dispersed in the market quickly enough to be visible in ABSR within three days.

### **3.6 Non-Linear Reaction Based on Size**

As seen in the previous section the wealth transfer hypothesis does not seem to offer a sole explanation of the bond market reaction to dividend change events. Potentially, not finding a clear explanation is driven by the fact that bondholders have a non-linear reaction to dividend announcements. On the one hand, signaling effects are more likely to occur in small and relatively unknown firms for which little information is available at the financial market and concurrently those small firms are more likely to offer small dividends only (DeAngelo et al., 2004). On the other hand, wealth transfer effects could overweigh in firms that pay high dividends. Bondholders in this case are worried about the higher amount of cash outflows, potentially increasing their risk of payback. Dhillon and Johnson (1994), e.g., find confirmation for the wealth transfer hypothesis when analyzing only large dividends. Mathur et al. (2013) show that the bond market reaction is positive/negative to a dividend increase/decrease as

long as the dividend yield is below a certain threshold. In this case bondholders consider an increase/decrease in the paid dividend as a positive/negative signal about the firm's future earnings. At the same time, the reaction is shown to be reversed (positive/negative for dividend decrease/increase) for a high dividend (Mathur et al., 2013). Based on these considerations, a more refined analysis of bondholder reactions by the size of the paid dividend is warranted.

Following the univariate analysis as in Table 3-5, but splitting the sample into an equal number of large and small dividends that are paid on the same announcement date, we check whether we can detect a prevailing signaling effect for small and wealth transfer effect for large dividends. Table 3-11 shows that bondholders have a more negative anticipation in period  $(t - 30, t - 5)$  of dividend decreases for small dividends. This is as expected. However, this effect reverses after the dividend decrease announcement itself. Next to that, the large dividend bondholders do not portray a positive reaction, but rather a negative reaction around a dividend decrease, which is consistent with the signaling hypothesis. Around dividend increase announcements, bondholders of firms that pay large and small dividends perceive the increase as negative. In case large dividends are paid, increase announcements are perceived even more negative up to five days before, during and after the event.

Overall, we find a reaction before and after dividend decrease announcement which can partly be explained by the signaling hypothesis, while we find a clear negative reaction around dividend increases consistent with the wealth transfer hypothesis. Additionally, the reaction for large dividends around dividend increase announcements is mainly more negative than for small dividends, which further supports the wealth transfer hypothesis. However, there is no clear distinction in effects between large and small dividend-paying bonds around either dividend change. As a result, we do not find a non-linear reaction to dividend announcements that imply a dividend change based on the size of the dividend paid.

### **3.7 Bond Market Reaction to Dividend Payout Ratio Changes**

So far, we examined the market reaction to an unexpected dividend change. While this unexpected dividend change is a relevant measure for e.g., shareholder that are interested in their current income from investments, it is not as informative about the dividend-paying firm holistically. The dividend payout ratio, in contrast, provides insights not only into the firm's dividend policy, but also in its financial stability since it links the paid dividend to the firm's

earnings. The dividend payout ratio is thereby equally easily accessible information as the dividend amount. A consistent dividend payout ratio shows that the firm is committed to maintaining its dividend payments, which can be seen as a sign of financial stability and therefore is relevant for investors that are interested in the long-term success of their investment. This is the case for most bondholders. Moreover, the change in the dividend payout ratio is important for a firm's management e.g., for cash flow steering, since it offers transparency on the impact of dividends (Miller & Modigliani, 1961). An overly high dividend payout ratio indicates that a dividend payment leaves the firm with less cash to cover interest payments, which a high dividend itself cannot indicate. Specifically, a high dividend increase could be accompanied by an equally large increase in earnings per share (EPS), which in turn does not decrease the firm's cash flow. A very high dividend payout ratio may also raise concerns in shareholders and bondholders about the firm's ability to reinvest in growth or withstand economic downturns in general and thus impact their portfolio construction (Miller & Modigliani, 1961).

In conclusion, the dividend payout ratio is likely the more relevant key figure for the long-term financial analysis and risk assessment of bondholders and allows a more direct observation of the validity of the hypotheses. Thus, we apply the percentage change in the dividend payout ratio as a proxy for the unexpected dividend payout ratio change instead of the  $D^U$  as explanatory variable. It is defined as:

$$\text{Dividend payout ratio change}_t = \frac{\text{Dividend payout ratio}_t - \text{Dividend payout ratio}_{t-1}}{\text{Dividend payout ratio}_{t-1}} \quad (3-11)$$

Table 3-12 portrays summary statistics of the dividend payout ratio and dividend payout ratio changes. Clearly, the number of dividend payout ratio decreases is very high as opposed to the other dividend payout ratio changes. Considering dividend payout ratio changes, decreases occur more frequently than dividend increases since e.g., a dividend increase that happens simultaneously to a sufficiently large increase in firm earnings can result in a dividend payout ratio decrease. Thus, managers do not seem to increase dividends at the same magnitude or pace as their firm earnings increase.<sup>14</sup>

### 3.7.1 Dividend Payout Ratio Changes

Table 3-13 shows the relationship of a change in the dividend payout ratio and the CAR of different event periods around the change. The findings confirm the negative and highly

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<sup>14</sup> In this research we do not further distinguish whether a dividend payout ratio change is caused by a change in dividend, caused by a change in earnings or both at different intensities.

significant reaction of bondholders up to five days before both decrease and increase announcements. For dividend payout ratio increases bondholders react negatively, cautiously at the event with a CAR of -0.064 and somewhat more strongly in the days afterwards with a CAR of -0.743. The negative reaction of bondholders proves to be persistent when analyzing dividend payout ratio increases as opposed to dividend increases. Thus, for increase changes wealth transfer effects prevail. The reaction of bondholders around dividend payout ratio decreases differs from the reaction around dividend decreases. Over the full period of  $(t - 30, t + 30)$  we find a negative and highly significant CAR of ABSR of up to -0.377. Bondholders react negatively to dividend payout ratio decreases potentially seeing a decrease as a reduced outlook on future earnings and profitability potential. Thus, for dividend payout ratio decrease changes signaling effects prevail. The finding, that dividend changes are anticipated as negative information to the bond market from Section 3.5, can be generalized by looking at dividend payout ratio changes: The bond market considers dividend payout ratio changes as negative news and does so irrespective of the sign of the change.

### 3.7.2 Risk Characteristics

If bondholders show a significant reaction around dividend payout ratio decreases, it is negative for risky bonds, i.e., speculative bonds and bonds from financially constrained or financially distressed firms. As just described, this is consistent with the signaling hypothesis. Contrary to the signaling effect, lower risk bonds portray higher negative coefficients, i.e., bondholders consider a decrease as negative since they profit less from a reduced cash outflow compared to bondholders of riskier bonds. We find a more diverse picture of bondholder reactions around dividend payout ratio increases compared to dividend payout ratio decreases, when looking at the risk-based subsamples (see Table 3-14). However, the results on dividend payout ratio increases are less significant than those on dividend increases (Table 3-5), which might be at least partially due to the lower number of observations for dividend payout ratio increases. The bond market response around dividend omissions and dividend initiations stays the same as their definition does not change when looking at dividend payout ratio changes.

Table 3-26 shows that the overall stock market response remains the same when looking at dividend payout ratio changes as compared to simple dividend changes

(Table 3-8). Thus, we detect that based on our data the stock market sees any dividend or dividend payout ratio change as favorable news.

### 3.7.3 Bond and Firm Characteristics

Table 3-15 shows the results of multivariate regressions following Equation 3-10 but using dividend payout ratio changes instead of  $D^U$ . The dividend payout ratio change does not have explanatory power immediately around dividend payout ratio decreases. Financial leverage and its interaction term as well as the interaction term with financial distress have positive and significant coefficients. In contrast, the interaction term with financial constraint has a negative coefficient. Around dividend payout ratio increases, the dividend payout ratio change is significant and positive at a small magnitude of 0.030 when considering all explanatory variables. This is in line with prevailing signaling or free cash flow effects. Furthermore, it stands in contrast to the findings of Table 3-10 on dividend increases since a significant predictive power of dividend payout ratio increases remains when including control variables. The previously seen negative reaction of bondholders around dividend (payout ratio) changes is at least partly caused by bond and firm-specific characteristics at the announcement date. Considering dividend payout ratio increases more independent variables carry explanatory value as opposed to dividend payout ratio decreases, however, the evidence is mixed. On the one hand, higher financial leverage, i.e., a higher risk at the firm level, causes a greater positive reaction, which is logical if an increase signals that future earnings increase. On the other hand, the interaction term with financial leverage shows that with a higher increase in the dividend payout ratio change, the bondholders react more negative. Given an increased risk bondholders suffer more from this higher increase in dividend payout ratio, which is consistent with the wealth transfer hypothesis. Overall, the chosen independent variables have explanatory power for the dividend payout ratio changes and both wealth transfer and signaling effects play a role.

In conclusion, the interaction of the two opposing effects in the bond market become clearer when looking at dividend payout ratio changes instead of dividend changes. While the wealth transfer hypothesis provides the stronger explanation around dividend payout ratio increases and initiations as well as before dividend payout ratio omissions, the signaling or free cash flow hypothesis weighs stronger around dividend payout ratio decreases and after omissions. Thus, we detect that bondholders perceive dividend payout ratio reductions as a negative signal of the firm's future and dividend payout ratio enhancements as negative e.g.,

since it reduces the cash flow available within the firm. Our findings of negative ABSR around dividend payout ratio changes indicate that bondholders pessimistically view dividend payout ratio change events as negative news independent of the sign of the change. Shareholders perceive the change announcements as favorable news. However, much of the described negative reaction of bondholders can be explained by bond and firm-specific characteristics and thus seems to not be brought about by a dividend payout ratio change event itself. This is in line with findings of Brav et al. (2005) that managers do not actively use dividends as a signaling device. Nevertheless, we show that small and significant ABSR exist immediately around dividend payout ratio increases even after controlling for bond and firm-specific characteristics. Thus, signaling or free cash flow effects are present.

Given this positive and significant bond market response around dividend payout ratio increases it is questionable whether signaling effects can indeed explain this ABSR and similarly whether these announcements contain information about the firm's future as predicted by the information content hypothesis. Consequently, we analyze the impact of dividend payout ratio changes on future earnings and profitability changes in the next section.

### **3.8 Impact on Firm Prospects**

Having looked at dividend payout ratio changes that directly set the paid-out dividend in relation to the firm's EPS, we find that bondholders have a positive reaction immediately around dividend payout ratio increases when controlling for bond and bond-issuing characteristics. This is consistent with the signaling hypothesis stating that an unexpected dividend payout ratio increase signals positive news about the development of future cash flows and earnings (Ofar & Natarajan, 1987). The information content hypothesis, which is entailed in the signaling hypothesis, states that an unexpected dividend payout ratio change provides information about the longer-term development of the firm to the market. If the hypothesis holds, a negative/positive unexpected dividend payout ratio change should be followed by a negative/positive change in earnings and profitability (Charitou et al., 2011; Grullon et al., 2002). Moreover, the larger the dividend payout ratio increase/decrease the larger/smaller unexpected earnings should be in the following years (Benartzi et al., 1997). Healy and Palepu (1988) and Nissim and Ziv (2001) confirm that current dividend changes or initiations/omissions are positively related to earnings changes in the years after the dividend announcement. In contrast, Benartzi et al. (1997) discover that dividend changes play a minimal role in explaining the strong existent link between dividend changes and

earnings. In addition, Watts (1973) and DeAngelo et al. (1996), amongst others, identify only very little or no impact of dividend changes on future earnings. Furthermore, Grullon et al. (2002) present evidence contradicting the hypothesis that a dividend change is followed by a change in earnings and profitability in the same direction. Finally, Grullon et al. (2005) find that dividend changes are negatively correlated with future changes in profitability.

We examine this future firm performance alongside the short-term bondholder reaction analyzed in Section 3.7 to gain a deeper understanding of bondholders' responses and risk assessments related to dividend policy changes. Thus, we evaluate whether dividend payout ratio changes contain information about the firm's future earnings and profitability changes and likewise whether the information content hypothesis can be confirmed. Table 3-16 provides summary statistics on key variables needed to determine the relation of dividend payout ratio changes and the firm's prospect.  $DPC_t$  represents a dummy variable that equals one for dividend increases and zero otherwise, while  $DNC_t$  is the same for dividend decreases. As to be expected  $DPC$ \*annualized dividend payout ratio change is close to zero since, as seen above, our sample includes very few dividend payout ratio increases. Thus, few instances exist in which the dividend payout ratio change is larger than zero which would lead to a  $DPC$  that differs from zero.  $DNC$ \*annualized dividend payout ratio change is clearly negative, which is due to the many instances of dividend payout ratio decreases and thus  $DNC$  being equal one. The earnings change is highly left-skewed. A detailed description of these variables is provided in Table 3-1.

### 3.8.1 Future Earnings Changes

A regression approach is set up to determine whether the change of a dividend payout ratio has an impact on contemporaneous and future earnings (Dhillon et al., 2003). The goal of this regression is to verify the information content of dividend announcements that imply a dividend change (Michayluk & Zhao, 2010). First, we conduct pooled ordinary least squares (OLS) regression with the approximated abnormal earnings change as the dependent variable and the annualized dividend payout ratio change as an independent variable:

$$\frac{EPS_t - EPS_{t-1}}{P_{t-1}} = \alpha_0 + \alpha_1 * \text{Annualized dividend payout ratio change}_t + \epsilon_t \quad (3-12)$$

Secondly, several explanatory variables are added as control variables and a refined Fama and MacBeth (1973) procedure is applied accounting for heteroskedasticity and autocorrelation. The annualized dividend payout ratio change coefficient then represents the impact an unexpected dividend payout ratio change has on future earnings changes:

$$\frac{EPS_t - EPS_{t-1}}{\text{Book value of equity per share}_{t-1}} = \alpha_0 + \alpha_1 * \text{Annualized dividend payout ratio change}_t + \alpha_2 * ROE_{t-1} + \epsilon_t \quad (3-13)$$

$$\frac{EPS_t - EPS_{t-1}}{\text{Book value of equity per share}_{t-1}} = \alpha_0 + \alpha_1 * DPC_t * \text{Annualized dividend payout ratio change}_t + \alpha_2 * DNC_t * \text{Annualized dividend payout ratio change}_t + \alpha_3 * ROE_{t-1} + \alpha_4 * \text{Earnings change}_{B,0} + \epsilon_t \quad (3-14)$$

both for  $t = 1$  and  $2$ .

$EPS_t$  denotes earnings per share excluding extraordinary items in year  $t$  relative to the dividend event year 0. We do not apply the next fiscal year's first dividend payout ratio change, as Nissim and Ziv (2001) do, since this might already include some earnings information and artificially strengthen the effect. We instead use an annualized dividend payout ratio change because the earnings are also measured on a yearly basis. The annualized payout ratio is calculated as the last dividend payout ratio of the fiscal year times the number of overall dividend payments made during the fiscal year (Benartzi et al., 1997).

In the first regression, following Equation 3-13, it is controlled for the return on equity,  $ROE_{t-1}$ . Next to that, the second regression includes two variables on dividend increases and decreases,  $DPC_t$  and  $DNC_t$ , to differentiate their coefficients and to therefore reveal the effect of the sign of the change which does not necessarily have to be symmetric. Moreover, the earnings change of the dividend payout ratio change year is included as an explanatory variable to measure an incremental effect in the earnings change in the years 1 and 2 after the dividend payout ratio change. A detailed explanation of the construction of all variables again is to be found in Table 3-1.

Table 3-17 shows the Spearman's rank correlation coefficients of the earnings determinants. As all coefficients are very small, multicollinearity does not pose a problem here. Table 3-18 shows the results to Equation 3-12. The coefficient of the dividend payment year is significant, however, close to zero. This indicates that the dividend payout ratio change does not impact the current earnings change in an economically significant way. The same holds for future changes of earnings in years 1 and 2, since both coefficients are significant, but close to zero. If these findings prove to be robust in the following analyses, dividend payout ratio changes would not have explanatory power for future earnings changes. Table 3-19 provides the results to Equations 3-13 and 3-14 including control variables. In Model 1, including only ROE, the payout ratio change is not significant in year 1 and only slightly significant in year 2. Moreover, the coefficients are close to zero and thus there is no

indication of an impact of the payout ratio change on future earnings. In contrast, current/year 1 ROE are highly significant and thus informative about future earnings changes of year 1/year 2. This effect remains existent in Model 2 and the current earnings change also provides explanatory information for earnings changes in years 1 and 2, but at a lower magnitude than ROE. Notably, when considering the sign of the payout ratio change it continues to not provide economically significant informational content for future earnings changes with (insignificant) coefficients of -0.001 and 0.000. This stands in contrast to the findings of Nissim and Ziv (2001) on dividend changes. Moreover, it contradicts the information content hypothesis as the annualized dividend payout ratio change does not provide relevant information for future earnings changes.

However, as Grullon et al. (2005) describe, Nissim and Ziv (2001) base their analysis on the assumption that earnings expectations are linear. Grullon et al. (2005) state that it is not pertinent to assume that earnings follow linear mean reversion and that they have a uniform level of autocorrelation. More specifically, it is shown that large or negative earnings changes invert faster than small or positive changes (Elgers & Lo, 1994). Grullon et al. (2005) thus propose to use a modified partial adjustment model by Fama and French (2000) to receive meaningful results while considering the non-linear earnings patterns. Using dividend payout ratio change instead of the simple  $D^U$  we conduct the following regression:

$$\frac{EPS_t - EPS_{t-1}}{\text{Book value of equity per share}_{t-1}} = \alpha + \beta_1 * DPC_t * \text{Annualized dividend payout ratio change}_t + \beta_2 * DNC_t * \text{Annualized dividend payout ratio change}_t + \gamma_1 * DFE_0 + \gamma_2 * NDFED_0 * DFE_0 + \gamma_3 * NDFED_0 * (DFE_0)^2 + \gamma_4 * PDFED_0 * (DFE_0)^2 + \lambda_1 * CE_0 + \lambda_2 * NCED_0 * CE_0 + \lambda_3 * NCED_0 * (CE_0)^2 + \lambda_4 * PCED_0 * (CE_0)^2 + \epsilon_t \quad (3-15)$$

with  $DPC_t$  representing a dummy variable that equals one for dividend increases while  $DNC_t$  represents the same for dividend decreases as introduced above.  $DFE_0$  is the value of  $ROE_0 - E[ROE_0]$ .  $E[ROE_0]$  equals the predicted value from the cross-sectional regression with  $ROE_0$  as the dependent variable and the logarithm of assets, the logarithm of the market-to-book ratio of equity and  $ROE$ , all three of the year before the announcement event, as independent variables.  $CE_0$  is calculated from  $\frac{EPS_0 - EPS_{-1}}{\text{Book value of equity per share}_{-1}}$ .  $NDFED/NCED$  is a dummy variable that is one if  $DFE/CE$  is negative and zero otherwise, and  $PDFED/PCED$  is the same but for the case in which  $DFE/CE$  is positive. A detailed explanation of the construction of all variables is again to be found in Table 3-1.

Table 3-20 states the results of the impact of dividend payout ratio changes on future earning changes considering non-linear earnings behavior. The findings confirm the simpler model above. Except for dividend payout ratio decreases that show a significant coefficient of -0.001 for earnings changes in year 2, we find that all coefficients are insignificant. In addition, the significant coefficient is very small indicating a limited economical relevance of its predictive power. This clearly indicates that dividend payout ratio changes do not have informational content for future earnings changes. All control variables, however, carry significant informational content for earnings changes in year 2. Our findings are consistent with the findings of Grullon et al. (2005), who use the same approach, yet analyze dividend changes as opposed to dividend payout ratio changes. Furthermore, they restrict their sample to quarterly dividend payments, which is not the case here. Consequently, this restriction does not seem to make a difference. Our findings contradict the information content hypothesis independently of whether non-linear earnings patterns are attended to or not.

### 3.8.2 Future Profitability Changes

Following Fama and French (2000) and Grullon et al. (2005), we apply the above-mentioned method of determining the impact of dividend payout ratio changes on changes in earnings also to changes in profitability. We apply an equation parallel to Equation 3-15 to assess the information content of dividend payout ratio changes for predicting the firm's future profitability changes:

$$\begin{aligned}
 ROA_t - ROA_{t-1} = & \alpha + \beta_1 * DPC_t * \text{Dividend payout ratio change}_t + \\
 & \beta_2 * DNC_t * \text{Annualized dividend payout ratio change}_t + \gamma_1 * DFE_{ROA,0} + \\
 & \gamma_2 * NDFED_{ROA,0} * DFE_{ROA,0} + \gamma_3 * NDFED_{ROA,0} * (DFE_{ROA,0})^2 + \\
 & \gamma_4 * PDFED_{ROA,0} * (DFE_{ROA,0})^2 + \lambda_1 * CE_{ROA,0} + \lambda_2 * NCED_{ROA,0} * CE_{ROA,0} + \\
 & \lambda_3 * NCED_{ROA,0} * (CE_{ROA,0})^2 + \lambda_4 * PCED_{ROA,0} * (CE_{ROA,0})^2 + \epsilon_t
 \end{aligned} \tag{3-16}$$

Return on assets  $ROA$  is shown to be a suitable measure to determine abnormal operating performance, i.e., enhanced or reduced profitability (Barber & Lyon, 1996). It is defined as the operating income before depreciation (EBITDA) scaled by total assets.  $DPC_t$  again represents a dummy variable that equals one for dividend increases and zero otherwise, while  $DNC_t$  is the same for dividend decreases.  $DFE_{ROA,0}$  is the value of  $ROA_0 - E[ROA_0]$ .  $E[ROA_0]$  equals the predicted value from the cross-sectional regression with  $ROA_0$  as the dependent variable and the logarithm of assets, the logarithm of the market-to-book ratio of equity and  $ROA$ , all three of the year before the announcement event, as independent

variables.  $CE_{ROA,0}$  equals  $ROA_0 - ROA_{-1}$ .  $NDFED_{ROA}/NCED_{ROA}$  again is a dummy variable that is one if  $DFE_{ROA}/CE_{ROA}$  is negative and zero otherwise, and  $PDFED_{ROA}/PCED_{ROA}$  is the same but for the case in which  $DFE_{ROA}/CE_{ROA}$  is positive.

