Covenant Prices of US Corporate Bonds*

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This paper provides a novel approach to empirically determine prices of bond covenants based on transaction data for the US corporate bond market. Thereby, we are the first to measure price effects over the whole lifetime of bond contracts. We find that covenant prices vary significantly over time and are associated with changes in market-wide credit risk, volatility, and macroeconomic variables. Apart from these time-series dynamics, there is also significant variation across bond and firm characteristics. In particular, covenant prices increase with interest rate, credit, and liquidity risk and are higher for firms that have more growth options, more tangible assets, and are smaller. Furthermore, we document a positive correlation between the prices of covenants and their subsequent inclusion rates.

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1. Introduction

Debt contracts typically include covenants to mitigate agency conflicts between stockholders and bondholders. Different covenants types either restrict pre-defined corporate actions or grant state-dependent rights to bond investors. For example, these clauses can be used to limit the possibility to dilute existing claims (financial covenants), prevent risk-shifting (investment covenants), lead to payment acceleration after certain adverse events (event covenants), or restrict dividend-like payments (dividend covenants). Thus, covenants are relevant contractual features, and it is vital to deepen our understanding of their price effects. Since the impact of covenants on bond yields, which we refer to as the covenant price, has significant implications for capital structure choices and market prices, it is highly relevant for firms and bond investors alike.

In this paper, we provide a novel approach to estimate covenant prices, allowing us to continuously observe the covenants' price effects over the lifetime of bond contracts. Thereby, we drastically increase the number and frequency of observations compared to the existing empirical literature, which focuses on issuance yields. This allows us to identify the effects of important bond-, market-, and firm-specific variables on the prices of covenants. In addition, we analyze the relation between average covenant prices and subsequent covenant inclusion decisions.

So far, the literature has not identified an ideal approach that overcomes the challenges associated with the estimation of covenant prices. The theoretical literature discusses covenants on a conceptual level and only provides abstract pricing formulas for simplified contractual features. However, the rules in actual debt indentures are far more complex, and existing theoretical models cannot be calibrated to real firms. For this reason, the existing empirical literature chooses a different strategy by linking the effect of covenants to bond yield differentials at issuance (see, e.g., Reisel, 2014; Simpson and Grossmann, 2017). Considering the firm's choice of covenants at issuance within an optimal contracting framework, they argue that the differences in yields can be attributed to the covenant choice after considering standard pricing factors. However, this approach leads to very small samples, which limit explanatory power and, in addition, these issuance yields themselves might be biased (see Nagler and Ottonello, 2020). Even more importantly, severe endogeneity issues arise, as firms choose the optimal set of covenants based on their individual situation at issuance. The literature applies different empirical strategies to mitigate these concerns. However, the general issue that firms are only observed when optimizing their capital structure remains.

Due to these concerns, we move away from issuance information and analyze the bonds' entire lifetime using their traded prices. Since the contractual details of bonds are fixed at issuance, changing firm fundamentals and financial market frictions allow situations where bonds with different covenant structures and the same underlying characteristics exist simultaneously. The yield differential of such bonds reflects the price effect of covenants. An ideal approach would match bonds with differing covenants based on a wide range of firm and bond characteristics. As bond markets are in general quite illiquid, the choice of matching criteria has to be restricted. Otherwise, the number of empirical observations is limited. We solve this trade-off by focusing on the view of bond investors. Thus, we pick the essential price factors investor use in their decision-making process. That is, in our empirical approach, we compare bonds that differ in one particular covenant type and match these bonds by duration, rating, and liquidity. Thus, we measure the covenant price from an investor's perspective after controlling for interest rate, credit, and liquidity risk.

For the matching procedure, we extend an approach of Cleveland and Devlin (1988) and Meese and Wallace (1991) and apply it to covenants.[1] With this approach, we identify the price of a certain covenant type for a bond by first considering the subset of simultaneously traded bonds with the same covenant structure as the original bond except for the covenant type in question. We then derive optimal weights within this subgroup to form a portfolio that perfectly replicates the original bond's risk profile. This benchmark has the same credit, liquidity, and interest rate risk but differs in one covenant type and, thus, the yield difference reflects the covenant

[1] Spiegel and Starks (2016) were among the first to adapt the original methodology to corporate bonds, and Jankowitsch et al. (2020) used their method in the context of rating changes.

price. This methodology provides a reliable time series of covenant prices and avoids the aforementioned endogeneity issues.[2]

Empirically, we analyze the US corporate bond market from 2004 to 2018. The US corporate bond market is an ideal laboratory as all secondary bond market transactions are available in the TRACE database. This detailed transaction data is necessary to implement our methodology. Furthermore, the considered period covers the years before the financial crisis, the crisis itself, and a longer post-crisis period, providing us with the opportunity to observe covenant prices across the business cycle. We consider a total of 12,904 bonds and close to one million covenant prices.

Overall, we find significant average yield effects between 13 and 20 bp for the different covenant types. When investigating the time series, we find that covenant prices start at a comparably low level of around 10 bp at the beginning of our sample period in 2004. Prices further decrease and are close to zero just before the onset of the crisis. In the crisis and the subsequent period, covenant prices increase significantly, spiking to around 80 bp in the case of financial covenants and to 40 bp for the other types. Afterwards, covenant prices are staying on these high levels for several years. During this period, the magnitude of covenant prices amounts to roughly 5% relative to overall bond yields. Thereafter, covenant prices slowly revert to their pre-crisis average. These results indicate a strong dependence on the economic environment.

In our empirical analysis, we set up panel regressions based on first differences of an individual bond's covenant prices. This setup has the additional advantage that the synthetic benchmark's potential imperfections due to unobservable factors are filtered out. Focusing first on bond-specific risk variables, we find that an increase in interest rate, credit or liquidity risk leads to higher covenant prices. Specifically, a shortening of bond duration by one year decreases the covenant price by 6.0 bp, a reduction in the credit rating by one notch increases the covenant price by 13.8 bp, and a one standard deviation higher illiquidity is associated with an increase

[2] We show that the methodology produces unbiased benchmarks by replicating bonds with the exact same covenant structure, see Section 5.2 for details.

in the covenant price of 3.3 bp. Overall, these results suggest that covenant prices increase with all three risk dimensions.

In the second analysis, we focus on the economic environment and explore the impact of market-wide credit risk, volatility and macroeconomic variables on covenant prices. We study changes in the default spread, CDS spreads, and VIX and use macroeconomic indicators, such as GDP growth, inflation, and interest rates. We find that all three aggregate credit risk and volatility variables have highly significant effects. A positive one standard deviation change in default spreads increases covenant prices by 2.1 bp, the VIX has an effect of 2.8 bp, and CDS spreads show the most substantial impact with 3.4 bp. Additionally, we find that all measures triple in the financial crisis preceding a similar spike in covenant prices. The macroeconomic variables show significant effects as well. In detail, a positive change in inflation by 1% corresponds to an increase in covenant prices by 1.1 bp and a decrease of the term spread by one standard deviation leads to 6.4 bp higher prices. To this end, we provide novel insights on market-wide measures as well as macroeconomic variables indicating that economic downturns are linked to elevated covenant prices. Thus, covenants lead to higher yield reductions in times when the risk of capital outflow, risk-shifting, and claim dilution is exceptionally high.

In our third analysis, we consider firm-specific variables. The existing literature documents significant relations between covenant inclusion frequencies and growth options, leverage, firm size, and tangibility. Their findings suggest that these firm characteristics might also have pricing effects. We analyze these conjectures and find that investors pay higher prices for covenants included in bonds issued by growth firms. Similarly, smaller firms and firms with more tangible assets have higher covenant prices on average.

In the last part of our analysis, we explore whether the level of covenant prices can be related to the inclusion of covenants in newly issued bonds. In general, our results indicate that the usage of certain covenant types shows cyclical behaviors and trends. In particular, all inclusion rates experience a pronounced drop before the crisis, which shows similarities to the developments of their respective prices. For example, the frequency of investment covenants decreases from 90% to around

60%. This drop is followed by a large spike in covenant prices preceding a subsequent increase in covenant inclusion rates. We can see this particularly well for event covenants included in almost all newly issued bonds after the financial crisis. Similarly, at the end of our observation window, when covenant prices go down again, we also observe a downward trend in the usage of covenants. In our analysis, we find supportive evidence for an effect on inclusions for large, long-term changes in covenant prices, whereas small, short-term price fluctuations do not influence the covenant choices of subsequently issued bonds in the near future.

To summarize, this paper's contribution is to develop and apply a new methodology for measuring covenant prices. This new approach allows us to observe a time series of covenant prices over a bond's entire lifetime. In this setup, we are able to identify the effects of bond-, market-, and firm-specific variables on covenant prices. We find that the bond-specific measures for interest rate, credit, and liquidity risk have a significant, positive effect on covenant prices. Moreover, market-wide variables measuring general default risk and volatility positively affect covenant prices. In general, these results indicate that covenant prices show a strong relation to the business cycle with higher covenant prices in economic downturns. In addition, prices are higher for growth firms, smaller firms, and firms with more tangible assets. Finally, we show that the covenant price is linked to the choice of covenants in subsequently issued bonds.