Figure 3-3 shows the average profitability level of all sample firms that make announcements with dividend payout ratio changes in the considered period. Around both, dividend payout ratio decreases and increases, the average ROA decreases slightly yet steadily from year -3 to year 3. The ROA of firms around dividend payout ratio decreases thereby is slightly higher than around dividend payout ratio increases. Nevertheless, there is no strong trend of change in average ROA during the years examined and consequently, the following results are not distorted by underlying ROA fluctuations.

Considering all non-linear control variables (Model 2), Table 3-21 on profitability changes shows a similar pattern as seen in Table 3-20 for earnings changes. Dividend payout ratio decreases have a significant coefficient for year 2 ROA changes. However, all coefficients for dividend payout ratio increases as well as decreases and for both years after the dividend payout ratio change are very close to zero. Consequently, they have no economically relevant impact on future profitability changes. This stands in contrast to the findings of Grullon et al. (2005) and thus, in parallel to earnings changes, we cannot verify the information content hypothesis for future profitability changes.

In conclusion, both dividend payout ratio decreases and increases do not carry economical significant information content for earnings changes. This supports the findings of a broad strand of literature on dividend changes (e.g., Benartzi et al., 1997; Grullon et al., 2005; Watts, 1973). Nonetheless, in contrast to previous findings we do not find an economical significant information content in dividend payout ratio changes for future profitability changes. Finding a parallel effect on earnings and profitability is not unreasonable as both provide a similar indication measure for a firm's future. Consequently, the information content hypothesis does not hold here. Potentially, the information content hypothesis does not apply to the bond market as bondholders are not focused on future growth signals. Rather, as they want to receive their principal payment in the future, they strive to see financial stability in the firm. An overly high increase in the dividend payout ratio thus may not be perceived as an advantage and positive signal by the bondholders. Therefore, we do not confirm the signaling hypothesis and it seems that rather free cash flow effects or undefined effects, instead of signaling effects, play a role in explaining the bond market reaction around

dividend (payout ratio) changes of Sections 3.5 and 3.7 besides the wealth transfer effects. Having gained all these insights, the next section summarizes all findings and concludes.

### **3.9 Conclusion**

This study provides a comprehensive analysis on corporate bond market reactions to 2,538 dividend announcements, addressing a gap in bond market literature by focusing on dividend payout ratio changes. Thus, we demonstrate how effectively bond prices reflect dividend policy changes.

Analyzing these events, we find that there is no single effect explaining the significant reactions of the bond market to dividend changes. Additionally, we find no non-linear relationship between bondholder reactions and dividend size. We consider dividend payout ratio changes as opposed to dividend changes, since they are more relevant for the management, e.g., in cash flow steering, but also for bondholders who are interested in a long-term success of their investment. We find evidence in favor of the signaling hypothesis around dividend payout ratio decreases and after omissions, while the wealth transfer hypothesis prevails around dividend payout ratio increases and initiations as well as before omissions. Consequently, bondholders have a pessimistic outlook on dividend payout ratio changes and react negatively to them irrespective of their direction. Shareholders on the other hand appear to react positively to these changes. Controlling for bond and firm characteristics, the bond market response immediately around dividend payout ratio increases is consistent with prevailing free cash flow effects. Thus, bondholders are sensitive to firm-level risk shifts.

Finally, the empirical analyses at hand show that dividend payout ratio changes lack economically significant information content for predicting future earnings or profitability changes. Hence, it is questionable whether the effects that offset wealth transfer effects around these changes truly signal future performance. Potentially, the information content hypothesis does not apply to the bond market as bondholders seek indicators of financial stability of the bond-issuing firm over future growth signals.

In summary, bondholders may consider dividend payout ratio changes as short-term indicators of risk exposure but should not rely on them for forecasting long-term firm prospects. Likewise, managers should be mindful that changes in dividend payout ratios influence bond prices, yet that they should not be over-interpreted as a signaling device for future firm performance. Overall, this study highlights the complex effects that drive bond

market reactions to dividend payout ratio changes and refutes the information content of dividend payout ratio changes for a firm's future performance.

### **3.10 Tables**

The first table of Chapter 3 is presented on the following page.

**Table 3-1: Definition of applied variables.** These tables present definitions of the variables used throughout this study. In addition, sources on which these definitions are based on and data sources, if applicable, are named for further reference. Relevant data sources are the National Association of Securities Dealers (NASD) Trade Reporting and Compliance Engine (TRACE) database, the Mergent Fixed Income Securities Database (FISD), the Center for Research in Security Prices (CRSP) annual stock event file, the CRSP daily stock file and the Compustat annual data file. The data is retrieved for the period of January 2013 to and including December 2022. All annually-published firm variables are measured in the last fiscal year ending before the event year.

Firm-level variables			
Variable name	Description/Formula	Relevant paper if applicable	Data source if applicable
Dividend	Dividend amount paid in USD per share	Chen (2016)	CRSP annual stock event file
Unexpected dividend change ( $D^U$ )	$\frac{Dividend_t - Dividend_{t-1}}{Dividend_{t-1}}$	Chen (2016); Grullon et al. (2002)	CRSP annual stock event file
Naïve unexpected dividend change	$Dividend_t - Dividend_{t-1}$	Handjinicolaou and Kalay (1984)	CRSP annual stock event file
Standardized unexpected dividend change	$\frac{Dividend_t - Dividend_{t-1}}{Stock\ price_{previous\ month\ end}}$	Wei et al. (2020)	CRSP annual stock event file; CRSP daily stock file
Dividend decrease	$Dividend\ delta < 0$		CRSP annual stock event file
Dividend increase	$Dividend\ delta > 0$		CRSP annual stock event file
Dividend omission	Firm omits a dividend after having paid a dividend for at least three years	Chen (2016)	CRSP annual stock event file

Dividend initiation	Firm pays dividend after not having paid a dividend for at least five years	Chen (2016)	CRSP annual stock event file
Total assets	Book value of total assets – Total of liabilities and stockholder's equity [USD M] (Compustat Item 6)		Compustat annual data file
Long-term debt	Book value of total long-term debt [USD M] (Compustat Item 9)		Compustat annual data file
Financial leverage	$\frac{\text{Long-term debt}}{\text{Total assets}}$	Chen (2016)	Compustat annual data file
Z-score	$\frac{3.3 * \text{Pre-income tax (Compustat Item 170)} + 1.0 * \text{Net sales (Compustat Item 12)} + 1.4 * \text{Retained earnings (Compustat Item 36)} + 1.2 * \text{Working capital (Compustat Item 179)}}{\text{Total assets}}$	Altman (1968)	Compustat annual data file
Financially non-distressed firm dummy	$\begin{cases} 1 \text{ if Z-score in top tercile within specific fiscal year} \\ 0 \text{ if Z-score in bottom two terciles within specific fiscal year} \end{cases}$	van Binsbergen et al. (2010)	
Financially unconstrained firm dummy	$\begin{cases} 1 \text{ if } \frac{\text{Long-term debt issuance (Compustat Item 11)}}{\text{Total assets}} \geq 66\text{th percentile} \\ \text{or } \frac{\text{Long-term debt reductions (Compustat Item 114)}}{\text{Total assets}} \geq 66\text{th percentile} \\ \text{or } \frac{\text{Sale of common or preferred stock (Compustat Item 108)}}{\text{Total assets}} \geq 66\text{th percentile} \\ \text{or } \frac{\text{Purchase of common or preferred stock (Compustat Item 115)}}{\text{Total assets}} \geq 66\text{th percentile} \\ 0 \text{ else} \end{cases}$	Chen (2016)	Compustat annual data file
Firm-level abnormal bond return ( $ABR_{f,t}$ )	$\sum_{i=1}^k ABR_{i,t} * \omega_i$	Bessembinder et al. (2009)	TRACE
Firm-level abnormal standardized bond return ( $ABSR_{f,t}$ )	$\sum_{i=1}^k ABSR_{i,t} * \omega_i$	Ederington et al. (2015)	TRACE

Abnormal stock return ( $ASR_t$ )	$a_i + b_i(R_{Mt} - R_{Ft}) + s_iSMB_t + h_iHML_t + r_iRMW_t + c_iCMA_t + \epsilon_{it}$ with $R_{Mt}$ being the return on the value-weighted market portfolio, $R_{Ft}$ the riskfree return, $SMB_t$ the difference in returns of diversified portfolios of small and big stocks, $HML_t$ the difference in returns of diversified portfolios of high and low book-to-market value stocks, $RMW_t$ the difference in returns of diversified portfolios of stocks with robust and weak profitability and $CMA_t$ the difference in returns of diversified portfolios of stocks of low and high investment firms (i.e., conservative and aggressive firms)	Fama and French (2015)	CRSP daily stock file
EPS	Earnings per share excluding extraordinary items (Compustat Item 58)		Compustat annual data file
Dividend payout ratio	$\frac{Dividend_t}{EPS_t}$		
Dividend payout ratio change	$\frac{Dividend\ payout\ ratio_{t,i} - Dividend\ payout\ ratio_{t-1,i}}{Dividend\ payout\ ratio_{t-1,i}}$		
Annualized dividend payout ratio	$Dividend\ payout\ ratio_{t,n} * n$ with $n$ being the number of dividend payments made per fiscal year	Benartzi et al. (1997) for $D^U$	
Annualized dividend payout ratio change	$\frac{Annualized\ dividend\ payout\ ratio_{t,i} - Annualized\ dividend\ payout\ ratio_{t-1,i}}{Annualized\ dividend\ payout\ ratio_{t-1,i}}$	Grullon et al. (2005) for $D^U$	
Dividend payout ratio decrease	$Dividend\ payout\ ratio\ delta < 0$		
Dividend payout ratio increase	$Dividend\ payout\ ratio\ delta > 0$		
Dividend payout ratio omission	Firm omits a dividend after having paid a dividend for at least three years		
Dividend payout ratio initiation	Firm pays dividend after not having paid a dividend for at least five years		
Earnings change $e_{p,t}$	$\frac{EPS_t - EPS_{t-1}}{Closing\ price\ of\ fiscal\ year\ (Compustat\ Item\ 24)_{t-1}}$	Nissim and Ziv (2001)	
Book value of equity (B)	$Total\ common\ equity\ (Compustat\ Item\ 60) + Preferred\ treasury\ stock\ (Compustat\ Item\ 227) - Preferred\ dividends\ in\ arrears\ (Compustat\ Item\ 242)$		Compustat annual data file
Book value of equity per share	$\frac{B_t}{Number\ of\ common\ shares\ outstanding}$		Compustat annual data file
ROE	$\frac{EPS}{Book\ value\ of\ equity\ per\ share}$	Nissim and Ziv (2001)	Compustat annual data file

Earnings change $_{B,t}$	$\frac{EPS_t - EPS_{t-1}}{\text{Book value of equity per share}_{t-1}}$	Grullon et al. (2005)	
ROA	$\frac{\text{Operating income before depreciation (Compustat Item 13)}}{\text{Total assets}}$	Grullon et al. (2002)	Compustat annual data file
ROA change $_t$	$ROA_t - ROA_{t-1}$	Grullon et al. (2005)	Compustat annual data file
DNC	$\begin{cases} 1 & \text{if dividend payout ratio decrease} \\ 0 & \text{else} \end{cases}$	Nissim and Ziv (2001)	
DPC	$\begin{cases} 1 & \text{if dividend payout ratio increase} \\ 0 & \text{else} \end{cases}$	Nissim and Ziv (2001)	
DFE	$ROE_0 - E[ROE_0]$ with $E[ROE_0]$ being the predicted value from the cross-sectional regression with $ROE_0$ as the dependent variable and $\log(\text{Total assets})_{-1}$ , $\log(\text{Market-to-book ratio of equity})_{-1}$ and $ROE_{-1}$ as independent variables	Grullon et al. (2005)	
CE	$\frac{EPS_0 - EPS_{-1}}{\text{Book value of equity per share}_{-1}}$	Grullon et al. (2005)	
$DFE_{ROA}$	$ROA_0 - E[ROA_0]$ with $E[ROA_0]$ being the predicted value from the cross-sectional regression with $ROA_0$ as the dependent variable and $\log(\text{Total assets})_{-1}$ , $\log(\text{Market-to-book ratio of equity})_{-1}$ and $ROA_{-1}$ as independent variables	Grullon et al. (2005)	
$CE_{ROA}$	$ROA_0 - ROA_{-1}$	Grullon et al. (2005)	
NDFED/NDFED $_{ROA}$	$\begin{cases} 1 & \text{if } DFE < 0 \text{ or } DFE_{ROA} < 0 \\ 0 & \text{else} \end{cases}$	Grullon et al. (2005)	
PDFED/PDFED $_{ROA}$	$\begin{cases} 1 & \text{if } DFE > 0 \text{ or } DFE_{ROA} > 0 \\ 0 & \text{else} \end{cases}$	Grullon et al. (2005)	
NCED/NCED $_{ROA}$	$\begin{cases} 1 & \text{if } CE < 0 \text{ or } CE_{ROA} < 0 \\ 0 & \text{else} \end{cases}$	Grullon et al. (2005)	
PCED/PCED $_{ROA}$	$\begin{cases} 1 & \text{if } CE > 0 \text{ or } CE_{ROA} > 0 \\ 0 & \text{else} \end{cases}$	Grullon et al. (2005)	

Bond-level variables

Variable name	Description/Formula	Relevant paper if applicable	Data source if applicable
Coupon rate	Bond's annual interest rate		FISD
Years to maturity	Remaining years until bond matures		FISD
Issued proceeds	Bond's par value at issuance		FISD
Bond rating	Moody's rating or, if this is not available, Standard and Poor's or Fitch rating, AAA is defined as 22, etcetera.		TRACE
Investment grade dummy	$\begin{cases} 1 & \text{if investment-grade rated bond, i. e. rating} > 11 \\ 0 & \text{else, i. e. rating} \leq 11 \end{cases}$	Chen (2016)	
Senior dummy	$\begin{cases} 1 & \text{if senior or secured issue} \\ 0 & \text{if junior, subordinated or unsecured issue} \end{cases}$	Chen (2016)	FISD
Abnormal bond return ( $ABR_{i,t}$ )	$RR_{i,t} - MR_{i,t}$ with $MR_{i,t}$ being the return of a matched portfolio. The matched portfolio is constructed as the average return of all bonds within one of 13 rating and time-to-maturity classes on a specific day	Bessembinder et al. (2009)	TRACE
Abnormal standardized bond return ( $ABSR_{i,t}$ )	$SRR_{i,t} - SMR_t$ with $SRR_{i,t}$ being the bond's $RR_{i,t}$ divided by the bond raw returns' time-series standard deviation over the period of $(t - 55, t - 6)$ and $(t + 6, t + 55)$ and $SMR_t$ being calculated as the average of the $SRR_{i,t}$ of all bonds within each rating and time-to-maturity class	Ederington et al. (2015)	TRACE

**Table 3-2: Descriptive statistics on firm characteristics.** This table presents summary statistics on the most important firm characteristics used throughout this study. All observations of the cleaned and merged dataset based on the TRACE, FISD, CRSP annual stock event file and Compustat data from 2013-2022 are considered. Panel A shows the characteristics of firms with dividend decrease and increase announcements and Panel B of firms with dividend omissions and initiations over the years. Dividend is defined as the dividend amount paid per share and  $D^U$  is the percentage change of the current dividend and the last paid dividend. Financial leverage is the ratio of a firm's long-term debt book value over its total assets. Financially non-distressed and financially unconstrained dummies equal 1 if a firm is non-distressed or unconstrained, respectively, and else 0. Total assets, financial leverage, financially non-distressed and unconstrained dummies are lagged by one fiscal year. A dividend decrease/increase occurs if  $D^U$  is smaller/larger than 0. A dividend omission occurs when firm omits a dividend after having paid a dividend for at least three years and a dividend initiation is defined as a dividend that is being paid after the firm has not paid a dividend for at least five years. A detailed description of all variables can be found in Table 3-1.

Year	N	Dividend [USD/share]	$D^U$	Total assets [USD M]	Financial leverage	Financially non-distressed	Financially unconstrained	N	Dividend [USD/share]	$D^U$	Total assets [USD M]	Financial leverage	Financially non-distressed	Financially unconstrained
Panel A	Dividend decreases							Dividend increases						
2013	23	0.25	-0.47	23,679	0.27	39%	89%	244	0.43	0.23	37,704	0.27	61%	95%
2014	25	0.33	-0.43	54,156	0.22	45%	90%	243	0.46	0.18	37,848	0.29	61%	97%
2015	42	0.36	-0.49	44,007	0.32	40%	94%	216	0.48	0.13	36,945	0.30	64%	96%
2016	31	0.41	-0.43	45,952	0.36	41%	86%	196	0.50	0.14	39,059	0.33	69%	97%
2017	16	0.36	-0.42	64,257	0.40	21%	93%	200	0.54	0.14	37,352	0.32	67%	96%
2018	17	0.47	-0.29	94,417	0.33	25%	83%	232	0.59	0.19	38,094	0.33	64%	96%
2019	15	0.39	-0.30	65,799	0.36	42%	83%	221	0.59	0.12	38,857	0.34	62%	93%
2020	37	0.24	-0.56	52,035	0.42	28%	89%	178	0.61	0.13	40,694	0.35	72%	95%
2021	20	0.34	-0.37	48,712	0.38	61%	78%	223	0.64	0.21	41,608	0.36	75%	94%
2022	19	0.61	-0.31	113,434	0.36	33%	60%	237	0.67	0.17	40,779	0.35	71%	93%
Overall	245	0.36	-0.43	55,103	0.34	38%	86%	2,190	0.55	0.17	38,861	0.32	66%	95%
Panel B	Dividend omissions							Dividend initiations						
	114	0.32	NA	19,382	0.39	46%	88%	51	0.21	NA	15,981	0.34	45%	86%

**Table 3-3: Descriptive statistics on bond characteristics.** This table provides summary statistics on the most important characteristics of bonds used throughout this study. All observations of the cleaned and merged dataset based on the TRACE, FISD, CRSP annual stock event file and Compustat data from 2013-2022 are considered. Panel A shows the characteristics of bonds issued by firms with dividend decrease and dividend increase announcements over the years. Characteristics of the bonds issued by firms with dividend omissions and dividend initiations are presented in Panel B. The coupon rate is the bond's annual interest rate, years to maturity are the number of years left until the bond matures and issued proceeds equal the bond's par value at issuance. The rating is based on Moody's rating or, if this is not available, based on ratings of Standard and Poor and Fitch, respectively. AAA is defined as 22, etcetera. Investment dummy and senior dummy equal 1 if a bond is investment-grade rated, i.e., rating higher than eleven, or if it has a senior security level, and else 0. A dividend decrease occurs if  $D^U$  is smaller than 0 and a dividend increase if it is larger than 0. A dividend omission occurs when firm omits a dividend after having paid a dividend for at least three years and a dividend initiation is defined as a dividend that is paid after the firm has not paid a dividend for at least five years. A detailed description of all variables can be found in Table 3-1.

Year	N	Coupon rate	Years to maturity	Issued proceeds [USD M]	Bond rating	Investment dummy	Senior dummy	N	Coupon rate	Years to maturity	Issued proceeds [USD M]	Bond rating	Investment dummy	Senior dummy
Panel A	Dividend decreases							Dividend increases						
2013	93	5.51%	14.60	904,157	13.68	72%	100%	867	4.55%	14.20	886,736	15.41	85%	100%
2014	93	4.99%	13.81	1,199,316	14.84	67%	100%	884	4.28%	14.01	933,680	15.27	83%	100%
2015	159	5.21%	12.23	991,225	13.36	62%	100%	882	4.17%	14.63	971,181	15.30	82%	100%
2016	124	4.55%	14.73	1,222,031	14.52	78%	100%	850	3.85%	14.24	1,078,365	15.74	87%	100%
2017	71	4.89%	15.63	1,654,819	13.51	73%	100%	965	3.76%	14.66	1,095,008	15.87	90%	100%
2018	75	4.31%	14.00	1,518,427	15.27	80%	100%	1,092	3.87%	14.26	1,087,864	15.43	87%	100%
2019	87	4.60%	13.02	1,606,500	14.34	63%	100%	1,136	3.97%	15.02	1,085,457	15.40	90%	100%
2020	247	4.31%	15.27	1,187,619	14.94	67%	100%	1,059	3.69%	15.45	1,049,964	15.79	93%	100%
2021	84	4.21%	16.79	953,571	14.31	67%	100%	1,370	3.54%	16.25	1,127,039	15.42	94%	100%
2022	122	4.31%	18.27	1,676,486	14.73	92%	100%	1,245	3.63%	15.12	1,010,221	15.37	91%	100%
Overall	1,155	4.66%	14.82	1,258,764	14.39	71%	100%	10,350	3.89%	14.87	1,039,512	15.50	89%	100%
Panel B	Dividend omissions							Dividend initiations						
	322	4.87%	11.45	711,333	12.89	65%	100%	155	5.06%	10.23	847,874	11.80	66%	100%

**Table 3-4: Descriptive statistics on abnormal firm returns.** This table presents descriptive statistics on the abnormal firm returns of period  $(t - 30, t + 30)$  used throughout this study. Panel A states the descriptives on firm-level abnormal bond returns (ABR), abnormal standardized bond returns (ABSR) and abnormal stock returns (ASR). ABR are based on a raw return calculated from trade-weighted daily prices minus a matched portfolio return following Equation 3-2. The matched portfolio is constructed as the average return of all bonds within one of 13 rating and time-to-maturity classes on a specific day. These ABR are aggregated to a firm level by weighing them by the trade volume of each bond as described in Equation 3-3. ABSR are calculated as standardized bond raw returns minus the average standardized return of all bonds' raw returns within the same rating/maturity group. ABSR are again aggregated to a firm level by weighing them by the trade volume of each bond. ASR are estimated using the Fama French five-factor model with an estimation window of  $(t - 60, t - 31)$ . Panel B reports the statistics on these returns winsorized at the 1% and 99% level.