The remainder of the paper is structured as follows. Section 2 provides a review of the literature. Section 3 discusses the various covenant types. Section 4 presents the data set we use. Section 5 introduces the methodology used to measure covenant prices based on secondary market transactions. Section 6 discusses the results. Finally, Section 7 concludes.

2. Literature

Jensen and Meckling (1976) and Smith and Warner (1979) are among the first to discuss covenants and their role in mitigating agency conflicts that arise from misaligned incentives of shareholders and bondholders. Covenants balance both parties' interests by restricting managerial actions or shifting control rights away from managers in poor economic situations. In both cases, covenants allow lenders to enforce their claims outside of bankruptcy (for a discussion of lenders' rights in bankruptcy, see, e.g., Gilson, 1990; Ayotte and Morrison, 2009) and thereby avoid the associated costs.

Restrictions on managerial actions aim to avoid financial distress and ensure that the firm retains a sufficient amount of equity (Christensen and Nikolaev, 2012). This is achieved by limiting payouts to equity holders, ruling out the issuance of additional (senior) debt claims, and limiting the type of projects the firm can undertake.[3] On the other hand, ex-post shifts in control rights can be triggered either by a signal about firm fundamentals (see, e.g., Aghion and Bolton, 1992) or by missed payments (see, e.g., Hart and Moore, 1998). In effect, these covenants act as an early signal for bondholders that allows them to shorten their maturity as discussed by Dichev and Skinner (2002). In recent years, the academic literature has further divided these two general groups by focusing on the type of firm decision affected. Specifically, we consider the grouping used by Chava et al. (2010), i.e., dividend, event, financial, and investment covenants, and discuss these covenant types in more detail in Section 3.

The literature on covenants also addresses differences between bond indentures and loan agreements (as recently studied by Li et al., 2015). One important point is that the enforcement of covenants requires monitoring and coordination, which is more difficult for dispersed lenders such as bondholders (see, e.g., Diamond, 1984; Ramakrishnan and Thakor, 1984; Asquith et al., 1994; Sweeney, 1994; Bolton and Scharfstein, 1996; Gilson, 1997; Denis and Mihov, 2003; Lou and Otto, 2020).

[3] There is an extensive literature that studies the effects that covenants have on various firm decisions (see, e.g., Baird and Rasmussen, 2006; Chava and Roberts, 2008; Nini et al., 2009; Roberts and Sufi, 2009; Sufi, 2009; Bradley and Roberts, 2015, among others).

Furthermore, it is empirically documented that loans contain more and stricter covenants (Li et al., 2015; Becker and Ivashina, 2016).

The literature provides several studies that analyze which firms are more likely to include covenants. Nash et al. (2003) find that firms with growth opportunities are more inclined to preserve financial flexibility by not including dividend and debt issuance restrictions. Billet et al. (2007) find that the use of covenants increases with debt maturity, leverage, and growth opportunities. Similarly, Bradley and Roberts (2015) study loan contracts and find that firms are more likely to include covenants when they are small, have high growth opportunities, or are highly levered. Moreover, they point out that loans include covenants more often during recessionary periods or when credit spreads are large. Lou and Otto (2020) show that firms with heterogeneous debt sources subsequently include new and stricter covenants. In the loan market, Prilmeier (2017) finds that covenant tightness is relaxed over the duration of a relationship, especially for opaque borrowers, consistent with information asymmetry theories. Finally, on a country level, Miller and Reisel (2012) find that bond contracts are more likely to include covenants when creditor protection laws are weaker.

Among the first ideas on the pricing of covenants, Black and Cox (1976) apply an option-pricing framework to derive the price of covenants. Thereafter, subsequent studies extend their approach using similar models (see, e.g., Stulz and Johnson, 1985; Titman and Torous, 1989; Childs et al., 1996, among others). Additionally, in the theoretical literature on optimal capital structure some authors incorporate the effects of covenants on leverage decisions (see, e.g., Leland, 1994; Mauer and Triantis, 1994; Leland, 1998). However, all of these models incorporate abstract and stylized covenants, e.g., by incorporating reorganization barriers linked to the firm value. Thus, the calibration of these model parameters cannot be directly related to existing covenants that are often linked to specific events or accounting ratios.

Due to the considerations discussed above, the existing empirical literature has not focused on such model calibrations but analyzes bond prices/yields directly. Reisel (2014) is the first paper to empirically investigate by how much the presence of covenants reduces yields. She studies issuance yields for bonds with covenants by building on the idea that firms include covenants when their benefits outweigh their costs.[4] To address the endogeneity problem, she employs a treatment effects model and finds that covenants are relevant for bond pricing. Specifically, she finds significant reductions in the cost of debt by around 35 to 75 bp at issuance. In the aftermath of the financial crisis, the same methodology is applied in Simpson and Grossmann (2017) to investigate potential differences between the pre- and post-crisis price impact of covenants. They find dramatic differences in the price effects of covenants before and after the financial crisis.