	Mean	SD	Skewness	Kurtosis	5th Perc.	50th Perc.	95th Perc.	N
Panel A - Abnormal (standardized) return measures								
ABR	0.00	0.01	-4.26	446.09	-0.01	0.00	0.01	576,049
ABSR	-0.01	0.66	-2.72	353.89	-0.97	0.00	0.89	576,049
ASR	0.00	0.05	-88.02	22,360.01	-0.02	0.00	0.03	967,081
Panel B - Winsorized abnormal (standardized) return measures								
ABR	0.00	0.00	-0.18	7.97	-0.01	0.00	0.01	576,049
ABSR	-0.01	0.54	-0.16	6.01	-0.97	0.00	0.89	576,049
ASR	0.00	0.02	0.05	5.24	-0.02	0.00	0.03	967,081

**Table 3-5: Bond market responses to dividend change announcements.** This table presents the results of CAR of firm-level ABR and ABSR based on the parametric t-test for the four considered event windows before, around and following a dividend decrease or increase announcement. A dividend decrease occurs if  $D^U$  is smaller than 0 and a dividend increase if it is larger than 0. Panel A shows the results for firm-level ABR and Panel B for firm-level ABSR, both winsorized at the 1st and 99th percentiles. ABR are based on a raw return calculated from trade-weighted daily prices minus a matched portfolio return following Equation 3-2. The matched portfolio is constructed as the average return of all bonds within one of 13 rating and time-to-maturity classes on a specific day. These ABR are aggregated to a firm level by weighing them by the trade volume of each bond as described in Equation 3-3. ABSR are calculated as standardized bond raw returns minus the average standardized return of all bonds' raw returns within the same rating/maturity group. ABSR are again aggregated to a firm level by weighing them by the trade volume of each bond as described in Equation 3-3.

Event window	Mean CAR	t-stat	Mean CAR	t-stat
Panel A - ABR	Dividend decreases		Dividend increases	
$(t - 30, t - 5)$	-0.004	-15.291	-0.001	-19.008
$(t - 4, t - 2)$	0.000	-1.199	0.000	-0.862
$(t - 1, t + 1)$	0.000	-0.138	0.000	-4.418
$(t + 2, t + 30)$	0.000	-0.967	-0.002	-38.964
Panel B - ABSR				
$(t - 30, t - 5)$	-0.790	-16.745	-0.405	-31.892
$(t - 4, t - 2)$	0.073	2.165	-0.028	-2.888
$(t - 1, t + 1)$	0.031	0.840	-0.039	-3.972
$(t + 2, t + 30)$	0.132	2.505	-0.491	-42.553

**Table 3-6: Bond market reaction to dividend changes with risk subsamples.** This table presents the results of CAR of firm-level ABSR based on the parametric t-test for the four considered event windows before, around and following a dividend decrease or increase announcement. A dividend decrease/increase occurs if  $D^U$  is smaller/larger than 0. The sample is split into two subsamples around each announcement type based on risk-relevant characteristics. Panel A provides results of rating subsamples, Panel B based on the severeness of financial constraints of the firm and Panel C on the level of financial distress of the firm. A detailed description of all variables can be found in Table 3-1.

Event window	Mean CAR	t-stat	Mean CAR	t-stat	Mean CAR	t-stat	Mean CAR	t-stat
ABSR	Dividend decreases				Dividend increases			
Panel A	Investment-rated bonds		Speculative bonds		Investment-rated bonds		Speculative bonds	
$(t - 30, t - 5)$	-0.713	-13.112	-0.998	-10.581	-0.425	-31.307	-0.264	-7.426
$(t - 4, t - 2)$	0.014	0.433	0.226	2.596	-0.040	-3.885	0.053	1.771
$(t - 1, t + 1)$	-0.042	-1.042	0.214	2.765	-0.036	-3.528	-0.062	-1.851
$(t + 2, t + 30)$	0.021	0.358	0.415	3.866	-0.533	-43.114	-0.184	-5.775
Panel B	Bonds of financially unconstrained firms		Bonds of financially constrained firms		Bonds of financially unconstrained firms		Bonds of financially constrained firms	
$(t - 30, t - 5)$	-0.778	-15.955	-0.862	-5.608	-0.424	-32.658	0.000	0.001
$(t - 4, t - 2)$	0.090	2.367	-0.026	-0.428	-0.033	-3.327	0.076	1.725
$(t - 1, t + 1)$	0.012	0.283	0.149	2.761	-0.046	-4.488	0.090	2.350
$(t + 2, t + 30)$	0.204	3.493	-0.333	-3.091	-0.488	-41.353	-0.541	-10.037
Panel C	Bonds of financially non-distressed firms		Bonds of financially distressed firms		Bonds of financially non-distressed firms		Bonds of financially distressed firms	
$(t - 30, t - 5)$	-0.499	-9.336	-0.993	-14.049	-0.388	-24.789	-0.435	-20.074
$(t - 4, t - 2)$	-0.021	-0.534	0.137	2.766	-0.080	-6.791	0.063	3.719
$(t - 1, t + 1)$	-0.111	-2.221	0.121	2.421	-0.056	-4.545	-0.011	-0.672
$(t + 2, t + 30)$	-0.333	-5.278	0.430	5.670	-0.444	-32.066	-0.570	-27.988

**Table 3-7: Bond market responses to dividend omissions and initiations.** This table presents the results of CAR of firm-level ABSR based on the parametric t-test for the four considered event windows before, around and following a dividend omission or initiation announcement. A dividend omission occurs when firm omits a dividend after having paid a dividend for at least three years and a dividend initiation is defined as a dividend that is paid after the firm has not paid a dividend for at least five years.

Event window	Mean CAR	t-stat	Mean CAR	t-stat
ABSR	Dividend omissions		Dividend initiations	
$(t - 30, t - 5)$	0.223	2.559	-0.174	-2.570
$(t - 4, t - 2)$	0.121	1.864	-0.009	-0.194
$(t - 1, t + 1)$	-0.007	-0.211	-0.037	-0.784
$(t + 2, t + 30)$	-1.452	-21.388	-0.698	-9.065

**Table 3-8: Stock and bond market responses to dividend changes.** This table presents the results of CAR of firm-level ABSR and abnormal stock returns (ASR) based on the parametric t-test for the four considered event windows before, around and following a dividend change announcement. Panel A and B show the results for ABSR and ASR, respectively, for dividend decreases and increases and Panel C and D do so for dividend omissions and initiations. ABSR are calculated as standardized bond raw returns minus the average standardized return of all bonds' raw returns within the same rating/maturity group. ABSR are aggregated to a firm level by weighing them by the trade volume of each bond as described in Equation 3-3. ASR are estimated using the Fama French five-factor model with an estimation window of  $(t - 60, t - 31)$ .

Event window	Mean CAR	t-stat	Mean CAR	t-stat
Panel A - ABSR	Dividend decreases		Dividend increases	
$(t - 30, t - 5)$	-0.790	-16.745	-0.405	-31.892
$(t - 4, t - 2)$	0.073	2.165	-0.028	-2.888
$(t - 1, t + 1)$	0.031	0.840	-0.039	-3.972
$(t + 2, t + 30)$	0.132	2.505	-0.491	-42.553
Panel B - ASR				
$(t - 30, t - 5)$	0.056	29.297	0.057	108.035
$(t - 4, t - 2)$	0.008	6.473	0.008	20.861
$(t - 1, t + 1)$	0.007	4.884	0.010	22.947
$(t + 2, t + 30)$	0.057	48.463	0.067	169.580
Panel C - ABSR	Dividend omissions		Dividend initiations	
$(t - 30, t - 5)$	0.223	2.559	-0.174	-2.570
$(t - 4, t - 2)$	0.121	1.864	-0.009	-0.194
$(t - 1, t + 1)$	-0.007	-0.211	-0.037	-0.784
$(t + 2, t + 30)$	-1.452	-21.388	-0.698	-9.065
Panel D - ASR				
$(t - 30, t - 5)$	0.079	8.953	0.022	9.394
$(t - 4, t - 2)$	0.004	1.403	0.008	5.452
$(t - 1, t + 1)$	0.007	3.113	0.010	4.005
$(t + 2, t + 30)$	0.071	25.354	0.055	25.992

**Table 3-9: Spearman's rank correlation coefficients of bond return determinants.** This table presents the Spearman's rank correlation coefficients of bond price determinants.  $D^U$  is the percentage change of the current dividend amount and the last paid dividend. The investment indicator equals 1 if a bond is investment-rated and else 0. While maturity indicates the years left until the bond matures, financial leverage is the firm's long-term debt over total assets. Financially non-distressed and financially unconstrained dummies equal 1 if a firm is non-distressed or unconstrained, respectively, and else 0. A detailed description of all determinants can be found in Table 3-1.

	$D^U$	Investment indicator	$D^U * Investment indicator$	Maturity	$D^U * Maturity$	Financial leverage	$D^U * Financial leverage$	Financially unconstrained	$D^U * Financially unconstrained$	Non-distressed indicator	$D^U * Non-distressed indicator$
$D^U$	1.00	0.02	0.80	0.00	0.96	-0.03	0.89	0.01	1.00	0.00	0.51
Investment indicator	0.02	1.00	0.19	0.36	0.00	-0.49	0.00	-0.03	0.02	0.48	0.00
$D^U * Investment indicator$	0.80	0.19	1.00	0.00	0.80	-0.04	0.65	0.00	0.80	0.01	0.58
Maturity	0.00	0.36	0.00	1.00	0.03	-0.06	0.01	0.02	0.00	0.04	0.00
$D^U * Maturity$	0.96	0.00	0.80	0.03	1.00	-0.03	0.86	0.01	0.96	0.00	0.49
Financial leverage	-0.03	-0.49	-0.04	-0.06	-0.03	1.00	0.02	-0.10	-0.04	-0.34	-0.05
$D^U * Financial leverage$	0.89	0.00	0.65	0.01	0.86	0.02	1.00	0.00	0.88	0.00	0.37
Financially unconstrained	0.01	-0.03	0.00	0.02	0.01	-0.10	0.00	1.00	0.01	-0.03	0.01
$D^U * Financially unconstrained$	1.00	0.02	0.80	0.00	0.96	-0.04	0.88	0.01	1.00	0.00	0.51
Non-distressed indicator	0.00	0.48	0.01	0.04	0.00	-0.34	0.00	-0.03	0.00	1.00	0.00
$D^U * Non-distressed indicator$	0.51	0.00	0.58	0.00	0.49	-0.05	0.37	0.01	0.51	0.00	1.00

**Table 3-10: Bond market responses to dividend changes including control variables.** This table presents the OLS regression results of CAR of firm-level ABSR based on the parametric t-test for the event window  $(t - 1, t + 1)$  around dividend decrease or increase announcement. A dividend decrease occurs if  $D^U$  is smaller than 0 and a dividend increase if it is larger than 0. The four portrayed models include an increasing number of bond and firm-specific variables.  $D^U$  is the percentage change of the current dividend amount and the last paid dividend. The investment indicator equals 1 if a bond is investment-rated and else 0. While maturity indicates the years left until the bond matures, financial leverage is the firm's long-term debt over total assets. Financially non-distressed and financially unconstrained dummies equal 1 if a firm is non-distressed or unconstrained, respectively, and else 0. A detailed description of all variables can be found in Table 3-1.

	Model 1		Model 2		Model 3		Model 4		Model 1		Model 2		Model 3		Model 4	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Mean CAR of ABSR	Dividend decreases								Dividend increases							
$D^U$	0.273	0.581	0.481	0.843	6.025	0.559	4.887	0.443	0.256	2.370	0.355	2.926	-0.420	-0.170	-0.554	-0.224
Investment indicator	-0.237	-1.386	-0.218	-1.264	-0.218	-1.189	-0.224	-1.064	0.061	1.808	0.048	1.384	0.050	1.416	0.071	1.979
$D^U$ * Investment indicator	0.025	0.078	0.038	0.117	0.028	0.082	-0.147	-0.368	-0.118	-2.055	-0.136	-2.331	-0.126	-1.945	-0.153	-2.204
Maturity	-0.103	-1.025	-0.107	-1.066	-0.107	-1.063	-0.109	-1.049	0.000	-0.002	0.001	0.094	0.002	0.108	-0.002	-0.096
$D^U$ * Maturity	-0.240	-1.136	-0.256	-1.203	-0.256	-1.203	-0.219	-0.997	-0.046	-0.998	-0.039	-0.840	-0.039	-0.857	-0.030	-0.639
Financial leverage			-0.303	-0.706	-0.297	-0.660	-0.292	-0.633			-0.072	-1.074	-0.063	-0.934	-0.114	-1.624
$D^U$ * Financial leverage			-0.615	-0.713	-0.707	-0.789	-0.532	-0.577			-0.311	-1.884	-0.295	-1.741	-0.228	-1.298
Financially unconstrained					0.134	0.023	0.229	0.038					0.936	1.073	0.713	0.816
$D^U$ * Financially unconstrained					-5.925	-0.516	-4.875	-0.416					0.824	0.312	0.910	0.344
Non-distressed indicator							-0.022	-0.129							-0.072	-2.889
$D^U$ * Non-distressed indicator							0.339	1.022							0.083	1.079
Constant	0.321	1.312	0.399	1.488	0.275	0.050	0.199	0.035	-0.101	-2.216	-0.072	-1.342	-0.942	-1.158	-0.688	-0.841

**Table 3-11: Bond market responses using subsamples based on dividend size.** This table presents the results of CAR of firm-level ABSR based on the parametric t-test for dividend decrease and increase announcements. A dividend decrease occurs if  $D^U$  is smaller than 0 and a dividend increase if it is larger than 0. All dividend payments are sorted into the two subsamples based on their size compared to all other dividend payments announced by bond-issuing firms at the same day.

Event window	Mean CAR	t-stat	Mean CAR	t-stat	Mean CAR	t-stat	Mean CAR	t-stat
ABSR	Dividend decreases				Dividend increases			
	Large dividends		Small dividends		Large dividends		Small dividends	
$(t - 30, t - 5)$	-0.244	-2.883	-0.576	-5.942	-0.229	-9.778	-0.164	-4.879
$(t - 4, t - 2)$	-0.058	-0.626	-0.029	-0.306	-0.013	-0.671	-0.053	-1.915
$(t - 1, t + 1)$	-0.065	-1.205	0.117	1.878	-0.036	-2.618	-0.025	-1.313
$(t + 2, t + 30)$	-0.137	-2.275	0.352	4.405	-0.556	-37.935	-0.492	-23.133

**Table 3-12: Descriptive statistics on the dividend payout ratio.** This table presents summary statistics on dividend payout ratio (changes) considered at the dividend announcement dates. All observations of the cleaned and merged dataset based on the TRACE, FISD, CRSP annual stock event file and Compustat data from 2013-2022 are considered. A dividend payout ratio decrease occurs if the dividend payout ratio change is smaller than 0 and a dividend payout ratio increase if it is larger than 0. A dividend payout ratio change thereby is defined as the percentage change of the current and last dividend payout ratio. A dividend omission occurs when firm omits a dividend after having paid a dividend for at least three years and a dividend initiation is defined as a dividend that is paid after the firm has not paid a dividend for at least five years. A detailed description of all variables can be found in Table 3-1.

	Mean	SD	Skewness	Kurtosis	5th Perc.	50th Perc.	95th Perc.	N
Dividend payout ratio	0.12	1.01	6.16	249.48	-0.10	0.11	0.45	47,171
Dividend payout ratio change	-0.88	0.38	-3.09	59.64	-1.08	-0.89	-0.57	46,692
Decrease	-0.90	0.32	-7.78	89.56	-1.08	-0.89	-0.62	45,809
Increase	0.80	0.73	1.30	4.18	0.10	0.65	2.25	565
Omission	-0.92	0.35	-1.59	15.94	-1.18	-0.90	-0.42	318
Initiation	NA	NA	NA	NA	NA	NA	NA	NA

**Table 3-13: Bond market responses to dividend payout ratio changes.** This table presents the results of CAR of firm-level ABSR based on the parametric t-test for the four considered event windows before, around and following dividend payout ratio decrease and increase events. The results are shown for firm-level ABSR winsorized at the 1st and 99th percentiles. A dividend payout ratio decrease occurs if the payout ratio change is smaller than 0 and a dividend payout ratio increase if it is larger than 0. A dividend payout ratio change thereby is defined as the percentage change of the current and last dividend payout ratio.

Event window	Mean CAR	t-stat	Mean CAR	t-stat
ABSR	Dividend payout ratio decreases		Dividend payout ratio increases	
$(t - 30, t - 5)$	-0.250	-41.731	-0.358	-8.621
$(t - 4, t - 2)$	-0.044	-9.626	0.045	1.130
$(t - 1, t + 1)$	-0.018	-3.717	-0.064	-1.777
$(t + 2, t + 30)$	-0.377	-65.458	-0.743	-17.431

**Table 3-14: Bond market reactions to payout ratio changes with risk subsamples.** This table presents the results of CAR of firm-level ABSR based on the parametric t-test for the four considered event windows before, around and following a dividend payout ratio decrease or increase. A dividend payout ratio decrease/increase occurs if the payout ratio change is smaller/larger than 0. The sample is split into two subsamples around each announcement type based on risk-relevant characteristics. Panel A provides results of rating subsamples, Panel B based on the severeness of financial constraints of the firm and Panel C on the level of financial distress of the firm. A detailed description of all variables can be found in Table 3-1.

Event window	Mean CAR	t-stat	Mean CAR	t-stat	Mean CAR	t-stat	Mean CAR	t-stat
ABSR	Dividend payout ratio decreases				Dividend payout ratio increases			
Panel A	Investment-rated bonds		Speculative bonds		Investment-rated bonds		Speculative bonds	
$(t - 30, t - 5)$	-0.272	-42.066	-0.132	-8.338	-0.533	-9.543	-0.052	-0.895
$(t - 4, t - 2)$	-0.056	-11.404	0.021	1.715	-0.060	-1.307	0.225	3.063
$(t - 1, t + 1)$	-0.020	-3.980	-0.003	-0.250	-0.098	-2.106	-0.011	-0.185
$(t + 2, t + 30)$	-0.401	-64.804	-0.249	-16.003	-0.809	-14.789	-0.642	-9.453
Panel B	Financially unconstrained		Financially constrained		Financially unconstrained		Financially constrained	
$(t - 30, t - 5)$	-0.267	-43.606	0.025	0.918	-0.324	-7.610	-1.239	-8.001
$(t - 4, t - 2)$	-0.046	-9.668	-0.020	-1.057	0.047	1.146	-0.017	-0.553
$(t - 1, t + 1)$	-0.020	-4.083	0.018	0.921	-0.069	-1.824	0.047	1.425
$(t + 2, t + 30)$	-0.384	-64.584	-0.276	-11.598	-0.766	-17.609	-0.045	-0.227
Panel C	Financially non-distressed		Financially distressed		Financially non-distressed		Financially distressed	
$(t - 30, t - 5)$	-0.281	-38.038	-0.204	-20.218	-0.776	-11.645	-0.150	-2.882
$(t - 4, t - 2)$	-0.067	-11.406	-0.011	-1.457	-0.065	-1.113	0.098	1.903
$(t - 1, t + 1)$	-0.032	-5.351	0.003	0.450	0.007	0.148	-0.098	-2.006
$(t + 2, t + 30)$	-0.386	-54.790	-0.364	-37.148	-1.001	-16.157	-0.619	-11.136

**Table 3-15: Bond market responses to payout ratio changes including control variables.** This table presents the OLS regression results of CAR of firm-level ABSR based on the parametric t-test for the event window  $(t - 1, t + 1)$  around dividend payout ratio decreases or increases. A dividend payout ratio decrease occurs if the payout ratio change is smaller than 0 and a dividend payout ratio increase if it is larger than 0. A dividend payout ratio change thereby is defined as percentage change of the current dividend amount over the current EPS and the last paid dividend amount over the EPS of the date the last dividend was paid. The four portrayed models include an increasing number of bond and firm-specific variables. A detailed description of all variables can be found in Table 3-1.

	Model 1		Model 2		Model 3		Model 4		Model 1		Model 2		Model 3		Model 4	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Mean CAR of ABSR	Dividend payout ratio decrease								Dividend payout ratio increase							
Payout ratio change	0.027	1.414	0.020	1.029	0.027	1.320	0.027	1.315	0.016	1.049	0.025	1.591	0.034	2.166	0.030	1.837
Investment indicator	-0.002	-0.055	0.043	1.083	0.064	1.476	0.044	0.968	0.177	1.680	0.258	2.176	0.212	1.770	0.175	1.434
Payout ratio change * Investm. indicator	0.020	0.605	0.065	1.613	0.087	1.981	0.057	1.213	-0.323	-3.504	-0.379	-3.911	-0.420	-4.130	-0.463	-3.959
Maturity	0.001	0.040	-0.032	-1.528	-0.014	-0.538	-0.001	-0.027	-0.238	-3.668	-0.296	-4.072	-0.140	-1.643	-0.110	-1.245
Payout ratio change * Maturity	-0.002	-0.143	-0.038	-1.713	-0.017	-0.638	-0.002	-0.087	0.059	2.246	0.136	2.591	-0.097	-1.061	-0.079	-0.814
Financial leverage			0.176	2.260	0.241	2.571	0.256	2.671			0.374	1.829	0.543	2.610	0.624	2.785
Payout ratio change * Financial leverage			0.168	2.056	0.243	2.411	0.274	2.672			-0.373	-1.602	-0.923	-3.302	-0.932	-3.172
Financially unconstrained					-0.230	-0.613	-0.313	-0.834					-4.847	-1.217	-4.313	-1.080
Payout ratio change * Fin. unconstrained					-0.106	-1.259	-0.159	-1.781					0.874	3.360	0.847	2.837
Non-distressed indicator							0.034	0.930							0.183	1.485
Payout ratio change * Non-distr. indicator							0.071	1.834							0.024	0.199
Constant	-0.009	-0.466	-0.019	-0.852	0.104	0.303	0.153	0.446	0.378	2.517	0.289	1.506	4.331	1.178	3.706	1.005

**Table 3-16: Descriptive statistics on earnings and profitability variables.** This table presents summary statistics on the most important earnings and profitability measures used throughout this study. All observations of the cleaned and merged dataset based on the TRACE, FISD, CRSP annual stock event file and Compustat data from 2013-2022 are considered. DPC and DNC are dummy variables that equal 1 if a dividend payout ratio increase or decrease, respectively, has taken place and 0 otherwise. ROE are defined as EPS scaled by the book value of equity per share and the current earnings change<sub>B</sub> is calculated as current EPS minus last fiscal years' EPS over last fiscal year's book value of equity. ROA are defined as operating income over total assets and the current ROA change is calculated as current ROA minus last fiscal year's ROA. A detailed description of all variables can be found in Table 3-1.

	Mean	SD	Skewness	Kurtosis	5th Perc.	50th Perc.	95th Perc.	N
DPC * annualized dividend payout ratio change	0.01	0.12	16.35	314.70	0.00	0.00	0.00	46,692
DNC * annualized dividend payout ratio change	-0.89	0.34	-6.19	71.47	-1.08	-0.89	-0.52	46,692
ROE	0.18	2.68	0.54	304.02	-0.64	0.17	1.01	46,874
Earnings change <sub>B,0</sub>	0.05	1.69	-87.21	13694.37	-0.36	0.01	0.51	46,752
ROA	0.15	0.08	-1.58	37.79	0.06	0.14	0.28	48,005
ROA change <sub>0</sub>	0.00	0.06	-1.05	133.22	-0.07	0.00	0.06	47,977

**Table 3-17: Spearman's rank correlation coefficients of earnings change determinants.** This table presents the Spearman's rank correlation coefficients of earnings change determinants. The DPC and DNC dummies equal 1 if a dividend payout ratio increase or decrease, respectively, has taken place and 0 otherwise. The annualized dividend payout ratio change equals the current annualized dividend payout ratio minus the annualized payout ratio at the last dividend payment divided by the annualized payout ratio at the last dividend payment. The annualized dividend payout ratio thereby is defined as the last dividend payout ratio of the previous fiscal year multiplied by the number of dividend payments made last fiscal year. ROE are defined as EPS scaled by the book value of equity per share and the current earnings change<sub>P,0</sub> is calculated as current EPS minus last fiscal years' EPS over last fiscal year's closing price. A detailed description of all determinants can be found in Table 3-1.

	DPC * Annualized dividend payout ratio change	DNC * Annualized dividend payout ratio change	ROE	Earnings change <sub>P,0</sub>
DPC * Annualized dividend payout ratio change	1.00	0.00	0.00	-0.02
DNC * Annualized dividend payout ratio change	0.00	1.00	0.00	0.06
ROE	0.00	0.00	1.00	0.00
Earnings change <sub>P,0</sub>	-0.02	0.06	0.00	1.00

**Table 3-18: Impact of dividend payout ratio changes on current and future earnings.** This table presents the results of earnings changes in the year of a dividend change announcement and in the two years following the announcement dependent on dividend payout ratio changes. The annualized dividend payout ratio change equals the current annualized dividend payout ratio minus the annualized payout ratio at the last dividend payment divided by the annualized payout ratio at the last dividend payment. The annualized dividend payout ratio thereby is defined as the last dividend payout ratio of the previous fiscal year multiplied by the number of dividend payments made last fiscal year. The earnings change<sub>P</sub> is calculated as current EPS minus last fiscal years' EPS over last fiscal year's closing price. A detailed description of all variables can be found in Table 3-1.

	Annualized dividend payout ratio change	t-statistic	Constant	t-statistic
Earnings change <sub>P,0</sub>	0.000	5.75	0.005	10.11
Earnings change <sub>P,1</sub>	0.000	2.08	0.002	1.15
Earnings change <sub>P,2</sub>	-0.001	-5.90	-0.004	-1.71

**Table 3-19: Impact on future earnings changes including control variables.** This table presents the results of earnings changes in the two years following a dividend change announcement dependent on dividend payout ratio changes. While Model 1 considers dividend payout ratio changes as a general event, Model 2 considers the sign of dividend payout ratio decreases vs. increases and in addition controls for current earnings changes. The annualized dividend payout ratio change equals the current annualized dividend payout ratio minus the annualized payout ratio at the last dividend payment divided by the annualized payout ratio at the last dividend payment. The annualized dividend payout ratio thereby is defined as the last dividend payout ratio of the previous fiscal year multiplied by the number of dividend payments made last fiscal year. ROE are defined as EPS scaled by the book value of equity per share and the current earnings change<sub>B</sub> is calculated as current EPS minus last fiscal years' EPS over last fiscal year's book value of equity. Finally, DPC and DNC are dummy variables that equal 1 if a dividend payout ratio increase or decrease, respectively, has taken place and 0 otherwise. A detailed description of all variables can be found in Table 3-1.

	Model 1		Model 2		Model 1		Model 2	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
	Earnings change <sub>B,1</sub>				Earnings change <sub>B,2</sub>			
Annualized dividend payout ratio change	0.000	-0.13			-0.001	-1.72		
ROE	-0.194	-78.20	-0.198	-76.25	-0.275	-95.73	-0.282	-92.48
Earnings change <sub>B,0</sub>			-0.074	-12.37			-0.090	-11.62
DPC * Annualized dividend payout ratio change			0.000	0.48			0.000	0.00
DNC * Annualized dividend payout ratio change			0.000	-0.88			-0.001	-1.97
Constant	-0.007	-1.08	-0.006	-0.83	-0.039	-4.92	-0.038	-4.75

**Table 3-20: Direction of impact on future earnings changes including control variables.** This table presents the results of earnings changes in the two years following a dividend change announcement dependent on dividend payout ratio changes. Fama and MacBeth (1973) cross-sectional regression coefficients are determined. DPC represents a dummy variable that equals 1 for dividend increases and 0 otherwise, while DNC is the same for dividend decreases.  $DFE_0$  is the value of  $ROE_0 - E[ROE_0]$ .  $E[ROE_0]$  is the predicted value from the cross-sectional regression with  $ROE_0$  as the dependent variable and the logarithm of assets, the logarithm of the market-to-book ratio of equity and ROE, all three of the year before the announcement event, as independent variables.  $CE_0$  is calculated from  $\frac{E_0 - E_{-1}}{B_{-1}}$ . NDFED/NCED is a dummy variable that is 1 if DFE/CE is negative and 0 otherwise, and PDFED/PCED are the same but if DFE/CE is positive. The control variables include squared factors to control for non-linear earnings expectations. A detailed description of all variables can be found in Table 3-1.

	Coefficient	t-statistic	Coefficient	t-statistic
	Earnings change <sub>B,1</sub>		Earnings change <sub>B,2</sub>	
DPC * Annualized dividend payout ratio change	0.000	-0.44	0.000	-1.26
DNC * Annualized dividend payout ratio change	0.000	0.06	-0.001	-2.10
DFE	-0.973	-124.34	-1.313	-173.90
NDFED * DFE	0.874	52.01	1.383	81.20
NDFED * DFE <sup>2</sup>	-0.002	-2.19	0.007	7.96
PDFED * DFE <sup>2</sup>	0.013	82.67	0.018	124.17
CE	-0.024	-1.25	-0.285	-13.41
NCED * CE	-0.561	-11.97	-0.111	-2.26
NCED * CE <sup>2</sup>	-0.004	-6.11	-0.005	-7.80
PCED * CE <sup>2</sup>	-0.010	-7.39	0.013	7.23
Constant	0.080	13.36	0.135	22.58

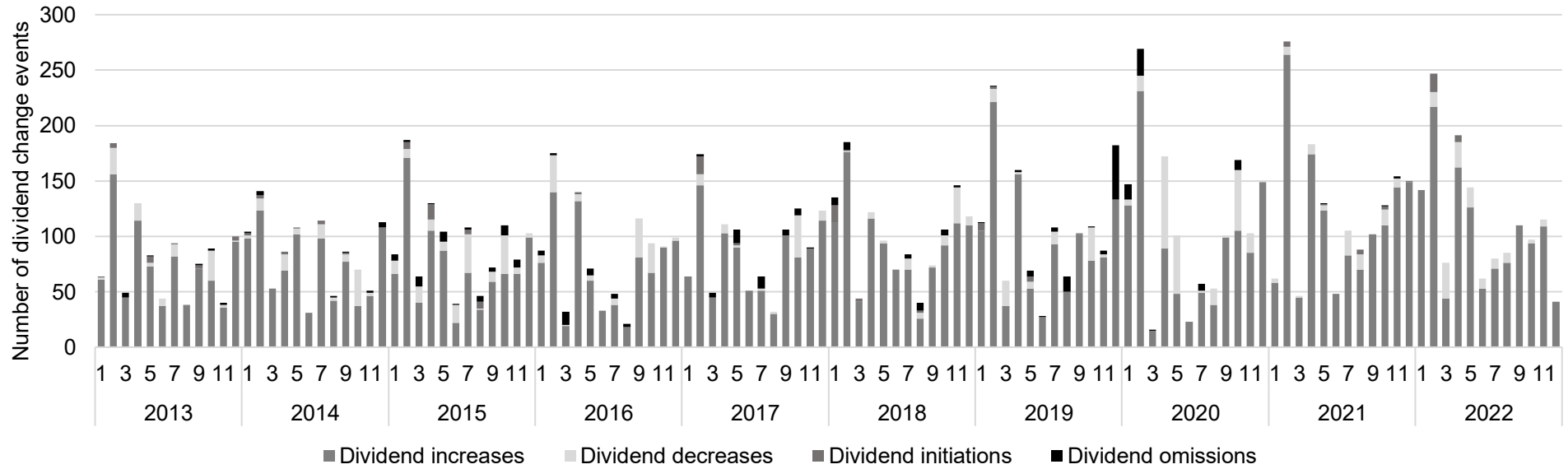
**Table 3-21: Impact on future profitability changes including control variables.** This table presents the results of profitability (ROA) changes in the two years following a dividend change announcement dependent on dividend payout ratio changes. Fama and MacBeth (1973) cross-sectional regression coefficients are determined. ROA is defined as the operating income before depreciation scaled by total assets. DPC represents a dummy variable that equals 1 for dividend increases and 0 otherwise, while DNC is the same for dividend decreases.  $DFE_{ROA}$  is the value of  $ROA_0 - E[ROA_0]$ .  $E[ROA_0]$  is the predicted value from the cross-sectional regression with  $ROA_0$  as the dependent variable and the logarithm of assets, the logarithm of the market-to-book ratio of equity and ROA, all three of the year before the announcement event, as independent variables.  $CE_{ROA}$  equals  $ROA_0 - ROA_{-1}$ .  $NDFED_{ROA}/NCED_{ROA}$  is a dummy variable that is 1 if  $DFE_{ROA}/CE_{ROA}$  is negative and 0 otherwise, and  $PDFED_{ROA}/PCED_{ROA}$  are the same but if  $DFE_{ROA}/CE_{ROA}$  is positive. The control variables include squared factors to control for non-linear earnings expectations. A detailed description of all variables can be found in Table 3-1.

	Model 1		Model 2		Model 1		Model 2	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
	ROA change <sub>1</sub>				ROA change <sub>2</sub>			
DPC * Annualized dividend payout ratio change	0.000	1.20	0.000	1.23	0.000	-0.11	0.000	-0.28
DNC * Annualized dividend payout ratio change	0.000	-1.70	0.000	-1.04	0.000	-3.56	0.000	-2.70
$DFE_{ROA}$			-0.342	-31.68			-0.106	-6.52
$NDFED_{ROA} * DFE_{ROA}$			0.024	1.54			-0.053	-2.25
$NDFED_{ROA} * DFE_{ROA}^2$			0.798	10.11			-0.177	-1.53
$PDFED_{ROA} * DFE_{ROA}^2$			1.006	14.34			-0.339	-3.13
$CE_{ROA}$			0.358	21.71			-0.186	-6.27
$NCED_{ROA} * CE_{ROA}$			-0.628	-24.03			-0.045	-1.05
$NCED_{ROA} * CE_{ROA}^2$			-0.419	-4.96			-0.090	-0.73
$PCED_{ROA} * CE_{ROA}^2$			-0.269	-13.30			0.152	4.76
$ROA_0$	-0.244	-46.20						
ROA change <sub>0</sub>	-0.154	-23.23			-0.103	-13.04		
$ROA_1$					-0.497	-102.22		
Constant	0.034	39.85	-0.011	-21.76	0.071	83.66	0.001	1.07

### **3.11 Figures**

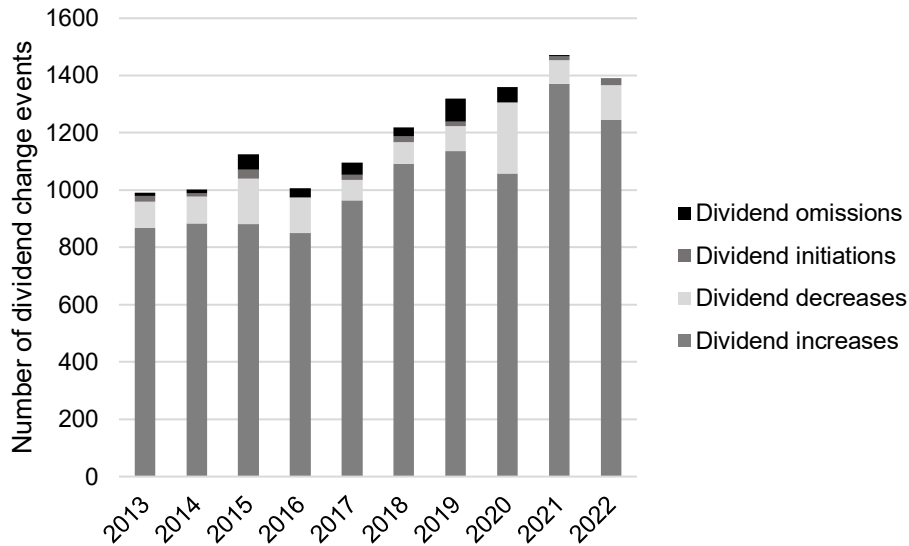
The first figure of Chapter 3 is presented on the following page.

**Figure 3-1: Number and distribution of dividend change announcements over time.** This figure presents the number of dividend decrease, dividend increase, dividend omission and dividend initiation announcements made by bond-issuing firms over the years of 2013-2022. The data is based on the cleaned and merged dataset of TRACE, FISD, CRSP annual stock event file and Compustat data.

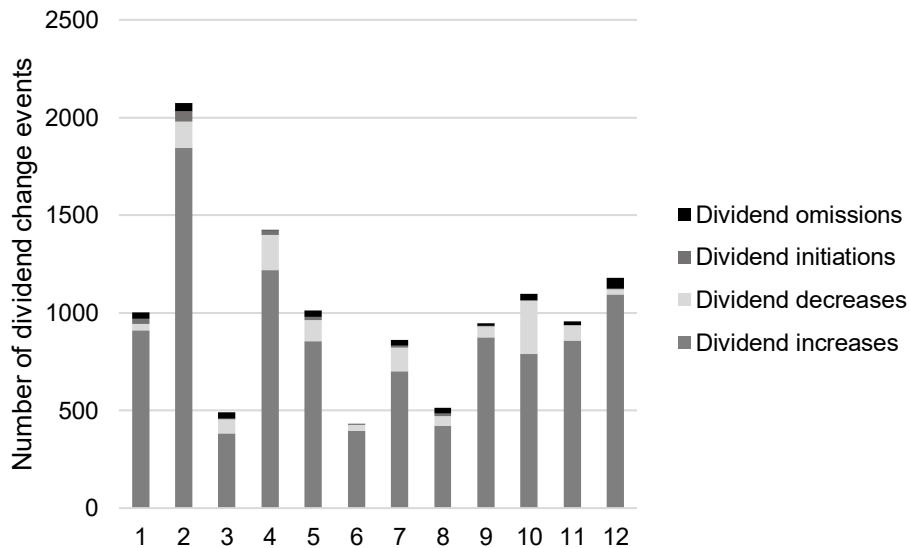


**Figure 3-2: Frequency distribution of dividend change announcements.** This figure presents the number of dividend decrease, increase, omission and initiation announcements made by bond-issuing firms. Panel A presents the distribution of these events over the examined years of 2013-2022, while Panel B shows the distribution of the same events over months. The data is based on the cleaned and merged dataset of TRACE, FISD, CRSP annual stock event file and Compustat data.

Panel A - Dividend announcement events distribution over years

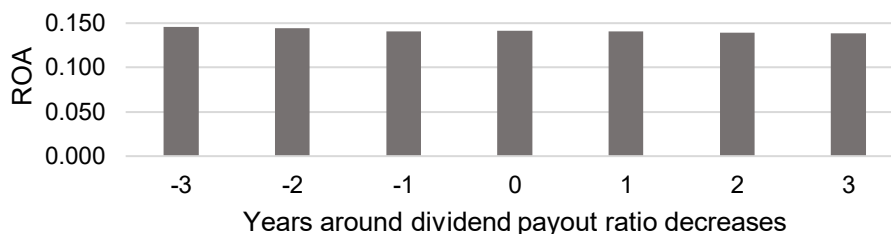


Panel B - Dividend announcement events distribution over months

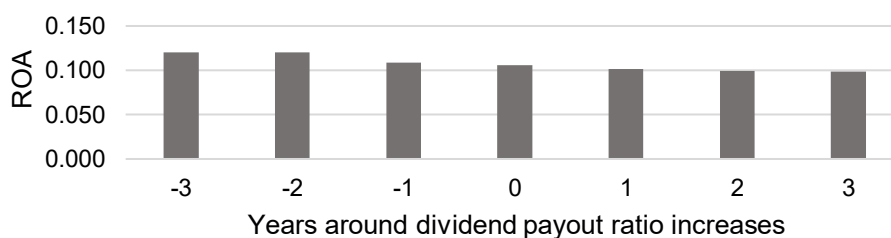


**Figure 3-3: Profitability development over the years around dividend changes.** This figure presents the ROA of the seven years during and around a dividend change announcement. Panel A states the ROA around dividend payout ratio decreases and Panel B around dividend payout ratio increases. ROA is defined as the operating income before depreciation scaled by total assets. A detailed description of all variables can be found in Table 1.

Panel A - ROA in years around dividend payout ratio decreases



Panel B - ROA in years around dividend payout ratio increases



## 3.12 Appendix

### A Alternative Tests and Robustness

**Table 3-22: Bond market reactions to dividend changes - Alternative dividend measures.** This table presents the results of CAR of firm-level ABR and ABSR based on the parametric t-test for the four considered event windows before, around and following a dividend decrease or increase announcement. The naïve unexpected dividend change is defined as the current dividend minus the last paid dividend. The standardized unexpected dividend change is calculated as the current dividend minus the last paid dividend, which is then standardized by the stock price at the month-end prior to the announcement. A dividend decrease occurs if  $D^U$  is smaller than 0 and a dividend increase if it is larger than 0. Panel A shows the results for firm-level ABR and Panel B for firm-level ABSR, both when applying the naïve unexpected dividend change. Panel C and D show the firm-level ABR and ABSR, respectively, when applying the standardized unexpected dividend change.

Event window	Mean CAR	t-stat	Mean CAR	t-stat
	Dividend decreases		Dividend increases	
Panel A - ABR applying naïve unexpected dividend change				
$(t - 30, t - 5)$	-0.004	-17.368	-0.001	-17.223
$(t - 4, t - 2)$	0.000	1.612	0.000	-2.753
$(t - 1, t + 1)$	0.000	0.144	0.000	-3.445
$(t + 2, t + 30)$	-0.001	-5.487	-0.002	-36.272
Panel B - ABSR applying naïve unexpected dividend change				
$(t - 30, t - 5)$	-0.660	-16.673	-0.196	-23.981
$(t - 4, t - 2)$	0.109	3.829	-0.033	-4.897
$(t - 1, t + 1)$	-0.012	-0.405	-0.018	-2.593
$(t + 2, t + 30)$	-0.082	-1.985	-0.323	-41.694
Panel C - ABR applying standardized unexpected dividend change				
$(t - 30, t - 5)$	-0.004	-17.346	-0.001	-18.041
$(t - 4, t - 2)$	0.000	1.612	0.000	-2.841
$(t - 1, t + 1)$	0.000	0.144	0.000	-3.619
$(t + 2, t + 30)$	-0.001	-5.487	-0.002	-36.165
Panel D - ABSR applying standardized unexpected dividend change				
$(t - 30, t - 5)$	-0.660	-16.673	-0.202	-24.659
$(t - 4, t - 2)$	0.109	3.829	-0.033	-4.882
$(t - 1, t + 1)$	-0.012	-0.405	-0.019	-2.690
$(t + 2, t + 30)$	-0.082	-1.985	-0.323	-41.605

**Table 3-23: Bond market responses to dividend changes - SR test.** This table presents the results of firm-level ABR and ABSR based on the non-parametric Wilcoxon signed-rank (SR) test for the four considered event windows before, around and following a dividend decrease or increase announcement. A dividend decrease occurs if  $D^U$  is smaller than 0 and a dividend increase if it is larger than 0. Panel A shows the results for firm-level ABR and Panel B for firm-level ABSR, both winsorized at the 1st and 99th percentiles. ABR are based on a raw return calculated from trade-weighted daily prices minus a matched portfolio return following Equation 3-2. The matched portfolio is constructed as the average return of all bonds within one of 13 rating and time-to-maturity classes on a specific day. These ABR are aggregated to a firm level by weighing them by the trade volume of each bond as described in Equation 3-3. ABSR are calculated as standardized bond raw returns minus the average standardized return of all bonds' raw returns within the same rating/maturity group. ABSR are again aggregated to a firm level by weighing them by the trade volume of each bond.