3. Covenant Types

The recent literature uses the framework by Smith and Warner (1979) and Chava et al. (2010) to group covenants into four types; dividend, event, financial, and investment covenants. Thus, we discuss important aspects of these types and the economic channel through which covenants affect firms.

All else equal, dividends reduce liquidity held within the firm, leading to an increased risk of default, which in turn reduces bond prices. This is not only the case for cash dividends but for all dividend-like payments, e.g., share repurchases which have a similar effect. Thus, it is advantageous for bondholders if dividend covenants limit this possibility. Dividend covenants vary in how stringent they are and typically do not prohibit dividend-like payments outright. Instead, limitations on such payments are tied to the development of specific accounting figures, like profit.

Individual covenants that are grouped in the event type trigger if certain special situations occur. For example, if the firm defaults on or accelerates other debt, event covenants allow the bondholders to accelerate their debt as well. Alternatively, this could also happen if the net worth of the firm falls below a pre-specified threshold. Moreover, control put provisions, also referred to as poison puts, allow bondholders to accelerate their claim if the firm is taken over.

[4] This cost-benefit consideration was already pointed out by, e.g., Smith and Warner (1979).

Financial covenants stop or limit stockholders from diluting the existing bondholders by creating any claims that effectively have a higher priority or endanger their ability to honor the outstanding debt. The most direct way for stockholders to achieve that would be to issue additional debt that is senior to the existing claims. Financial covenants either prohibit this outright or automatically elevate existing debt to the same seniority level. Additionally, covenants of this type might also restrict rentals, leases, and sale-leaseback arrangements since they also create payments that are effectively senior.

Generally, investment covenants restrict the stockholders investment policy to prevent risky investment that decreases the value of existing debt, i.e., they prevent risk-shifting. However, they can also mandate stockholders to invest in certain projects or require the maintenance of a firms working capital, which also includes retaining earnings to cover fixed charges. For example, these covenants restrict firms from acquiring a claim in another business or merging with another entity. Similarly, these covenants limit the interaction of a parent company with its affiliates. Should the firm have no other covenants prohibiting the sale of assets, investment covenants also force the stockholders to use the proceeds to pay back the bondholders.

4. Data

For our empirical analysis, we combine bond data from Mergent FISD with transaction data from TRACE. We follow the relevant literature on corporate bonds and consider senior, unsecured corporate bonds denoted in US dollar with a fixed coupon that are straight, callable, or puttable, excluding all others with complex structures, such as asset-backed and convertible securities. In addition, we require that the bonds are rated by at least one rating agency. We consider ratings from S&P, Moody, and Fitch and convert them to numeric values (i.e., one corresponds to AAA/Aaa, two to AA+/Aa1, etc.). In total, we observe 37,863 bonds.

For these bonds, we consider transaction data from 2004 onward, when TRACE reporting became mandatory for all bonds, up to the second quarter of 2018. We delete non-institutional trades (i.e., transaction volume below USD 100,000), clean the transaction data following Dick-Nielsen (2009), and apply median as well as reversal filters.[5] This leaves us with a sample of 13,289 traded bonds.

Next, we add bond covenant information from Mergent FISD. This information is available for most bonds with trading data, and our final sample consists of 12,904 bonds, representing approximately 80% of the overall market trading activity. As discussed in Section 3, we follow the framework by Smith and Warner (1979) and Chava et al. (2010) to group the individual covenant dummies from Mergent FISD into four covenant types, namely, dividend, event, financial, and investment covenants. We provide a complete list of how to map covenant dummies to covenant types in the Appendix. Note that no data is available that covers the details of the individual covenants (e.g., trigger values or others). Furthermore, information concerning covenant violations is not available. Table 1 shows summary statistics of our bonds in Panel A and the relative covenant inclusion frequency in Panel B (with additional insights on covenant frequencies in Internet Appendix I).

Our empirical setup, focuses on a weekly observation frequency since some variables require multiple observations for their calculation. In addition, given the general illiquidity of the US corporate bond market, weekly observations reduce the volatility of variables and the missing value problem, see, e.g., Bessembinder et al. (2009). Specifically, we require more than three transactions per week. Overall, we observe 1,498,420 bond-weeks. We discuss the main bond-specific variables below and provide their exact definitions in the Appendix.