Event window	Z	p	Z	p
Panel A - ABR	Dividend decreases		Dividend increases	
$(t - 30, t - 5)$	-14.347	0.000	-17.206	0.000
$(t - 4, t - 2)$	-0.559	0.576	-1.218	0.223
$(t - 1, t + 1)$	-2.008	0.045	-3.688	0.000
$(t + 2, t + 30)$	-4.443	0.000	-32.839	0.000
Panel B - ABSR				
$(t - 30, t - 5)$	-17.023	0.000	-28.179	0.000
$(t - 4, t - 2)$	2.356	0.018	-2.098	0.036
$(t - 1, t + 1)$	0.657	0.511	-3.635	0.000
$(t + 2, t + 30)$	0.628	0.530	-35.565	0.000

**Table 3-24: Bond market reactions to dividend changes with risk subsamples - SR test.** This table presents the results of firm-level ABSR based on the non-parametric Wilcoxon signed-rank (SR) test for the four considered event windows before, around and following a dividend decreases or increases. The sample is split into two subsamples around each announcement type based on risk-relevant characteristics. Panel A provides results of rating subsamples, Panel B based on the of financial constraints and Panel C on the level of financial distress of the firm. A detailed description of all variables can be found in Table 1.

Event window	Z	p	Z	p	Z	p	Z	p
ABSR	Dividend decreases				Dividend increases			
Panel A	Investment-rated bonds		Speculative bonds		Investment-rated bonds		Speculative bonds	
$(t - 30, t - 5)$	-12.644	0.000	-12.200	0.000	-28.242	0.000	-4.922	0.000
$(t - 4, t - 2)$	0.884	0.377	2.802	0.005	-3.078	0.002	2.070	0.038
$(t - 1, t + 1)$	-0.906	0.365	2.590	0.010	-3.060	0.002	-2.242	0.025
$(t + 2, t + 30)$	-3.555	0.000	5.937	0.000	-36.640	0.000	-3.131	0.002
Panel B	Financially unconstrained		Financially constrained		Financially unconstrained		Financially constrained	
$(t - 30, t - 5)$	-16.464	0.000	-4.847	0.000	-28.588	0.000	-0.980	0.327
$(t - 4, t - 2)$	2.952	0.003	-1.289	0.197	-2.484	0.013	1.544	0.123
$(t - 1, t + 1)$	-0.460	0.645	3.726	0.000	-3.953	0.000	0.928	0.353
$(t + 2, t + 30)$	1.355	0.176	-1.307	0.191	-34.490	0.000	-8.407	0.000
Panel C	Financially non-distressed		Financially distressed		Financially non-distressed		Financially distressed	
$(t - 30, t - 5)$	-9.675	0.000	-13.471	0.000	-20.805	0.000	-19.153	0.000
$(t - 4, t - 2)$	1.084	0.278	2.070	0.038	-5.626	0.000	3.862	0.000
$(t - 1, t + 1)$	-0.964	0.335	1.546	0.122	-4.045	0.000	-0.696	0.486
$(t + 2, t + 30)$	-6.886	0.000	5.557	0.000	-27.446	0.000	-22.779	0.000

**Table 3-25: Bond market responses to dividend omissions and initiations - SR test.** This table presents the results of firm-level ABSR based on the non-parametric Wilcoxon signed-rank (SR) test for the four considered event windows before, around and following a dividend omission or initiation announcement. A dividend omission occurs when firm omits a dividend after having paid a dividend for at least three years and a dividend initiation is defined as a dividend that is paid after the firm has not paid a dividend for at least five years.

Event window	Z	p	Z	p
ABSR	Dividend omissions		Dividend initiations	
$(t - 30, t - 5)$	1.375	0.169	-2.119	0.034
$(t - 4, t - 2)$	1.503	0.133	-1.145	0.252
$(t - 1, t + 1)$	-0.915	0.360	0.156	0.876
$(t + 2, t + 30)$	-17.146	0.000	-4.923	0.000

**Table 3-26: Stock and bond market responses to dividend payout ratio changes.** This table presents the results of CAR of firm-level ABSR and abnormal stock returns (ASR) based on the parametric t-test for the four considered event windows before, around and following a dividend payout ratio decrease or dividend payout ratio increase or a dividend omission or initiation announcement. Panel A shows the results for ABSR and Panel B for ASR considering dividend payout ratio decreases and increases. Panel C and Panel D state the results for ABSR and ASR, respectively, around dividend omission and initiation announcements. ASR are estimated using the Fama French five-factor model with an estimation window of  $(t - 60, t - 31)$ . A detailed description of all variables can be found in Table 1.

Event window	Mean CAR	t-stat	Mean CAR	t-stat
Panel A - ABSR	Dividend payout ratio decreases		Dividend payout ratio increases	
$(t - 30, t - 5)$	-0.250	-41.731	-0.358	-8.621
$(t - 4, t - 2)$	-0.044	-9.626	0.045	1.130
$(t - 1, t + 1)$	-0.018	-3.717	-0.064	-1.777
$(t + 2, t + 30)$	-0.377	-65.458	-0.743	-17.431
Panel B - ASR				
$(t - 30, t - 5)$	0.060	218.588	0.094	53.542
$(t - 4, t - 2)$	0.007	38.281	0.012	10.376
$(t - 1, t + 1)$	0.008	39.007	0.009	6.192
$(t + 2, t + 30)$	0.071	359.481	0.091	68.848
Panel C - ABSR	Dividend omissions		Dividend initiations	
$(t - 30, t - 5)$	0.223	2.559	-0.174	-2.570
$(t - 4, t - 2)$	0.121	1.864	-0.009	-0.194
$(t - 1, t + 1)$	-0.007	-0.211	-0.037	-0.784
$(t + 2, t + 30)$	-1.452	-21.388	-0.698	-9.065
Panel D - ASR				
$(t - 30, t - 5)$	0.079	8.953	0.022	9.394
$(t - 4, t - 2)$	0.004	1.403	0.008	5.452
$(t - 1, t + 1)$	0.007	3.113	0.010	4.005
$(t + 2, t + 30)$	0.071	25.354	0.055	25.992

## 4. Interaction Effect in the Corporate Bond Market

*This chapter is based on a working paper jointly written with Dr. Patrick Weiss.*

### 4.1 Abstract

In this study, we examine the existence of the interaction effect between earnings and dividend announcements in the US corporate bond market. Using a sample of 2,608 events where these two announcements occur within ten working days, we identify a significant interaction effect. We demonstrate its robustness across several specifications, such as the announcement sequence, timing and firm characteristics. Both dividend and earnings changes contain informational content for bond prices, underscoring the need to account for the interaction effect in future research on the informational efficiency around these announcements.

### 4.2 Introduction

In an efficient market, new information is rapidly reflected in asset prices. To assess the informational efficiency of the bond market, dividend announcements (e.g., Chen, 2016; Tsai & Wu, 2015; Wei et al., 2020) and earnings announcements (e.g., Defond & Zhang, 2014; Easton et al., 2009; Kapons & Kelly, 2023) are prominently studied. However, while these two announcements are typically studied independently, they are often made in close temporal proximity and investors are likely to evaluate them jointly (Easton, 1991). Thus, earnings and dividend announcements potentially carry joint information content (Beaver, 1968).

Ignoring this joint information content may result in over- or underestimating the informational value of earnings and dividend announcements. Thus, studies that fail to consider closely timed announcements (e.g., Datta & Dhillon, 1993; Easton et al., 2009; Kapons & Kelly, 2023; Woodley et al., 2020 for earnings announcements) or exclude them from the sample (e.g., Chen, 2016; Dhillon & Johnson, 1994; Tsai & Wu, 2015; Wei et al., 2020 for dividend announcements) risk misinterpreting their true impact. In this study, we analyze whether an interaction effect is present in the corporate bond market and whether it is robust and relevant enough to warrant consideration in future research.

Using a comprehensive sample of US corporate bond trading data and 2,608 events of dividend and earnings announcements made within ten working days, we identify an

interaction effect in the corporate bond market. Thus, unexpected dividend and earnings changes contain joint information for the corporate bond market. We demonstrate the interaction effect's robustness across announcement sequences, relative timing and time periods. Furthermore, we find that the interaction effect exists independent of the magnitude of the announcements and the characteristics of the announcing firms. Additionally, we observe a significant information content of dividend and earnings announcements for the bond market, which underscores that the overlap in information, i.e., the interaction effect, should be considered in analyses of the informational efficiency in the bond market around these announcements.

This study extends the literature on the interaction effect of dividend and earnings announcements. Building on the initial work of Pettit (1972) and Watts (1973), Kane et al. (1984) lay the foundation for understanding the interaction effect in the equity market. Subsequent research of Bozos et al. (2011), Chang and Chen (1991), Chen et al. (2002, for China), Datta and Dhillon (1993) and Huang (2008), amongst others, examines the robustness of the interaction effect in the equity market considering the sequence of announcements and economic circumstances. Additionally, several studies of international stock markets support the existence of interaction effects (Easton, 1991; Kouki, 2017; Lonie et al., 1996), including in countries in which the announcements are made at the same day (e.g., Cheng & Leung, 2006). In contrast, the bond market has received little attention. Datta and Dhillon (1993) strive to determine whether an interaction effect exists in the US bond market, but do not reach a meaningful conclusion due to insufficient data.

Our research provides the first robust evidence of an interaction effect in the corporate bond market. The findings highlight the importance of accounting for joint informational content in future analyses of the information efficiency in the corporate bond market around dividend and earnings announcements.

### **4.3 Data and Methodology**

#### **4.3.1 Sampling**

We study a comprehensive sample of US over-the-counter bond trading data over the period of January 2004 to and including September 2023 obtained from TRACE. We source and clean the data following Dick-Nielsen (2009, 2014) using code from Scheuch et al. (2023). Furthermore, to reduce potential noise, we remove trades with an individual trade volume of less than USD 50,000 and all observations with maturities outside of the range of one year

to 50 years. We filter the cross-section of bonds based on characteristics obtained from the Mergent FISD. In particular, putable, convertible, pay-in-kind, exchangeable, preferred, and perpetual bonds, as well as bonds issued by foreign issuers and Canadian bonds are excluded from the dataset. The remaining bonds are all USD-denominated with fixed semi-annual coupons. To complete our bond market data, we add rating information from Mergent FISD, considering them as they are available in the following order Moody's before Standard & Poor's before Fitch's rating.

Firm accounting data obtained from the Compustat fundamentals annual data file are added with a lag of one fiscal year (Watts, 1973). We also use analyst forecasts from the IBES to compute their dispersion (alongside the surprise measure discussed below). Additionally, we adopt the CRSP annual stock event file for data on dividend announcements. We list all variables and their construction in Table 4-7.

### 4.3.2 Abnormal Returns

We construct abnormal bond returns following the recent literature (see, e.g., Bessembinder et al., 2009; Ederington et al., 2015; Mueller et al., 2024). Particularly, we use bond  $i$ 's trade-weighted average prices  $P_{i,t}$  on day  $t$  to compute the abnormal return:

$$ABR_{i,t} = RR_{i,t} - MR_{i,t} \quad (4-1)$$

where  $RR_{i,t}$  is the raw return of bond  $i$  (i.e.,  $\frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}}$ ) and  $MR_{i,t}$  is the return of the benchmark bond portfolio. We construct the benchmark returns considering credit risk (proxied by rating) and interest rate risk (proxied by time to maturity). In the rating dimension, we split into seven groups. The two time-to-maturity classes are chosen to have approximately the same amount of bond returns in each portfolio (May, 2010).<sup>15</sup> The matching benchmark is only considered if it contains at least five bonds, and we exclude non-matched observations. To avoid a bias towards larger firms and to account for bond market illiquidity, we aggregate bonds issued by the same firm to the firm level by weighing them with the bonds' respective trade volumes.

Finally, we standardize abnormal returns using the two standard approaches to account for the bond return's cross-sectional heteroskedasticity and improve test power (see Mueller et al., 2024, for a recent discussion). First, we consider abnormal standardized bond returns, which we compute as:

<sup>15</sup> We again choose the matched portfolio approach of Chapter 3.4 in contrast to Chapter 2.3 to allow for comparability within the dividend announcement bond event study literature.

$$ABSR_{i,t} = SRR_{i,t} - SMR_{i,t} \quad (4-2)$$

where  $SRR_{i,t}$  is the bond's  $RR_{i,t}$  divided by the bond's raw returns' time-series standard deviation over the period of  $(t - 55, t - 6)$  and  $(t + 6, t + 55)$ . At least six return observations are required over this period to determine a standard deviation and, consequently, ABSR. The  $SMR_{i,t}$  is calculated as the average of the  $SRR_{i,t}$  of all bonds within each corresponding rating and time-to-maturity class as before. Second, we compute standardized abnormal bond returns by:

$$SABR_{i,t} = \frac{ABR_{i,t}}{\sigma_{i,t,ABR}} \quad (4-3)$$

where  $\sigma_{i,t,ABR}$  is the time-series standard deviation of the bond's abnormal returns over the period of  $(t - 55, t - 6)$  and  $(t + 6, t + 55)$ . The SABR, thereby, is the more powerful standardized measure in case the announcements would cause a substantial increase in return variance (Mueller et al., 2024). All ABSR and SABR are again aggregated to the firm level.

Table 4-1 provides descriptive statistics for the three firm-level abnormal return measures  $ABR_{f,t}$ ,  $ABSR_{f,t}$  and  $SABR_{f,t}$ . For our event analyses, we compute the cumulative abnormal returns (CAR) as the sum of the ABR, ABSR, or SABR per firm, respectively, over the chosen event windows.

### 4.3.3 Dividend and Earnings Announcements

In our sample, we consider only ordinary dividends and exclude non-regular dividends (Chang & Chen, 1991). In addition, we discard announcements by utility firms (SIC code 49\*\*) or financial firms (SIC code 6\*\*\*) (Woodley et al., 2020). We use the seasonal difference of dividends to approximate the unexpected dividend change  $D_t^U$  as the percentage change between the current dividend  $dividend_t$  and previous dividend payment (in line with, e.g., Cooper & Lambertides, 2018; Grullon et al., 2002; Tsai & Wu, 2015, amongst others), i.e.,

$$Unexpected\ dividend\ change_t = D_t^U = \frac{dividend_t - dividend_{t-1}}{dividend_{t-1}} \quad (4-4)$$

We eliminate dividend announcements with a percentage change higher than or equal to 500% to exclude outliers from our sample (Grullon et al., 2002).

To determine the unexpected earnings, we make use of analysts' consensus forecasts. In particular, we compute the unexpected information content of an earnings announcement

as the standardized unexpected earnings  $E_t^U$  (in line with, e.g., Datta & Dhillon, 1993; Woodley et al., 2020, amongst others), i.e.,

$$\text{Standardized unexpected earnings } s_t = E_t^U = \frac{AE_t - F_t}{\sigma_t} \quad (4-5)$$

where  $AE_t$  is the actual quarterly earnings announced at quarter  $t$ ,  $F_t$  the mean analysts' earnings forecast at quarter  $t$  and  $\sigma_t$  the standard deviation of the analyst expectations for firm  $f$ . We restrict the analysts' forecast periods to one fiscal quarter to focus on the most recent forecasts reflecting experts' latest knowledge and insight. Following Datta and Dhillon (1993), we also require at least three analyst forecasts for each particular quarterly earnings estimate to be included in the sample. Moreover, analyst forecasts that are made within ten days before the earnings announcement are excluded to ensure that no information from a potential earlier dividend announcement is considered in the calculation of the analyst's expectation of a subsequent earnings announcement. Additionally, standardized unexpected earnings are eliminated if their absolute value is smaller than or equal to one to limit the noise in the sample by eliminating the smallest earnings surprises (Datta & Dhillon, 1993).

Table 4-2 holds summary statistics of unexpected dividend change and standardized unexpected earnings.

#### 4.3.4 Joint Announcement Events

We are particularly interested in events that happen in close proximity to each other. Therefore, we define the joint occurrence of a dividend (measured by the dividend declaration date) and an earnings announcement if these two happen within a maximum interval of ten working days. The two days of the announcements, as well as all days in between, are defined as event dates. While the last day before the first announcement (either dividend or earnings announcement) is the last day of the pre-event period, the first day following the second announcement is the first day of the post-event period.

The joint dataset consists of 2,608 events of dividend and earnings announcements being made within ten working days for which ABSR and SABR are available. Table 4-3 Panel A shows this final number of announcements split by the sign of the respective announcements. Panel B portrays the number of events, i.e., announcement pairings, for the different days that lie between the announcements. The highest number of announcement pairings by a large margin is a positive earnings surprise with no change in the dividend, totaling 1,573 events in the sample. Likewise, the lowest number of events, i.e., 22, are unexpected dividend decrease announcements that are made jointly with unexpected

earnings changes of either sign. Additionally, about 28% of announcements are made on the same day, while the number of announcements made with ten days in between is the lowest in our sample.

Figure 4-1 shows that the number of joint announcements increases slightly over the years.<sup>16</sup> Generally, the joint announcements are spread out evenly over the years as well as over the course of the year and we do not face a clustering problem.

#### 4.3.5 Methodology

We assess the existence of an interaction effect statistically with two approaches. We estimate restricted (i.e., not considering an interaction possibility) and unrestricted regressions. First, we assess the significance of the interaction dummies that exist in the unrestricted model. Second, we assess the joint significance of the unexpected earnings and dividend changes and of the interaction dummies, respectively, by considering F-statistics.

We estimate the interaction effect between the dividend and earnings announcements (in line with Kane et al., 1984; Pettit, 1972):

$$CAR = \alpha + \beta_0 D^U + \beta_1 E^U + \gamma_0 I(-0) + \gamma_1 I(-+) + \gamma_2 I(+ -) + \gamma_3 I(+0) + \gamma_4 I(++ ) + \epsilon \quad (4-6)$$

with  $D^U$  being the unanticipated dividend and  $E^U$  being the percentage error in the earnings forecast as introduced in Equations 4-4 and 4-5.  $I(\dots)$  represent interaction dummies for the direction of the earnings and dividend changes, e.g.,  $I(+ -)$  represents the case that the standardized unexpected earnings are positive and the dividend decreases unexpectedly.  $I(- -)$  is omitted to avoid the problem of over-specification and to prevent collinearity. Thus, the coefficients of the presented interaction dummy variables represent the incremental return over the case in which both the unexpected earnings as well as the unexpected dividend are negative. Thereby, if any interaction between the informational content of these two announcements exists, the interaction dummy variables will significantly differ from zero (conditional on having sufficient test power). At the same time, the coefficient of the unexpected dividend changes and unexpected earnings changes and therefore, their impact on the cumulative ABSR or SABR should decrease.

To determine the impact of unexpected dividends and unexpected earnings on the bond market, we use the following regression:

<sup>16</sup> Note that the year 2023 is an exception because the sample includes data only up to and including September 2023.

$$CAR = \alpha + \beta_0 D^U + \beta_1 E^U + \epsilon \quad (4-7)$$

Additionally, we consider the first-order and interaction F-statistics as proposed by Kane et al. (1984):

$$Interaction\ F\text{-}statistic = \frac{(SSE_{restricted} - SSE_{unrestricted})/R}{SSE_{unrestricted}/(N-K)} \quad (4-8)$$

where  $SSE$  is the error sum of squares. The restricted model is shown in Equation 4-7, while the unrestricted model is shown in Equation 4-6.  $R$  is number of restrictions,  $N$  is the number of observations,  $K$  is the number of independent variables in the unrestricted model. (Lonie et al., 1996)

The first-order F-statistic is defined in parallel to the interaction F-statistic, however, the restricted model is given by:

$$CAR = \alpha + \gamma_0 I(-0) + \gamma_1 I(-+) + \gamma_2 I(+ -) + \gamma_3 I(+0) + \gamma_4 I(++ ) + \epsilon \quad (4-9)$$

(Lonie et al., 1996). The first-order F-statistic thereby tests the joint significance of the unanticipated earnings and dividend, while the interaction F-statistic shows the joint significance of the interaction dummy variables. Consequently, if an interaction effect between the analyzed earnings and dividend announcements exists, the interaction F-statistic is expected to be significant. A precise definition of all variables used throughout the chapter is presented in Table 4-7.

#### 4.4 Interaction Effect

We now turn to the core analysis of the existence of an interaction effect in the corporate bond market. As discussed above, the interaction effect is present whenever any interaction coefficient or the Interaction F-statistic is significant. We present our main results in Table 4-4.

Overall, all four tests provide statistical support for the existence of the interaction effect between dividend and earnings announcements on corporate bond returns. In particular, we present our inference based on two event periods and two abnormal bond return measures to assess the interaction effects here. Considering the shorter event window, we find a significant interaction coefficient (i.e.,  $I(-,0)$ ) alongside a statistically significant interaction F-statistic<sup>17</sup>). For the longer period of  $(t - 10, t + 10)$ , the majority of the interaction variables are positive and statistically significant. This finding is supported by the highly significant

<sup>17</sup> The interaction F-statistic reaches significance at the 5%-level at 2.21 and at the 1%-level at 3.02.

interaction F-statistic of 18.6 and 16.9, respectively. These results confirm the existence of a strong interaction effect between dividend and earnings announcements. While the unexpected dividend and unexpected earnings changes jointly continue to have a significant impact on the cumulative ABSR or SABR as shown by the significant first-order F-statistic<sup>18</sup>, the significant interaction effects have to be accounted for to draw precise conclusions about announcement effects for corporate bonds.

Table 4-8 in Appendix A provides additional insights into the interaction effect by providing findings based on sequential event periods around the joint announcements.

Next, we assess if these main results extend to other specifications, i.e., whether our evidence for the interaction effect is a robust feature of the data. We summarize our findings across many tests in Table 4-5. Here we report the significance of the interaction dummies (based on the highest t-statistic) and the interaction F-statistic over five groups of tests based on ABSR.<sup>19</sup>

#### 4.4.1 Announcement Sequence

In Table 4-5 Panel A, we examine whether the sequence of dividend and earnings announcements impacts the presence of an interaction effect. Table 4-14 in Appendix C provides the detailed findings. One potential economic rationale for the sequence to impact the interaction effect comes from dividends' redistribution of cash flows. Theoretically, a dividend announcement made before earnings might trigger a stronger interaction than if the sequence is reversed since dividends reduce bondholders' shares in a firm's earnings. Consequently, bondholders, having fixed-income claims, are particularly impacted by these changes, which could increase the interaction effect. In the opposite case, there might not be an interaction effect if earnings are fully informative about the firm's prospects. Hence, the sequence of events potentially matters for the interaction. While Huang (2008) analyzes the specific case of earnings announcements made before dividend announcements for the stock market, bond market evidence is only available from a very small sample. Datta and Dhillon (1993) test both announcement sequences for the bond market. However, the bond market findings are based on a very low number of observations. Thus, comprehensive findings for the bond market are pending.

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<sup>18</sup> The first-order F-statistic reaches significance at the 5%-level at 3.00 and at the 1%-level at 4.61.

<sup>19</sup> The results for SABR are qualitatively the same, for details see Appendix C of this chapter.

We find that for all considered analyses (shorter vs. longer period and both sequences) all interaction variable coefficients are significant at the 5% level. Moreover, the interaction F-statistic is significant at the 1% level. Thus, the interaction effect is robust to the sequence in which the two announcements are made.

#### **4.4.2 Announcement Time Distance**

In Panel B of Table 4-5, we analyze whether the interaction effect is sensitive to the relative timing of the two announcements. The detailed findings are presented in Table 4-15. In our main analysis, we consider all announcements to be joint events that are made within ten working days since announcements in the US market do not necessarily have to be made on the same day. Problematically, other events with confounding information can fall into this ten-day period. Thus, to reduce this noise, we analyze whether the interaction effect remains strong in a subsample that contains announcements made within five working days. Additionally, firms in several countries (e.g., UK, Australia, Japan, Hong Kong as well as China) announce dividends and earnings almost always on the same day (see e.g., Chen et al., 2002; Cheng & Leung, 2006). These same day announcements eliminate any confounding events and limit managers' strategic picking of the timing of announcements (Kalay & Loewenstein, 1986). Hence, we additionally consider subsamples of same day vs. one or more days in between announcements as a second analysis. In all cases, we make restrictions on the time between events but still consider two return computation windows as before.

Our findings show that the interaction effect is robust in relation to the relative timing of the announcements. For same day announcements, the interaction dummy variables have no significant coefficients, while the F-statistic points to a significant interaction effect. Potentially, this evidence from same day announcements is due to a slow information incorporation driven by the illiquidity of the corporate bond market.

#### **4.4.3 Announcement Timing by Period**

Table 4-5 Panel C shows the analysis of an interaction effect in two distinct periods. We present the detailed findings in Table 4-16. This analysis tests whether the interaction effect is persistent over time and not driven by major economic events, e.g., the financial crisis or the COVID-19 pandemic. We split our sample in half based on the number of years, i.e., the

period until and including 2014 and from 2015 onwards. Our findings show a significant interaction effect in both periods. Consequently, the interaction effect is time persistent.

#### 4.4.4 Announcement Magnitude

Next, in Table 4-5 Panel D, we test the robustness of the interaction effect to the magnitude of the announcements, including those indicating both very large and very small changes. Thus, we consider the extremes of the announcements. Table 4-17 holds detailed results if no earnings change announcements are included and Table 4-18 those if only dividend changes or dividend initiations or omissions, respectively, are included. First, we consider a sample including no earnings changes. No earnings change is defined as the absolute earnings change being lower than one. Second, we remove events from our sample in which the dividend does not change, leaving us with events in which both earnings and dividends change. Third, we consider dividend initiations and omissions only. The unexpected dividend change of dividend initiations naturally does not hold a value. To be able to portray results in this analysis we set the unexpected dividend change in the case of a dividend initiation equal to one. Thus, only events with an earnings change announcement and an announcement of a dividend initiation or omission are considered. Dividend initiations occur when a firm pays a dividend for the very first time or if a dividend is paid after the firm has not paid a dividend for the last five years. In contrast, dividend omissions occur when a firm omits a dividend after having paid a dividend for at least three years (in line with Chen, 2016).

Chen (2016) shows for dividend changes that more extreme reactions of bondholders occur around more extreme announcements, i.e., that investors have a significant negative reaction to dividend omissions while they do not have a significant reaction to dividend decreases. Generally, more extreme announcements might trigger a stronger market reaction. However, it is unclear whether this implies that their informational content of announcements interacts to the same degree.

We find that in the longer considered period of  $(t - 10, t + 10)$  the interaction effect is robust across any considered specification of announcements of a high magnitude. Considering the shorter period  $(t - 3, t + 3)$ , the scenarios in which only dividend changes or dividend initiations and omissions are examined are less or not significant. Potentially, the bond market again needs more time to process these more extreme announcements. Moreover, the low number of observations for these specific scenarios might work in the same direction.

#### 4.4.5 Firm Characteristics

Finally, in Panel E of Table 4-5, we examine the robustness based on firm characteristics. We provide the detailed findings in Table 4-19. In addition, Table 4-9 provides detailed findings on bond characteristics for further reference. The interaction between the informative value of dividend and earnings announcements might be influenced by the context in which these announcements are made. Specifically, firm-specific characteristics can affect bond prices per se and thus have an impact on the observed interaction effect as well (Kouki, 2017). Furthermore, we aim to rule out that the interaction effect we find is driven by certain firms, e.g., by small firms or firms with high analyst forecast dispersion (i.e., firms with more information frictions).

Our findings show that the interaction effect is a robust feature across the firm size, its financial leverage and the dispersion of analysts' earnings estimates of the sample. Overall, the interaction effect is not dependent on certain firm characteristics.

In conclusion, we find a strong interaction effect between dividend and earnings announcements that influences the bond market. Furthermore, we demonstrate its robustness across various relevant subsets to address concerns about the effect's external validity. Consequently, the interaction effect should be considered in bond market event studies analyzing earnings or dividend announcements.

#### 4.5 Information Content

While our initial analyses demonstrate a significant interaction effect between dividend and earnings announcements, the individual contributions of these announcements to bondholder reactions remain unclear. Understanding how the announcements impact bond prices is critical for comprehending their combined effects and assessing their unique informational content. If both announcements do not impact bond returns, i.e., carry information content, it would be of no importance to consider the interaction effect they have. Thus, we analyze whether unexpected dividends and unexpected earnings individually have an impact on the bond market following Equation 4-7. We thereby aim to provide a deeper understanding of the relevance of considering the interaction effect for bond market efficiency analyses.

In Table 4-6 we find that unexpected earnings changes and unexpected dividend changes have a highly significant impact on cumulative ABSR and SABR in line with previous research on earnings (Datta & Dhillon, 1993; Easton et al., 2009; Woodley et al., 2020) and dividends (Tsai & Wu, 2015; Wei et al., 2020). In the period  $(t - 3, t + 3)$  we identify the same

effect, however, marginally not significant. This decreasing significance with shorter event windows is likely caused by the illiquidity of the bond market (Bessembinder et al., 2009). Dividend and earnings changes having a parallel and positive effect on ABSR and SABR is in line with the signaling hypothesis.

Figure 4-2 provides the information content for bond returns split based on the sign of the change that is announced, showing only scenarios in which both dividends and earnings change. We find that if both decrease and if unexpected earnings increase and unexpected dividends decrease, they have a positive and significant impact on the cumulative ABSR. This effect is slightly stronger if both decrease. The positive influence of both around earnings increase and dividend decrease events, as we detect, indicates prevailing wealth transfer effects. This stands in contrast to the overarching finding of Table 4-6, highlighting the complex effects around earnings and dividend changes. For events of an earnings decrease paired with a dividend increase, the earnings change coefficient is negative and significant. Finally, if both changes are positive, no significant impact on the CAR of ABSR exists.

Our finding that unexpected dividend and earnings changes contain informational content emphasizes the fact that the interaction effect should be considered in future research. It is central to acknowledge that they hold joint information to not over- or underestimate their informational impact when evaluating the informational efficiency in the bond market.

#### **4.6 Conclusion**

In this study, we examine the existence of the interaction effect between earnings and dividend announcements in the US corporate bond market. Using a comprehensive sample of 2,608 joint announcement events, we find a strong interaction effect is present. Thus, dividend and earnings announcements provide joint information content to bondholders. Additionally, we demonstrate the interaction effect's robustness across several specifications. Specifically, it is robust to the sequence of and the time distance between the announcements as well as the time period. Furthermore, its existence is independent of the magnitude of the announcements and the characteristics of the announcing firms.

Given that unexpected dividend and earnings changes contain informational content for bond prices, it is important to acknowledge their joint information content to avoid over- or underestimating their informational significance.

In conclusion, the robust interaction effect should be considered in future research on the informational efficiency of the corporate bond market around dividend and earnings announcements. Furthermore, bond-issuing firms managing dividend and earnings announcements strategically and bondholders interested in determining a precise implication of these announcements on bond prices, should take the interaction effect into account.

## 4.7 Tables

**Table 4-1: Summary statistics of abnormal return measures  $ABR_{f,t}$ ,  $ABSR_{f,t}$  and  $SABR_{f,t}$ .** This table presents descriptive statistics on the abnormal firm returns of period  $(t - 30, t + 30)$  used throughout this study. It states the descriptives on firm-level abnormal bond returns (ABR), abnormal standardized bond returns (ABSR), and standardized abnormal bond returns (SABR). ABR are based on a raw return calculated from trade-weighted daily prices minus a matched portfolio return following Equation 4-1. ABSR are calculated following Equation 4-2 and SABR following Equation 4-3. ABSR and SABR are again aggregated to a firm level by weighing them by the trade volume of each bond.

	N	Mean	SD	Skew	Kurt	5th perc.	50th perc.	95th perc.
ABR	158,905	0.000	0.006	-0.978	120.198	-0.007	0.000	0.007
ABSR	126,842	-0.011	0.698	-0.098	9.698	-1.144	0.000	1.085
SABR	126,842	-0.016	0.698	-0.107	9.698	-1.151	-0.001	1.077

**Table 4-2: Summary statistics of unexpected dividend and earnings changes.** This table shows summary statistics of the unexpected dividend change (Panel A) and the standardized unexpected earnings (Panel B) observations distinguished by the type of change. The unexpected dividend change is defined as the simple percentage change between the current and previous dividend payment, while the standardized unexpected earnings are determined as actual quarterly earnings announced minus the mean analysts' earnings forecast over the standard deviation of the analyst expectations.

	$E_t^U$ decrease, $D_t^U$ decrease	$E_t^U$ decrease, $D_t^U$ no change	$E_t^U$ decrease, $D_t^U$ increase	$E_t^U$ increase, $D_t^U$ decrease	$E_t^U$ increase, $D_t^U$ no change	$E_t^U$ increase, $D_t^U$ increase
<b>Panel A - Unexpected dividend change</b>						
N	1,310	25,573	6,417	1,320	94,979	27,978
Mean	-0.532	0.000	0.143	-0.548	0.000	0.168
SD	0.278	0.000	0.170	0.256	0.000	0.305
5th perc.	-0.947	0.000	0.011	-0.858	0.000	0.018
50th perc.	-0.500	0.000	0.100	-0.603	0.000	0.105
95th perc.	-0.176	0.000	0.500	-0.026	0.000	0.455
<b>Panel B - Unexpected earnings change</b>						
N	1,310	25,573	6,417	1,320	94,979	27,978
Mean	-2.746	-2.638	-2.807	3.683	3.189	3.074
SD	1.975	2.017	6.231	4.642	2.428	2.681
5th perc.	-6.497	-6.249	-6.376	1.183	1.111	1.075
50th perc.	-1.970	-2.010	-1.649	1.762	2.483	2.289
95th perc.	-1.054	-1.072	-1.079	10.000	7.474	7.741

**Table 4-3: Summary statistics of events.** This table provides an overview of the considered events of the sample. Panel A shows the number of joint announcement events distinguished by the change type for which abnormal bond return data is available. Panel B shows the number of events per count of days that lie between the two announcements.

Panel A - Number of events with abnormal bond return data			
	Unexpected earnings increase	Unexpected earnings decrease	Total
Unexpected dividend increase	464	110	574
No unexpected dividend change	1,573	417	1,990
Unexpected dividend decrease	22	22	44
Total	2,059	549	2,608

Panel B - Days between announcements	
Days	Bonds
0	742
1	588
2	327
3	116
4	82
5	139
6	161
7	211
8	143
9	75
10	24

**Table 4-4: Interaction effect in the corporate bond market.** This table presents the results of CAR of ABSR (Panel A) and SABR (Panel B) following Equation 4-6. The interaction dummy variable  $I(+ -)$  equals 1 if the standardized unexpected earnings are positive and the dividend decreases unexpectedly at the announcement, otherwise 0. The interaction F-statistic is defined following Equation 4-8. The encompassing event periods  $(t - 10, t + 10)$  and  $(t - 3, t + 3)$  are considered.

	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
	$(t - 10, t + 10)$				$(t - 3, t + 3)$			
	CAR ABSR		CAR SABR		CAR ABSR		CAR SABR	
$E^U$	0.002	0.216	-0.002	-0.341	-0.024	-2.831	-0.024	-2.928
$D^U$	0.706	4.517	0.678	4.322	0.350	1.666	0.334	1.585
$I(-,0)$	0.382	2.352	0.244	1.498	-0.856	-3.830	-0.915	-4.085
$I(-,+)$	1.065	5.624	0.918	4.831	-0.044	-0.175	-0.105	-0.414
$I(+,-)$	1.468	5.153	1.357	4.745	-0.137	-0.390	-0.199	-0.564
$I(+,0)$	0.822	5.133	0.688	4.282	-0.247	-1.122	-0.309	-1.397
$I(+,+)$	0.721	4.166	0.618	3.558	-0.347	-1.459	-0.394	-1.653
Constant	-1.165	-7.499	-1.117	-7.163	0.111	0.514	0.130	0.600
N	24,758		24,758		9,064		9,064	
First-Order F	10.270		9.238		4.922		5.082	
Interaction F	18.600		16.900		18.000		18.060	

**Table 4-5: Robustness of the interaction effect.** This table gives an overview of the significance of interaction dummy variables and the interaction F-statistic across numerous specifications of the earnings and dividend announcements. The encompassing event periods  $(t - 10, t + 10)$  and  $(t - 3, t + 3)$  are considered. \*\*\* indicates significance at the 1% level, \*\* at the 5% level and \* at the 10% level.

Cumulative ABSR	Int.	Int. F-	Int.	Int. F-
	Dummies	statistic	Dummies	statistic
	$(t - 10, t + 10)$		$(t - 3, t + 3)$	
<b>Panel A - Sequence of announcements</b>				
Earnings before dividends	**	***	***	***
Dividends before earnings	***	***	**	***
<b>Panel B - Time distance of announcements</b>				
< 5 days	***	***	***	***
>= 5 days	***	***	***	***
Same day	-	***	-	***
>=1 day	***	***	***	***
<b>Panel C - Announcement timing by period</b>				
<= 2014	***	***	**	***
>=2015	***	***	***	***
<b>Panel D - Magnitude of announcements</b>				
No earnings changes included	***	***	**	***
Dividend changes only	***	***	-	-
Dividend init. and omissions only	***	***	-	**
<b>Panel E - Firm characteristics</b>				
Small firm size	***	***	*	***
Large firm size	***	***	***	***
Low financial leverage	***	***	***	***
High financial leverage	***	***	***	***
Low analyst dispersion	***	***	***	*
High analyst dispersion	*	***	**	**

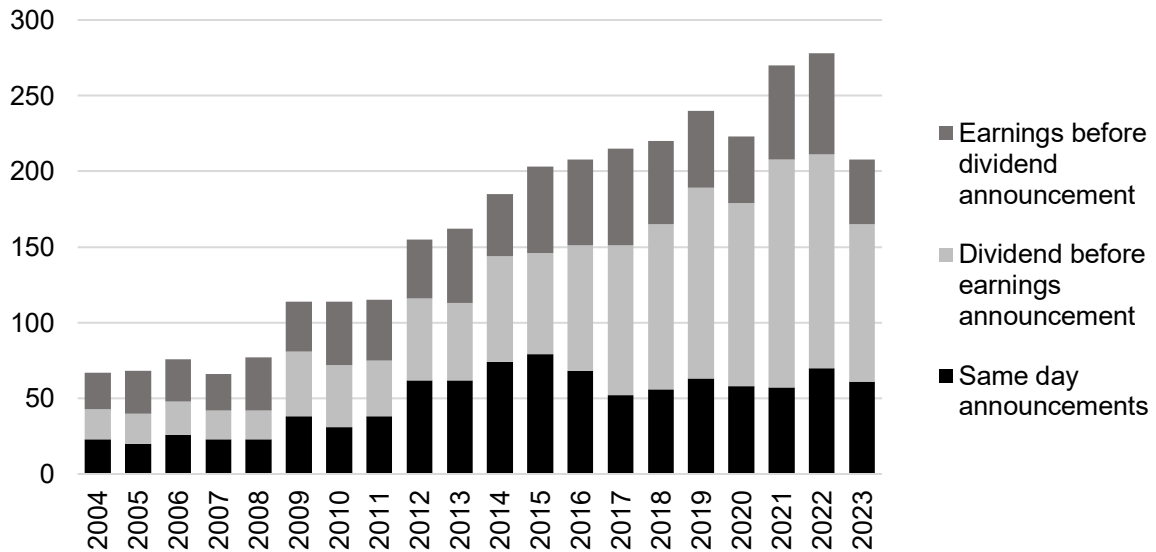
**Table 4-6: Impact of unexpected dividend and earnings changes on the bond market.** This table presents the results of CAR of ABSR (Panel A) and SABR (Panel B) based on the parametric t-test. The impact of unexpected earnings and dividend changes following Equation 4-7 is analyzed for the encompassing event periods  $(t - 10, t + 10)$  and  $(t - 3, t + 3)$ .

	Coefficient	t-statistic	Coefficient	t-statistic
	$(t - 10, t + 10)$		$(t - 3, t + 3)$	
Panel A - Cumulative ABSR				
$E^U$	0.027	5.145	0.010	1.592
$D^U$	0.758	6.063	0.204	1.270
Constant	-0.477	-22.528	-0.293	-12.363
N	24,758		9,064	
Panel B - Cumulative SABR				
$E^U$	0.023	4.407	0.009	1.401
$D^U$	0.725	5.779	0.189	1.177
Constant	-0.557	-26.198	-0.332	-13.967
N	24,758		9,064	

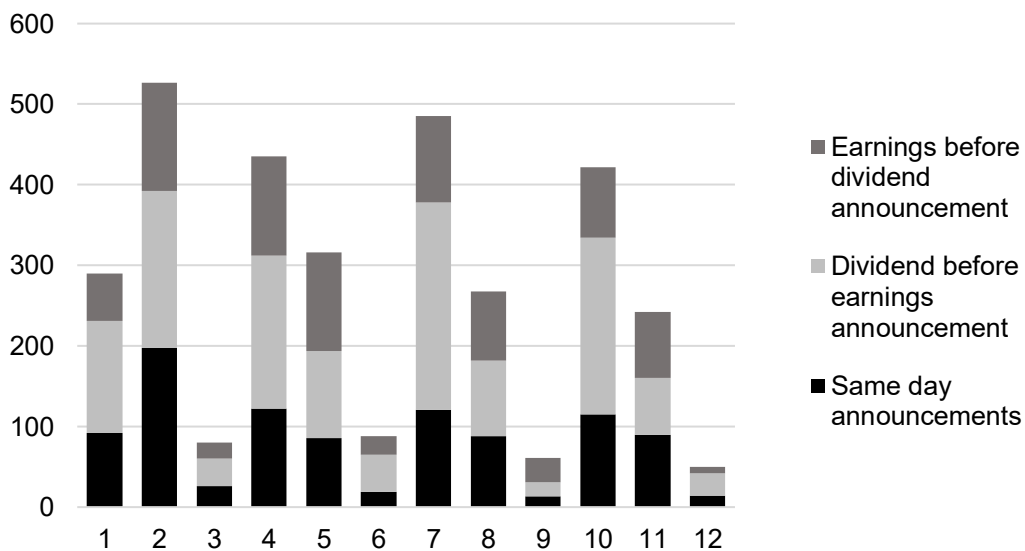
## 4.8 Figures

**Figure 4-1: Frequency distribution of joint announcement events.** This figure presents the number of joint dividend and earnings announcement events. While Panel A presents the distribution of these events over the examined periods of January 2004 to September 2023, Panel B shows the distribution of the same events over months. The announcements are considered joint if both are made within ten working days.