We calculate a volume-weighted price for each week (see Bessembinder et al., 2009) and use these to compute yield to maturity and duration.[6] We incorporate all aspects of liquidity risk by considering the Roll measure as a transaction cost meas-

[5] Median filters address excessive intra-day price variation, i.e., if a trade deviates from the daily median or the two-week median centered at the trading day by more than 10%, it is considered erroneous. The price reversal filter deletes transactions that deviate from the previous price, the next price, and the average of both prices by more than 10%.

[6] In order to avoid potential outliers when calculating yields, we truncate the yield to maturity at the 0.5% level in both tails.

ure (see Roll, 1984), the Amihud measure as a price impact measure (see Amihud, 2002), and the price dispersion measure that is particularly well suited for dealer markets (see Jankowitsch et al., 2011). We then aggregate these three variables into one liquidity measure by performing a principal component analysis.[7] Table 2 shows summary statistics for the weekly variables alongside the number of trades per bond and the trading volume.

Table 1: Summary Statistics for Traded Bonds.
This table shows summary statistics for the 12,904 traded bonds in our sample. In Panel A we show the amount issued in billions, the coupon in percent, time-to-maturity at issuance in years, and the rating as numeric variable between 1 (best) and 24 (worst). We present the mean, the standard deviation, the median, and the interquartile range. In Panel B we show how often a covenant type (dividend, event, financial, and investment) is included in bond indentures. First, the overall relative frequency is shown, followed by how often a given covenant is included conditional on the presence of another covenant type.

Panel A: Bond Characteristics

	Mean	SD	Median	IQR
Amount Issued	0.58	0.59	0.40	0.50
Coupon	5.74	2.20	5.75	3.08
Time-to-Maturity	12.29	10.11	10.00	3.51
Rating	9.19	3.78	9.00	4.00

Panel B: Covenant Inclusion Frequency

		Conditional %			
	%	$\|D$	$\|E$	$\|F$	$\|I$
Dividend	18.23	-	22.55	19.04	20.29
Event	79.89	98.81	-	79.49	79.94
Financial	95.67	99.87	95.19	-	99.57
Investment	89.34	99.41	89.39	92.98	-

[7] We smooth the liquidity variables by considering a three-month rolling average and winsorize the variables and principal component at the 1% level.

In addition to the bond-specific information, we also consider various explanatory variables. We obtain the following macroeconomic variables from FRED; gross domestic product growth, consumer price index, term spread, T-bill rate, VIX, and default spread. Furthermore, we match firm-specific information to the bond data using the WRDS cusip-permno link and access equity and accounting variables from the matched CRSP-Compustat database. These include market-to-book, firm size, leverage, tangibility, equity beta, abnormal earnings, asset maturity, Altman Z scores, interest coverage ratio, retained earnings, and cash balance. A full list and exact definitions are shown in the Appendix.[8]

Table 2: Summary Statistics for Time-Series of Bond.
This table shows summary statistics for the 1,498,420 bond-weeks included in our sample. The variables shown are; yield in percent, duration in years, rating as numeric variable between 1 (best) and 24 (worst), price dispersion in percent, Roll measure in percent, Amihud measure in millions, the number of trades per week and the weekly trading volume in millions. We present the mean, standard deviation, median, and interquartile range for each metric.

	Mean	SD	Median	IQR
Yield	5.11	4.31	4.51	3.21
Duration	5.61	3.92	4.70	4.22
Rating	9.19	3.87	9.00	5.00
Price Dispersion	0.37	0.30	0.31	0.27
Roll	0.56	0.53	0.46	0.38
Amihud	0.01	0.02	0.01	0.01
Number of Trades	11.55	14.86	7.00	9.00
Volume	19.62	61.08	8.00	17.65

[8] To ensure that outliers do not drive our results, we winsorize the accounting variables at the 1% level on both sides.

5. Methodology

In this section, we present our approach to determine covenant prices and the regression setup for our analysis. In the first part, we focus on the identification of covenant pricing effects by controlling for the essential bond risk factors and discuss important features of the covenant price sample. In the second part, we explain how we explore its variation using bond-, market-, and firm-specific variables based on first differences.

5.1. Covenant Prices

We identify the covenant price of a particular covenant type by comparing the yields of bonds including this covenant to bonds with matching characteristics where the covenant structure differs only in the considered type. Ideally, we would compare two identical bonds except for the one covenant type within the same firm. However, firms generally never find it optimal to issue identical bonds with different covenant structures simultaneously. Similarly, a comparison of bonds issued at different points in time by the same firm also leads to very few observations, which additionally might be significantly different in bond maturity and liquidity.

Thus, following the literature, we focus on a comparison across firms. However, unlike existing studies, we do not limit our sample to issuance yields, which provides two advantages. First, by analyzing traded prices over the entire lifetime of bonds, we have enough observations to compare bond yields observed at the same point in time. Even more critical, since the contractual details of bonds are fixed at issuance, changing firm fundamentals and financial market frictions allow situations where bonds with different covenant structures and the same underlying characteristics exist simultaneously.