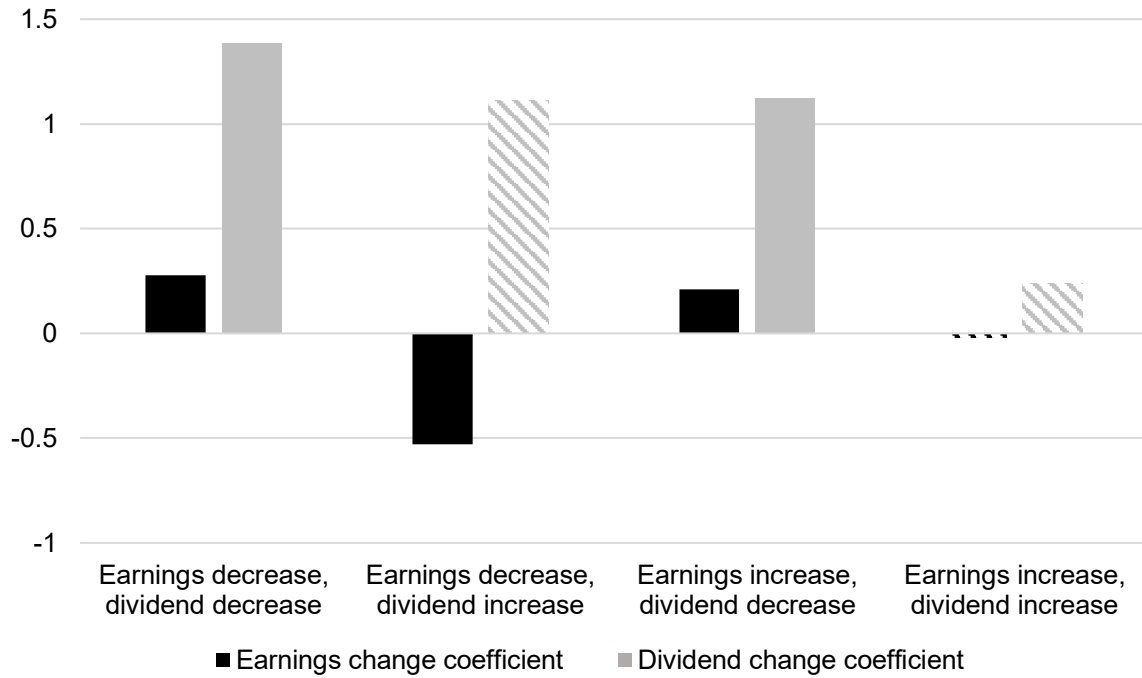
Panel A - Joint announcement events distribution over years



Panel B - Joint announcement events distribution over months



**Figure 4-2: Information content based on announcement types.** This figure presents the impact of unexpected earnings and dividend changes on CAR of ABSR following Equation 4-7. All scenarios of earnings and dividend changes are shown. Hatched bars signify the coefficient not being significant at the 10% level.



## **4.9 Appendix**

### **A Variable Definition and Robustness**

This section provides a definition of all variables used throughout this study in Table 4-7. This is followed by Table 4-8 presenting the interaction effect analysis in sequential periods around the event period and Table 4-9 showing its robustness to bond characteristics.

**Table 4-7: Definition of applied variables.** These tables present definitions of the variables used throughout this study. In addition, sources on which these definitions are based on and data sources, if applicable, are named for further reference. Relevant data sources are the National Association of Securities Dealers (NASD) Trade Reporting and Compliance Engine (TRACE) database, the Mergent Fixed Income Securities Database (FISD), the CRSP annual stock event file, the CRSP daily stock file, the Compustat annual data file and the Institutional Brokers' Estimate System (IBES) Detail History Details with Actuals file. The data is retrieved for the period of January 2004 to and including September 2023. All annually-published firm variables are measured in the last fiscal year ending before the event year.

Firm-level variables			
Variable name	Description/Formula	Relevant paper if applicable	Data source if applicable
Dividend	Dividend amount paid in USD per share		CRSP annual stock event file
Unexpected dividend change ( $D^U$ )	$\frac{Dividend_t - Dividend_{t-1}}{Dividend_{t-1}}$	Cooper and Lambertides (2018); Grullon et al. (2002); Tsai and Wu (2015)	CRSP annual stock event file
Dividend decrease	$D^U < 0$		CRSP annual stock event file
Dividend increase	$D^U > 0$		CRSP annual stock event file
Dividend omission	Firm omits a dividend after having paid a dividend for at least three years	Chen (2016)	CRSP annual stock event file
Dividend initiation	Firm pays dividend after not having paid a dividend for at least five years	Chen (2016)	CRSP annual stock event file
Actual earnings ( $AE$ )	Earnings per share	Datta and Dhillon (1993)	IBES Detail History Actuals

Standardized unexpected earnings ( $E^U$ )	$\frac{(AE_t - F_t)}{\sigma_t}$ where $AE_t$ is the actual quarterly earnings announced at quarter $t$ , $F_t$ the mean analysts' forecast at quarter $t$ and $\sigma_t$ the standard deviation of the analyst forecasts	Datta and Dhillon (1993)	IBES Detail History Actuals
Earnings decrease	$E^U < 0$		IBES Detail History Actuals
Earnings increase	$E^U > 0$		IBES Detail History Actuals
Firm-level abnormal bond return ( $ABR_{f,t}$ )	$\sum_{i=1}^k ABR_{i,t} * \omega_i$	Bessembinder et al. (2009)	TRACE
Firm-level abnormal standardized bond return ( $ABSR_{f,t}$ )	$\sum_{i=1}^k ABSR_{i,t} * \omega_i$	Ederington et al. (2015)	TRACE
Firm-level standardized abnormal bond return ( $SABR_{f,t}$ )	$\sum_{i=1}^k SABR_{i,t} * \omega_i$	Ederington et al. (2015)	TRACE
Abnormal stock return ( $ASR_t$ )	$a_i + b_i(R_{Mt} - R_{Ft}) + s_iSMB_t + h_iHML_t + r_iRMW_t + c_iCMA_t + \epsilon_{it}$ with $R_{Mt}$ being the return on the value-weighted market portfolio, $R_{Ft}$ the riskfree return, $SMB_t$ the difference in returns of diversified portfolios of small and big stocks, $HML_t$ the difference in returns of diversified portfolios of high and low book-to-market value stocks, $RMW_t$ the difference in returns of diversified portfolios of stocks with robust and weak profitability and $CMA_t$ the difference in returns of diversified portfolios of stocks of low and high investment firms (i.e., conservative and aggressive firms)	Fama and French (2015)	CRSP daily stock file
$I(+ -)$	$\begin{cases} 1 \text{ if earnings increase (+) and dividend decrease (-) \\ 0 \text{ else} \end{cases}$	Kane et al. (1984)	
First-order F- statistic	$\frac{(SSE_{restricted} - SSE_{unrestricted})/R}{SSE_{unrestricted}/(N-K)}$ where SSE is the error sum of squares, $R$ is number of restrictions, $N$ is the number of observations, $K$ is the number of independent variables in the unrestricted model. Restricted model: $CAR = \alpha + \beta_0 D^U + \beta_1 E^U + \epsilon$ Unrestricted model: $CAR = \alpha + \gamma_0 I(-0) + \gamma_1 I(-+) + \gamma_2 I(+ -) + \gamma_3 I(+0) + \gamma_4 I(++ ) + \epsilon$	Lonie et al. (1996)	

Interaction F-statistic	$\frac{(SSE_{restricted} - SSE_{unrestricted})/R}{SSE_{unrestricted}/(N-K)}$ where SSE is the error sum of squares, $R$ is number of restrictions, $N$ is the number of observations, $K$ is the number of independent variables in the unrestricted model. Restricted model: $CAR = \alpha + \beta_0 D^U + \beta_1 E^U + \epsilon$ Unrestricted model: $CAR = \alpha + \beta_0 D^U + \beta_1 E^U + \gamma_0 I(-0) + \gamma_1 I(-+) + \gamma_2 I(+ -) + \gamma_3 I(+0) + \gamma_4 I(++ ) + \epsilon$	Lonie et al. (1996)	
Analyst dispersion ( $\sigma_t$ )	Standard deviation of the analyst earnings forecasts per firm	Datta and Dhillon (1993)	IBES Detail History Actuals
Firm size	Book value of total assets – Total of liabilities and stockholder's equity [USD M] (Compustat Item 6)		Compustat annual data file
Financial leverage	$\frac{Long - term\ debt}{Total\ assets}$		Compustat annual data file

Bond-level variables

Variable name	Description/Formula	Relevant paper if applicable	Data source if applicable
Abnormal bond return ( $ABR_{i,t}$ )	$RR_{i,t} - MR_{i,t}$ with $MR_{i,t}$ being the return of a matched portfolio. The matched portfolio is constructed as the average return of all bonds within one of 13 rating and time-to-maturity classes on a specific day	Bessembinder et al. (2009)	TRACE
Abnormal standardized bond return ( $ABSR_{i,t}$ )	$SRR_{i,t} - SMR_t$ with $SRR_{i,t}$ being the bond's $RR_{i,t}$ divided by the bond raw returns' time-series standard deviation over the period of $(t - 55, t - 6)$ and $(t + 6, t + 55)$ and $SMR_t$ being calculated as the average of the $SRR_{i,t}$ of all bonds within each rating and time-to-maturity class	Ederington et al. (2015)	TRACE
Standardized abnormal bond return ( $SABR_{i,t}$ )	$\frac{ABR_{i,t}}{\sigma_{i,t,ABR}}$ where $\sigma_{i,t,ABR}$ is the time-series standard deviation of the bond's abnormal returns over the period of $(t - 55, t - 6)$ and $(t + 6, t + 55)$	Ederington et al. (2015)	TRACE
Coupon rate	Bond's annual interest rate		FISD
Bond trade volume	Price of trade transaction in USD		FISD
Bond rating	Moody's rating or, if this is not available, Standard and Poor's or Fitch rating; AAA is defined as 22, etcetera.		TRACE
Investment grade dummy	$\begin{cases} 1 & \text{if investment-grade rated bond, i.e., rating} > 11 \\ 0 & \text{else, i.e., rating} \leq 11 \end{cases}$		
Issue offered globally	$\begin{cases} 1 & \text{if issue is offered globally} \\ 0 & \text{if issue is offered only in the US} \end{cases}$		FISD

**Table 4-8: Interaction effect in the bond market using sequential event periods.** This table presents the results of CAR of ABSR (Panel A) and SABR (Panel B) following Equation 4-6 and the F-statistics. The interaction dummy variable  $I(+ -)$  equals 1 if the standardized unexpected earnings are positive and the dividend decreases unexpectedly at the announcement, otherwise 0. The sequential event periods  $(t - 30, t - 5)$ ,  $(t - 4, t - 2)$ ,  $(t - 1, t + 1)$  and  $(t + 2, t + 30)$  are considered.

	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
	$(t - 30, t - 5)$		$(t - 4, t - 2)$		$(t - 1, t + 1)$		$(t + 2, t + 30)$	
<b>Panel A - Cumulative ABSR</b>								
$E^U$	-0.048	-6.966	0.001	0.207	-0.007	-1.146	0.002	0.206
$D^U$	0.679	3.929	0.031	0.247	0.665	2.693	1.310	5.320
$I(-,0)$	0.824	5.594	-0.178	-1.193	-0.768	-2.902	0.186	0.709
$I(-,+)$	1.263	7.293	-0.145	-0.850	-0.331	-1.116	0.447	1.469
$I(+,-)$	0.229	0.958	0.102	0.428	0.417	1.014	2.278	5.707
$I(+,0)$	1.056	7.268	-0.167	-1.144	-0.274	-1.054	0.409	1.596
$I(+,+)$	0.537	3.381	-0.169	-1.085	-0.441	-1.585	1.001	3.567
Constant	-0.942	-6.723	0.100	0.698	0.182	0.707	-0.736	-2.908
N	44,888		4,207		5,578		25,579	
First-Order F	30.390		0.059		4.007		15.000	
Interaction F	39.020		0.611		11.100		23.750	
<b>Panel B - Cumulative SABR</b>								
$E^U$	-0.054	-7.798	0.001	0.113	-0.008	-1.170	-0.002	-0.237
$D^U$	0.588	3.407	0.028	0.224	0.646	2.608	1.177	4.761
$I(-,0)$	0.646	4.387	-0.198	-1.328	-0.796	-3.001	0.119	0.450
$I(-,+)$	1.062	6.137	-0.166	-0.975	-0.357	-1.201	0.331	1.082
$I(+,-)$	0.013	0.054	0.086	0.359	0.387	0.939	2.103	5.244
$I(+,0)$	0.870	5.995	-0.186	-1.267	-0.308	-1.180	0.334	1.298
$I(+,+)$	0.369	2.327	-0.185	-1.188	-0.463	-1.658	0.960	3.405
Constant	-0.891	-6.366	0.105	0.733	0.186	0.720	-0.815	-3.207
N	44,888		4,207		5,578		25,579	
First-Order F	34.690		0.035		3.810		11.990	
Interaction F	34.100		0.678		10.880		24.260	

**Table 4-9: Interaction effect based on bond characteristics.** This table presents the results of CAR of ABSR following Equation 4-6 over the periods  $(t - 10, t + 10)$  and  $(t - 3, t + 3)$  and the F-statistics. The sample is split based on a specific firm characteristic within each year. A precise definition of the characteristics can be found in Table 4-7.

CAR ABSR	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
	$(t - 10, t + 10)$				$(t - 3, t + 3)$			
	Small coupon rate		Large coupon rate		Small coupon rate		Large coupon rate	
$E^U$	-0.004	-0.390	-0.024	-1.873	-0.007	-0.666	-0.063	-3.267
$D^U$	-0.665	-2.034	0.619	3.164	0.217	0.563	0.392	1.284
$I(-,0)$	-0.107	-0.466	0.015	0.061	0.094	0.305	-2.512	-6.606
$I(-,+)$	0.800	3.004	0.712	2.391	0.425	1.232	-1.237	-2.778
$I(+,-)$	0.215	0.569	1.530	3.293	0.756	1.663	-1.973	-3.110
$I(+,0)$	0.341	1.500	0.952	3.897	0.374	1.216	-1.397	-3.804
$I(+,+)$	0.586	2.377	0.576	2.103	0.355	1.079	-1.582	-3.839
Constant	-0.659	-2.976	-0.948	-4.052	-0.544	-1.798	1.460	4.056
N	16,018		6,573		6,046		2,252	
First-Order F	2.269		6.190		0.365		5.522	
Interaction F	12.020		15.370		2.588		17.010	
	Low bond trade volume		High bond trade volume		Low bond trade volume		High bond trade volume	
$E^U$	0.086	3.811	-0.062	-3.504	0.001	0.050	0.026	0.848
$D^U$	-1.667	-2.239	0.348	1.511	3.085	1.970	-0.214	-0.576
$I(-,0)$	1.624	1.956	0.452	1.032	-1.420	-1.012	-0.015	-0.020
$I(-,+)$	2.617	2.920	0.667	1.341	-1.212	-0.797	1.323	1.609
$I(+,-)$	0.728	0.831	3.812	4.672	1.569	0.997	0.494	0.457
$I(+,0)$	0.579	0.697	0.744	1.716	-1.314	-0.935	0.330	0.460
$I(+,+)$	1.710	1.893	0.977	2.038	-0.915	-0.580	0.480	0.611
Constant	-1.423	-1.732	-1.089	-2.592	0.821	0.587	-0.374	-0.523
N	3,421		2,179		1,360		712	
First-Order F	10.640		6.607		1.943		0.403	
Interaction F	17.470		5.462		4.581		2.849	

	Issues offered globally		Issues not offered globally		Issues offered globally		Issues not offered globally	
$E^U$	-0.014	-1.341	-0.004	-0.274	-0.004	-0.315	-0.051	-2.158
$D^U$	-0.045	-0.134	0.392	1.869	0.200	0.483	0.236	0.733
I(-,0)	-0.191	-0.743	0.546	1.880	0.181	0.505	-1.665	-3.442
I(-,+)	0.219	0.730	0.750	2.123	0.462	1.150	-0.531	-0.937
I(+,-)	0.592	1.474	3.014	4.575	0.947	1.813	-1.937	-2.595
I(+,0)	0.231	0.907	1.056	3.655	0.525	1.460	-0.881	-1.841
I(+,+)	0.387	1.400	0.878	2.641	0.513	1.331	-1.069	-1.991
Constant	-0.599	-2.421	-1.117	-4.080	-0.731	-2.072	1.009	2.164
N	12,983		3,644		4,880		1,214	
First-Order F	0.825		1.773		0.161		2.352	
Interaction F	5.600		6.909		2.645		6.844	

	Investment-rated		Speculative		Investment-rated		Speculative	
$E^U$	0.084	3.725	-0.025	-1.366	0.002	0.073	0.089	1.707
$D^U$	-1.668	-2.233	3.383	5.627	3.085	1.965	3.942	1.511
I(-,0)	1.586	1.905	-1.052	-1.985	-1.446	-1.027	-3.831	-1.397
I(-,+)	2.618	2.913	-1.783	-2.415	-1.211	-0.794	-4.286	-1.087
I(+,-)	0.732	0.834	-	-	1.567	0.994	-	-
I(+,0)	0.587	0.704	0.465	0.879	-1.318	-0.935	-2.473	-0.906
I(+,+)	1.716	1.895	-0.907	-1.326	-0.918	-0.580	-6.197	-1.959
Constant	-1.426	-1.731	-0.007	-0.014	0.822	0.587	3.475	1.279
N	3,378		723		1,352		206	
First-Order F	10.300		16.890		1.935		2.621	
Interaction F	16.940		10.680		4.627		5.933	

## B Interaction Effect in the Stock Market

In this section we provide a brief analysis of the stock market interaction effect based on our sample. This allows for a comparison of our sample with earlier interaction effect studies, e.g., Kane et al. (1984).

We use the CRSP daily stock return file from January 2004 to and including September 2023 as well as the Fama French five factors (French, 2024). Abnormal stock returns (ASR) are estimated using the Fama French five factor model with an estimation window of  $(t - 60, t - 31)$ , following the equation:

$$ASR_t = a + b(R_{Mt} - R_{Ft}) + sSMB_t + hHML_t + rRMW_t + cCMA_t + \epsilon_t \quad (B-1)$$

with  $R_{Mt}$  being the return on the value-weighted market portfolio,  $R_{Ft}$  the riskfree return,  $SMB_t$  the difference in returns of diversified portfolios of small and big stocks,  $HML_t$  the difference in returns of diversified portfolios of high and low book-to-market value stocks,  $RMW_t$  the difference in returns of diversified portfolios of stocks with robust and weak profitability and  $CMA_t$  the difference in returns of diversified portfolios of stocks of low and high investment firms (i.e., conservative and aggressive firms). Finally,  $\epsilon_t$  is the zero-mean residual. (Fama & French, 2015)

In parallel to the bond market tables Table 4-1 and Table 4-3, Table 4-10 and Table 4-11 provide summary statistics on ASR and joint announcement events. Naturally, we have a larger number of events compared to the bond sample as ASR can be calculated for more returns given the higher liquidity of the stock market.

Table 4-12 portrays the results for the interaction effect including interaction dummy variables following Equation (4-6). We find that for both considered event periods interaction dummy coefficients are highly significant and thus an interaction effect exists. Furthermore, the interaction F-statistics are also highly significant. Unexpected dividend and earnings changes carry informational content for stock prices, as expected and shown in Table 4-13.

Consequently, we confirm earlier research starting with Kane et al. (1984), that a significant interaction effect exists in the stock market. As both announcements contain information for the stock market the interaction effect should be considered in future research around dividend and earnings announcements.

**Table 4-10: Summary statistics of abnormal stock returns  $ASR_t$ .** This table presents descriptive statistics on the abnormal stock returns of period  $(t - 30, t + 30)$  used throughout this study. ASR are estimated using the Fama French five-factor model with an estimation window of  $(t - 60, t - 31)$ .

	N	Mean	SD	Skew	Kurt	5th perc.	50th perc.	95th perc.
ASR	264,713	0.002	0.020	0.842	73.082	-0.024	0.002	0.029

**Table 4-11: Summary statistics of events in stock market sample.** Panel A shows the number of joint announcement events distinguished by the change type for which abnormal stock return data is available. Panel B shows the number of events per count of days that lie between the two announcements.

Panel A - Number of events with abnormal stock return data			
	Unexpected earnings increase	Unexpected earnings decrease	Total
Unexpected dividend increase	737	196	933
No unexpected dividend change	2,372	795	3,167
Unexpected dividend decrease	35	23	58
Total	3,144	1,014	4,158

Panel B - Days between announcements	
Days	Stocks
0	1146
1	938
2	481
3	201
4	154
5	246
6	293
7	314
8	214
9	130
10	41

**Table 4-12: Interaction effect in the stock market.** This table presents the results of CAR of abnormal stock returns (ASR) following Equation 4-6 for the event periods  $(t - 10, t + 10)$  and  $(t - 3, t + 3)$ . The interaction dummy variable  $I(+ -)$  equals 1 if the standardized unexpected earnings are positive and the dividend decreases unexpectedly at the announcement, otherwise 0. The interaction F-statistic is defined following Equation 4-8.

CAR ASR	$(t - 10, t + 10)$		$(t - 3, t + 3)$	
	Coefficient	t-statistic	Coefficient	t-statistic
$E^U$	0.001	9.167	0.001	7.797
$D^U$	0.009	4.101	0.004	1.962
$I(-,0)$	-0.011	-1.913	0.003	0.612
$I(-,+)$	-0.017	-2.748	0.010	1.687
$I(+,-)$	0.028	3.928	0.045	6.590
$I(+,0)$	0.017	2.926	0.036	6.374
$I(+,+)$	0.016	2.706	0.036	6.225
Constant	0.048	8.243	-0.001	-0.111
N	100,704		41,474	
First-Order F	91.620		35.430	
Interaction F	137.500		187.300	

**Table 4-13: Impact of unexpected dividend and earnings changes on the stock market.** This table presents the results of CAR of abnormal stock returns (ASR) based on the parametric t-test. The impact of unexpected earnings and dividend changes following Equation 4-7 is analyzed for the encompassing event periods  $(t - 10, t + 10)$  and  $(t - 3, t + 3)$ .

	Coefficient	t-statistic	Coefficient	t-statistic
CAR ASR	$(t - 10, t + 10)$		$(t - 3, t + 3)$	
$E^U$	0.002	29.199	0.002	30.648
$D^U$	0.007	3.298	0.005	2.636
Constant	0.055	127.152	0.025	61.480
N	100,704		41,474	

## **C Detailed Results**

This section presents the detailed results for Panels A-E of Table 4-5. Both ABSR and SABR as well as the two event periods considered above are shown. Detailed findings on the impact of the announcement sequence (Panel A) are displayed in Table 4-14 and findings on the relative time distance between the announcements (Panel B) in Table 4-15. Table 4-16 provides all details on the robustness of the interaction effect across time periods (Panel C). Next, Table 4-17 and Table 4-18 show the findings for the announcement magnitude (Panel D) and finally, Table 4-19 those based on firm characteristic subsamples (Panel E).

**Table 4-14: Interaction effect based on the announcement sequence.** This table presents the results of CAR of ABSR (Panel A) and SABR (Panel B) following Equation 4-6 over the periods  $(t - 10, t + 10)$  and  $(t - 3, t + 3)$  and the F-statistics. The overall sample is split distinguishing the sequence in which the earnings and dividend announcements are made.

	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
	$(t - 10, t + 10)$				$(t - 3, t + 3)$			
	Earnings < dividend		Dividend < earnings		Earnings < dividend		Dividend < earnings	
Panel A - Cumulative ABSR								
$E^U$	-0.067	-3.714	0.012	1.572	-0.144	-6.758	-0.007	-0.771
$D^U$	0.271	1.176	1.168	5.243	1.149	3.194	-0.281	-1.002
$I(-,0)$	-0.494	-1.534	0.425	2.150	-2.681	-5.675	-0.107	-0.394
$I(-,+)$	-0.113	-0.284	1.118	4.866	-1.953	-3.722	0.789	2.558
$I(+,-)$	-1.763	-2.106	1.957	6.403	-	-	0.177	0.509
$I(+,0)$	0.177	0.596	0.884	4.451	-1.506	-3.383	0.524	1.932
$I(+,+)$	0.626	1.978	0.553	2.518	-1.315	-2.845	0.323	1.082
Constant	-0.538	-1.825	-1.167	-6.079	1.344	3.032	-0.536	-2.017
N	6,590		18,168		2,587		6,477	
First-Order F	7.003		14.990		24.010		0.817	
Interaction F	8.878		23.590		11.650		18.490	
Panel B - Cumulative SABR								
$E^U$	-0.073	-4.042	0.009	1.148	-0.149	-6.943	-0.007	-0.778
$D^U$	0.278	1.202	1.120	5.009	1.160	3.207	-0.309	-1.100
$I(-,0)$	-0.556	-1.717	0.265	1.337	-2.755	-5.799	-0.162	-0.597
$I(-,+)$	-0.253	-0.631	0.964	4.186	-2.055	-3.896	0.741	2.402
$I(+,-)$	-1.755	-2.086	1.812	5.910	-	-	0.109	0.315
$I(+,0)$	0.114	0.380	0.729	3.656	-1.562	-3.490	0.465	1.711
$I(+,+)$	0.608	1.910	0.427	1.937	-1.349	-2.902	0.275	0.920
Constant	-0.550	-1.859	-1.101	-5.715	1.365	3.061	-0.519	-1.953
N	6,590		18,168		2,587		6,477	
First-Order F	8.257		13.170		25.230		0.928	
Interaction F	9.460		21.330		12.110		18.220	

**Table 4-15: Interaction effect based on the relative time between the announcements.** This table presents results of CAR of ABSR (Panel A and C) and SABR (Panel B and D) following Equation 4-6 and the F-statistics. The sample is split by the number of workdays between the announcements: less than five vs. five or more days and same day vs. one or more days.

	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
	$(t - 10, t + 10)$				$(t - 3, t + 3)$			
	< five days		>= five days		< five days		>= five days	
Panel A - Cumulative ABSR								
$E^U$	0.007	0.892	-0.021	-1.488	-0.011	-1.187	-0.069	-3.746
$D^U$	0.585	3.520	1.866	3.590	0.096	0.469	3.439	3.892
$I(-,0)$	0.109	0.590	0.961	2.790	-0.574	-2.622	-3.168	-3.614
$I(-,+)$	1.266	5.916	-0.103	-0.244	0.511	2.035	-3.608	-3.888
$I(+,-)$	1.492	4.589	1.855	2.950	-0.445	-1.276	3.013	2.185
$I(+,0)$	0.743	4.054	0.926	2.748	-0.049	-0.226	-2.206	-2.551
$I(+,+)$	0.695	3.510	0.611	1.640	-0.151	-0.644	-2.668	-2.957
Constant	-1.144	-6.471	-1.126	-3.393	-0.068	-0.322	2.098	2.427
N	17,618		7,111		6,246		2,815	
First-Order F	6.850		7.181		0.759		13.880	
Interaction F	26.200		7.254		18.170		12.230	
Panel B - Cumulative SABR								
$E^U$	0.003	0.421	-0.026	-1.778	-0.012	-1.356	-0.069	-3.693
$D^U$	0.574	3.440	1.678	3.207	0.089	0.431	3.326	3.756
$I(-,0)$	-0.022	-0.120	0.809	2.331	-0.630	-2.871	-3.250	-3.701
$I(-,+)$	1.132	5.279	-0.292	-0.690	0.453	1.802	-3.690	-3.968
$I(+,-)$	1.383	4.243	1.666	2.631	-0.498	-1.425	2.834	2.052
$I(+,0)$	0.618	3.367	0.772	2.273	-0.101	-0.465	-2.303	-2.658
$I(+,+)$	0.586	2.952	0.543	1.448	-0.201	-0.855	-2.712	-2.999
Constant	-1.103	-6.222	-1.061	-3.176	-0.049	-0.234	2.134	2.463
N	17,618		7,111		6,246		2,815	
First-Order F	6.132		6.318		0.955		13.200	
Interaction F	25.570		6.174		18.270		12.070	

	Same day		>= one day		Same day		>= one day	
Panel C - Cumulative ABSR								
$E^U$	0.001	0.095	0.002	0.200	-0.032	-2.407	-0.026	-2.535
$D^U$	0.727	2.319	0.781	4.298	0.058	0.156	0.686	2.626
$I(-,0)$	-0.634	-2.412	1.182	5.462	-0.527	-1.615	-0.883	-2.695
$I(-,+)$	0.967	3.182	0.920	3.560	0.412	1.089	-0.338	-0.931
$I(+,-)$	1.129	3.058	1.447	3.035	-0.552	-1.424	2.371	2.814
$I(+,0)$	0.215	0.807	1.390	6.588	-0.014	-0.042	-0.122	-0.381
$I(+,+)$	0.183	0.619	1.213	5.406	-0.101	-0.277	-0.327	-0.973
Constant	-0.514	-2.034	-1.752	-8.462	0.085	0.267	-0.046	-0.143
N	7,117		17,612		2,308		6,753	
First-Order F	2.714		9.431		2.901		5.835	
Interaction F	27.570		11.310		8.355		15.080	
Panel D - Cumulative SABR								
$E^U$	-0.005	-0.372	-0.001	-0.157	-0.034	-2.560	-0.027	-2.579
$D^U$	0.693	2.205	0.758	4.155	0.050	0.133	0.670	2.560
$I(-,0)$	-0.799	-3.035	1.069	4.918	-0.590	-1.804	-0.934	-2.844
$I(-,+)$	0.803	2.635	0.796	3.065	0.343	0.907	-0.390	-1.073
$I(+,-)$	0.991	2.679	1.392	2.906	-0.615	-1.585	2.315	2.740
$I(+,0)$	0.092	0.345	1.265	5.971	-0.066	-0.198	-0.176	-0.547
$I(+,+)$	0.080	0.272	1.119	4.966	-0.149	-0.410	-0.366	-1.085
Constant	-0.455	-1.797	-1.719	-8.268	0.113	0.356	-0.039	-0.122
N	7,117		17,612		2,308		6,753	
First-Order F	2.491		8.648		3.280		5.782	
Interaction F	28.360		9.382		8.506		14.920	

**Table 4-16: Interaction effect based on the time period.** This table presents results of CAR of ABSR (Panel A) and SABR (Panel B) following Equation 4-6 and the F-statistics. The sample is split in half by the number of years in the overall sample, representing all events up to and including 2014 and separately all events in the recent years.

	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
	$(t - 10, t + 10)$				$(t - 3, t + 3)$			
	<= 2014		>= 2015		<= 2014		>= 2015	
<b>Panel A - Cumulative ABSR</b>								
$E^U$	-0.070	-4.539	0.019	2.343	0.008	0.439	-0.036	-3.806
$D^U$	1.435	3.258	0.602	3.547	0.256	0.493	0.423	1.823
$I(-,0)$	-0.813	-2.890	0.824	4.114	-1.035	-2.391	-0.825	-3.149
$I(-,+)$	0.061	0.168	1.329	5.832	-1.250	-2.406	0.327	1.119
$I(+,-)$	1.892	4.019	1.254	3.442	-0.697	-1.190	0.097	0.209
$I(+,0)$	0.316	1.166	1.009	5.085	-0.891	-2.124	0.006	0.024
$I(+,+)$	0.393	1.268	0.838	3.946	-0.486	-1.060	-0.265	-0.952
Constant	-0.449	-1.687	-1.413	-7.361	0.554	1.326	-0.061	-0.242
N	6,795		17,963		2,508		6,556	
First-Order F	13.280		9.579		0.234		8.215	
Interaction F	22.670		10.440		4.614		23.900	
<b>Panel B - Cumulative SABR</b>								
$E^U$	-0.073	-4.736	0.016	1.924	0.006	0.329	-0.036	-3.817
$D^U$	1.404	3.182	0.573	3.363	0.277	0.534	0.401	1.723
$I(-,0)$	-0.916	-3.253	0.671	3.334	-1.088	-2.510	-0.891	-3.389
$I(-,+)$	-0.014	-0.039	1.159	5.066	-1.296	-2.490	0.258	0.882
$I(+,-)$	1.826	3.872	1.110	3.034	-0.724	-1.234	0.021	0.044
$I(+,0)$	0.220	0.807	0.856	4.295	-0.937	-2.229	-0.065	-0.252
$I(+,+)$	0.325	1.046	0.719	3.371	-0.516	-1.124	-0.323	-1.154
Constant	-0.413	-1.551	-1.358	-7.043	0.570	1.362	-0.038	-0.149
N	6,795		17,963		2,508		6,556	
First-Order F	13.870		7.926		0.209		8.120	
Interaction F	23.420		8.050		4.979		23.450	

**Table 4-17: Interaction effect including no earnings change events.** This table presents the results of CAR of ABSR (Panel A) and SABR (Panel B) following Equation 4-6 over the periods  $(t - 10, t + 10)$  and  $(t - 3, t + 3)$  and the F-statistics. Announcements in which earnings are not changed are included in the sample. No earnings change is defined as the unexpected earnings change having an absolute value of smaller than or equal to one.

	Coefficient	t-statistic	Coefficient	t-statistic
	$(t - 10, t + 10)$		$(t - 3, t + 3)$	
<b>Panel A - Cumulative ABSR</b>				
$E^U$	0.034	4.949	0.013	1.740
$D^U$	-0.002	-0.022	0.067	0.623
$I(-,0)$	0.529	3.518	-0.384	-2.053
$I(-,+)$	0.742	4.268	0.241	1.160
$I(0,0)$	1.021	6.973	0.035	0.193
$I(0,+)$	0.877	5.607	-0.063	-0.325
$I(0,-)$	1.155	5.886	-0.136	-0.599
$I(+,-)$	1.573	5.858	0.463	1.473
$I(+,0)$	0.927	6.205	0.072	0.388
$I(+,+)$	0.930	5.919	0.053	0.271
Constant	-1.377	-9.545	-0.297	-1.633
N	48,099		19,170	
First-Order F	12.370		1.775	
Interaction F	26.090		15.300	
<b>Panel B - Cumulative SABR</b>				
$E^U$	0.032	4.690	0.012	1.629
$D^U$	-0.013	-0.136	0.060	0.559
$I(-,0)$	0.449	2.973	-0.421	-2.246
$I(-,+)$	0.668	3.827	0.216	1.034
$I(0,0)$	0.960	6.527	0.010	0.053
$I(0,+)$	0.823	5.242	-0.087	-0.448
$I(0,-)$	1.053	5.346	-0.171	-0.749
$I(+,-)$	1.548	5.742	0.443	1.404
$I(+,0)$	0.864	5.758	0.043	0.231
$I(+,+)$	0.878	5.563	0.026	0.132
Constant	-1.444	-9.969	-0.324	-1.775
N	48,099		19,170	
First-Order F	11.080		1.540	
Interaction F	25.990		15.890	

**Table 4-18: Interaction effect of extreme dividend events.** This table presents the results of CAR of ABSR (Panel A) and SABR (Panel B) following Equation 4-6 and the F-statistics. First, dividend events with no change are excluded from the sample, whereas secondly, only dividend initiation and omission events instead of increases and decreases are considered.

	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
	$(t - 10, t + 10)$				$(t - 3, t + 3)$			
	Dividend changes only		Dividend initiations/omissions		Dividend changes only		Dividend initiations/omissions	
Panel A - Cumulative ABSR								
$E^U$	0.027	1.954	0.168	3.432	-0.013	-0.729	-0.277	-0.603
$D^U$	0.615	3.868	-	-	0.338	1.579	-	-
$I(-,0)$	-	-	-	-	-	-	-	-
$I(-,+/\text{initiation})$	1.280	5.731	0.775	2.233	-0.046	-0.162	4.405	1.233
$I(+,-/\text{omission})$	1.482	4.831	-1.643	-3.451	-0.209	-0.564	6.732	1.222
$I(+,0)$	-	-	-	-	-	-	-	-
$I(+,+/\text{initiation})$	0.800	3.661	1.591	3.423	-0.407	-1.472	2.930	0.558
Constant	-1.308	-6.712	0.305	0.926	0.142	0.567	-4.761	-1.148
N	5,338		228		1,785		62	
First-Order F	59.280		9.438		63.360		0.228	
Interaction F	9.998		7.787		1.426		3.238	
Panel B - Cumulative SABR								
$E^U$	0.024	1.756	0.187	3.989	-0.014	-0.774	-0.336	-0.678
$D^U$	0.585	3.661	2.426	2.334	0.320	1.485	-1.530	-0.369
$I(-,0)$	-	-	-	-	-	-	-	-
$I(-,+/\text{initiation})$	1.128	5.025	-2.046	-1.857	-0.103	-0.359	6.234	0.948
$I(+,-/\text{omission})$	1.357	4.401	-2.012	-4.377	-0.268	-0.719	7.506	1.245
$I(+,0)$	-	-	-	-	-	-	-	-
$I(+,+/\text{initiation})$	0.685	3.116	-1.334	-1.156	-0.450	-1.619	5.032	0.617
Constant	-1.251	-6.388	0.495	1.572	0.158	0.625	-5.269	-1.179
N	5,338		228		1,785		62	
First-Order F	48.540		9.936		63.430		0.234	
Interaction F	8.171		9.007		1.383		3.195	

**Table 4-19: Interaction effect based on firm-specific characteristics.** This table presents the results of CAR of ABSR following Equation 4-6 over the periods  $(t - 10, t + 10)$  and  $(t - 3, t + 3)$  and the F-statistics. The sample is split based on a specific firm characteristic within each year. A precise definition of the characteristics is provided in Table 4-7.

CAR ABSR	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
	$(t - 10, t + 10)$				$(t - 3, t + 3)$			
	Low analyst dispersion		High analyst dispersion		Low analyst dispersion		High analyst dispersion	
$E^U$	0.697	5.607	-0.181	-1.402	-0.524	-10.394	0.053	0.408
$D^U$	7.615	1.966	-12.793	-1.988	-34.037	-4.871	-6.524	-1.009
$I(-,0)$	-	-	1.573	1.152	-	-	-0.539	-0.495
$I(-,+)$	-	-	-1.296	-0.760	-	-	-	-
$I(+,-)$	-	-	-	-	-	-	-	-
$I(+,0)$	-7.139	-4.017	1.337	0.861	-1.962	-3.245	-2.321	-2.025
$I(+,+)$	-7.658	-3.679	3.179	1.757	-	-	0.159	0.225
Constant	3.613	2.402	-1.562	-1.108	3.982	6.616	1.645	1.564
N	158		498		66		188	
First-Order F	16.200		2.780		79.870		0.601	
Interaction F	3.199		9.506		2.004		2.917	
	Small firm size		Large firm size		Small firm size		Large firm size	
$E^U$	0.307	7.045	-0.119	-4.163	-0.353	-7.167	0.027	0.952
$D^U$	3.726	6.881	-1.349	-1.600	3.661	3.473	-8.306	-3.524
$I(-,0)$	2.229	3.917	1.652	3.743	-1.739	-1.613	6.655	3.700
$I(-,+)$	1.250	1.411	0.762	1.406	0.106	0.046	8.945	4.411
$I(+,-)$	-	-	1.379	1.653	-	-	-	-
$I(+,0)$	-0.500	-0.812	0.910	2.095	1.979	1.839	5.604	3.123
$I(+,+)$	-0.887	-1.249	1.117	2.245	0.500	0.407	7.219	3.452
Constant	-1.061	-2.060	-1.390	-3.350	-0.494	-0.512	-6.115	-3.414
N	613		2,441		228		820	
First-Order F	46.660		9.805		34.230		6.715	
Interaction F	9.501		4.604		7.620		11.540	

	Low financial leverage		High financial leverage		Low financial leverage		High financial leverage	
$E^U$	0.578	7.085	-0.284	-5.695	-0.535	-11.032	-0.057	-1.080
$D^U$	4.184	4.451	-5.443	-2.362	-0.814	-0.752	-13.002	-2.975
$I(-,0)$	3.784	3.434	1.897	2.835	-	-	-2.619	-4.484
$I(-,+)$	1.873	1.294	1.571	1.898	8.263	5.554	-	-
$I(+,-)$	-	-	-1.182	-0.712	-	-	-12.174	-3.590
$I(+,0)$	-1.309	-1.100	2.252	3.154	10.150	8.949	-3.310	-5.235
$I(+,+)$	-1.579	-1.192	3.479	4.036	9.890	7.651	-0.401	-0.817
Constant	-1.656	-1.687	-2.215	-3.346	-8.330	-7.928	3.139	5.496
N	316		1,011		104		328	
First-Order F	32.360		19.050		60.540		5.231	
Interaction F	9.593		5.410		21.630		6.786	

## 5. Synthesis

This dissertation advances the quality of bond event studies and provides new insights in the informational efficiency of the corporate bond market.

It demonstrates that using standardized abnormal returns of bonds in combination with non-parametric tests offers the strongest test power and thus significance of an event study in a corporate bond market. A sample size of at least 100 events should be ensured. Applying standardized abnormal returns is especially crucial if event-induced variance is expected. Additionally, it is advisable to exclude highly illiquid bonds from the sample if the bonds carry above-average maturities and low ratings, i.e., high credit risk. Once these aspects are considered the presented bond event study methodology is robust and powerful and can be applied in future research on informational efficiency in the bond market.

This dissertation examines dividend announcement effects considering dividend payout ratio changes, a more precise measure for cash flow considerations, as opposed to those used in previous research. Bondholders' negative reactions to unexpected dividend payout ratio changes cannot be explained by the signaling or wealth transfer hypotheses in isolation, suggesting they consider a broad range of effects around a dividend announcement. Furthermore, the information content hypothesis is refuted since dividend payout ratio changes do not provide significant information content for a firm's future performance. Consequently, the corporate bond market is not fully informationally efficient around dividend payout ratio changes, a result that bondholders and bond-issuing firms should carefully consider.

Finally, this dissertation is the first to present results on a robust interaction effect between dividend and earnings announcements in the corporate bond market. Given that both announcements hold information for the corporate bond market, it is relevant to consider this overlap in informational content. Thus, when analyzing the information content of either of these announcements, future research should account for the interaction effect. Similarly, bond-issuing firms managing dividend and earnings announcements strategically, as well as bondholders evaluating their impact on bond prices, should incorporate the interaction effect into their analyses and decision-making.

Overall, this dissertation provides valuable insight for bond-issuing firms seeking to optimize dividend policies, bondholders assessing firm-level risk and the overall financial market interested in informational efficiency by enhancing the understanding of the informational efficiency in the corporate bond market.

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## Declaration of Honor

I declare upon my word of honor that the dissertation submitted herewith is my own work. All sources and aids used have been listed. All references or quotations in any form and their use have been clearly identified. The dissertation has not been submitted for examination purposes to any institution before.

Ich erkläre hiermit ehrenwörtlich, dass ich die vorliegende Arbeit selbstständig angefertigt habe. Sämtliche aus fremden Quellen direkt und indirekt übernommene Gedanken sind als solche kenntlich gemacht. Die Dissertation wurde bisher keiner anderen Prüfungsbehörde vorgelegt und noch nicht veröffentlicht.

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Sonja Lisa Buschulte

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