We identify covenant prices from the perspective of bond investors. Ideally, the matching of bonds with different covenant types would consider a wide range of firm and bond characteristics. However, given the illiquidity of the corporate bond market, this choice has to be restricted, as otherwise, only a low number of observations would be available. We solve this trade-off by selecting the most important pricing factors investors use in their decision-making process. That is, we compare bonds that differ in one particular covenant type and match these bonds by duration, rating, and liquidity. The remaining yield difference represents the pricing effect of covenants.[9]

To identify the price of a particular covenant type c, that is included in the contract of our treatment bond i, in week t, we single out all bonds j that are traded at the same time t and have the same covenant structure apart from the type c that we want to identify. These bonds form our control sample, denoted $J_{i,t}$, which is specific to each treatment bond i and week t. Next, we weight the bonds in the control sample $J_{i,t}$ such that the resulting portfolio forms a synthetic control bond with the same risk characteristics as bond i.

First, we initiate the identification of the optimal control bond by employing a local fitting approach (see Cleveland and Devlin, 1988).[10] The initial weights are derived by computing the differences in the standardized characteristics between the treatment bond and all bonds in the control sample.[11] These distances are then weighted using the tri-cube function proposed in the original paper, leading to larger weights for bonds closer to the treatment bond.

However, this approach does not ensure that the resulting portfolio matches the treatment bond's characteristics perfectly. Thus, while the original approach is useful when comparing a bond to the rest of the market, it is less appealing for smaller control samples. In our case, when selecting the control bonds based on the covenant structure, constellations are possible where the control bonds deviate significantly from the considered bond in one or more of the dimensions (e.g., the

[9] Note that such an approach might lead to biased results in the case that the covenant structure influences the matching criteria. In a robustness test, see Internet Appendix II we show that this is not the case. In particular, we show that rating is not dependent on the choice of the covenants. Indeed, there are discussions among market participants that ratings are not addressing the effects of covenants.

[10] This approach was already used in the context of corporate bonds, though with different characteristics, by Spiegel and Starks (2016) and Jankowitsch et al. (2020).

[11] We ensure that each category is weighted equally by standardizing all three risk variables to unit standard deviation.

weighted control sample could have a significantly higher duration). Such deviations can then lead to price differences that are unrelated to the covenant structure. Thus, we improve the existing methodology by adding an additional step to ensure the perfect replication of the treatment bond.

Thus, we use the weights calculated in the first step as the starting point for a numerical optimization process to match all dimensions of the risk profile. Formally, we consider a three-dimensional characteristics space. In this space, we have the characteristics vector $X_{i,t}$ for the treatment bond i and similar vectors for all bonds in the control sample $J_{i,t}$. The optimal weights $w^\star_{J_{i,t}}$ minimize the squared Euclidean distance between the treatment and control bond without allowing for short selling, i.e., they are the solution to[12]

$$\min_{w_{J_{i,t}}} ||X_{i,t} - w'_{J_{i,t}} X_{J_{i,t}}||_2 \tag{1}$$
$$\text{s.t.} \qquad w_{i,j} \geq 0,\ \forall j \quad \text{and} \quad \sum_{j \in J_{i,t}} w_{i,j} = 1.$$

Then, we identify the price of covenant type c as the difference between the synthetic yield $Y'_{J_{i,t}} w^\star_{i,J_{i,t}}$ and the treatment yield $Y_{i,t}$, i.e.,

$$\text{Covenant Price}_{i,t} := (Y'_{J_{i,t}} w^\star_{i,J_{i,t}} - Y_{i,t}). \tag{2}$$

This methodology produces a large sample of weekly covenant prices by controlling for all major bond-specific risk dimensions. In general, the resulting prices are robust. However, we take several additional measures to address potential economic concerns and increase our results' robustness even further. In general, our main results hold without these restrictions, but these measures reduce the noise in the sample.

[12] The optimization is performed by the R package of Theul et al. (2020). For computational efficiency, we only include the 100 bonds with the highest initial weights (covering more than 99.8% of the initial weights).

First, we restrict the bonds in the control sample $J_{i,t}$ within the estimation procedure to address potential curvature issues. Note that the weighting algorithm (see Equation 1) uses a first-order approximation. Thus, we need to filter out cases where non-linear effects could dominate the result. For example, we cannot perfectly replicate a medium-term bond with a linear combination of only very short-term and long-term bonds. We eliminate this effect by restricting the control sample to bonds that are sufficiently close in all characteristics, as non-linearity issues are relevant if deviations in the characteristics become large. Specifically, we implement a one standard deviation threshold in all three risk dimensions. This translates to a maximum difference between the treatment bond i and the control bonds in $J_{i,t}$ of no more than 3.92 years in the maturity dimension, less than 4 rating notches, and a difference in liquidity corresponding to no more than 50 bp in transaction costs. In addition, we require that the control sample after this adjustment contains at least four bonds. Furthermore, we only keep observations that perfectly replicate the characteristics of the treatment bond i (i.e., the squared distance is lower than 0.01), avoiding that the control sample does not span the characteristics of the treatment bond, e.g., in case all bonds in the control sample have a longer maturity.

Second, we only consider bonds that can be priced adequately by our chosen bond risk factors, i.e., duration, rating, and liquidity. To do so, we apply the matching approach described above to each bond but build the control sample $J_{i,t}$ with bonds that have the exact same covenant structure as the treatment bond i. This control sample should be able to reproduce the yield of the considered bond exactly.[13] If this is not the case for a particular bond, the observed pricing error is most likely transmitted into the covenant price estimation. To avoid this effect, we do not consider bond-week observations if the pricing errors exceed 0.5%. Thus, we eliminate cases where the pricing errors are above the average transaction costs in the market.[14] Such a pricing error might occur with fire-sale prices, time periods around earning announcements, or M&A activity, among others.

[13] We present summary statistics as well as the time-series of pricing errors on a quarter by quarter basis in Internet Appendix III. In general, our methodology produces unbiased results, and the pricing errors are basically zero on average and over time.

[14] Note that these restrictions do not impact our main results as shown in Internet Appendix III.

Third, when analyzing covenant prices in Section 6, we focus on a sample using the following criteria to avoid unwanted effects of unbalanced or unrepresentative control samples. Focusing on our defined risk factors, we exclude covenant prices identified from bonds with a duration of less than 0.25 or more than 15 years and illiquid bonds with a liquidity measure greater than 1.5, which is roughly equivalent to transaction costs in excess of 150 bp. These bonds often do not fulfil the minimum requirements of the control sample and, thus, are not consistently part of the sample over time. We further exclude speculative-grade bonds as they have similar issues. Furthermore, covenant prices of speculative bonds might be noisy, as these bonds are often close to or violate covenant thresholds or trigger default or default-like events. Thus, an in-depth analysis of speculative-grade bonds would require additional information concerning covenant thresholds and bond-related firm events. Additionally, covenant prices of speculative bonds represent only roughly 5% of our sample, and their exclusion does not affect the main results.[15] Concerning covenant types, dividend covenants are generally not frequently included in bond indentures, and if they are, often all other covenant types are included as well (see Table 1). In addition, bonds with dividend covenants trade significantly less often. Thus, a thorough discussion of individual results for dividend covenants is not possible, because of the low number of price observations representing less than 1% of our sample. Thus, we exclude dividend covenant prices from our analysis.[16] Finally, to avoid possible other distortions due to outliers, we require that there are at least twelve observations of a given bond-covenant combination and truncate the covenant prices at the 1% level.

Our final sample represents 965,651 covenant prices. Each observation represents a bond-covenant-week observation, i.e., for each bond, up to three covenant type prices per week can be derived (for the event, financial, and investment covenant type). In total, we report covenant prices for 7,519 unique bonds, with an average of 128 observations per bond. These observations correspond to 1,264 unique firms, with an average of 764 covenant prices per firm.

[15] We show the results with speculative- grade bonds in Internet Appendix IV.

[16] However, the dividend covenant type is still used when comparing the covenant structures to determine covenant prices in our sample.

5.2. Regression Analysis

In our main analysis, we use pooled time-series regressions to explain covenant prices by bond-, market-, and firm-specific variables. We employ specifications based on first differences to address autocorrelation effects in our analysis. Furthermore, we cluster the standard errors on a firm and quarter level:

$$\begin{aligned}\Delta\text{Covenant Price}_{i,t,c} = \alpha &+ \beta\Delta(\text{Duration})_{i,t} + \gamma\Delta(\text{Rating})_{i,t} + \delta\Delta(\text{Liquidity})_{i,t} \\ &+ \zeta\Delta(\text{Macroeconomic Variables})_{t} \\ &+ \eta\Delta(\text{Firm-specific Variables})_{i,t} + \epsilon_{i,t}.\end{aligned} \tag{3}$$

Note that in our setup, the use of regressions based on first differences has the additional advantage that any potential bias in covenant prices of a particular bond due to imperfect matching or omitted variables is filtered out. We aggregate all variables on a monthly basis, which allows us to directly use certain measures, e.g., macroeconomic variables, that are not available on a weekly basis.[17]

In our regression analysis, we include the bond-specific variables duration, rating, and liquidity, which we also employ in the derivation of the covenant prices. This allows us to analyze whether covenant prices are related to bond pricing factors (e.g., whether lower-rated bonds have higher covenant values). We use GDP growth, inflation, term spread, T-Bill rate, default spread, VIX, and CDS spread to represent market-specific variables. We use these variables to study market-wide movements of covenant prices. As firm-specific variables, we employ market-to-book, leverage, firm size, and tangibility as motivated by the previous literature. These variables allow us to analyze whether certain firms, e.g., firms with higher growth options, show higher covenant values.

In addition, we apply alternative model specifications as robustness checks. First, we analyze a weekly time horizon within the first difference model. Furthermore, we employ two different regression specifications as an alternative to first differences. In the first specification, we consider differences of all variables with respect to the

[17] We analyze a weekly specification in Internet Appendix V.

bond's issuance. Thus, changes in the covenant prices since issuance are explained by changes of the other variables relative to the same reference point. Thus, this analysis offers a slightly different view on covenant prices. Furthermore, we add a model explaining covenant prices using bond fixed-effects instead of first differences. Overall, we find the same results in all of these three additional models.[18]

6. Results

Our results are structured in the following way. We first present general summary statistics on the covenant prices of the various types and their evolution over time. Next, we analyze various bond-, market-, and firm-specific variables and their effects on covenant prices based on our regression setup. Finally, we investigate whether the covenant price affects subsequent covenant inclusions in newly issued bonds.

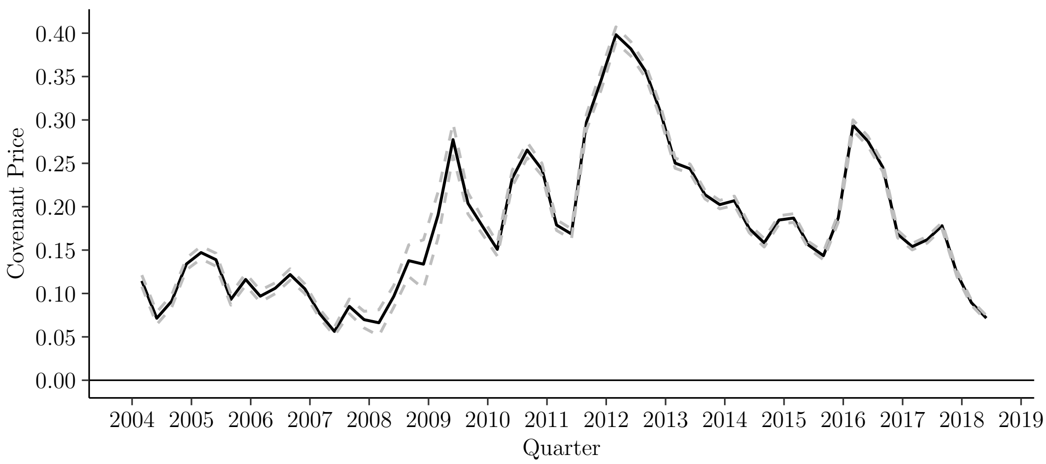
In general, we find that covenants reduce bond yields, consistent with the existing literature. On average, the inclusion of a covenant reduces the yield by 18 bp across all three covenant types, as shown in Table 3. The individual types have average covenant prices that range from 13 bp for financial, 17 bp for investment, to 20 bp for event covenants. All these price effects are highly statistically significant. Moreover, this yield reduction of around 18 bp is also relevant in economic terms, i.e., this translates into a price reduction of more than 1% for a bond with average duration.

[18] Due to space considerations, we show the full regression results in Internet Appendix V.

Table 3: Summary Statistics for Covenant Prices.
This table shows summary statistics for the identified covenant prices, measured as a yield reduction in percent, over the entire sample period from 2004 to 2018 Q2. In the first row, we show how many covenant prices were identified overall, followed by their mean, standard deviation, median, and interquartile range. Afterwards, we present the same information for each covenant type individually.

	Observations	Mean	SD	Median	IQR
Combined	965,651	0.18	0.31	0.16	0.38
Event	448,683	0.20	0.32	0.18	0.38
Financial	77,322	0.13	0.29	0.12	0.37
Investment	439,646	0.17	0.31	0.14	0.38

Figure 1: Covenant Prices over Time.
This graph shows the evolution of the overall covenant prices, measured as a yield reduction in percent, from 2004 until 2018 Q2. We aggregate the weekly observations to quarters. Alongside the mean, we plot the 99% confidence region (dashed lines) based on heteroskedasticity robust standard errors that are clustered at the firm level.

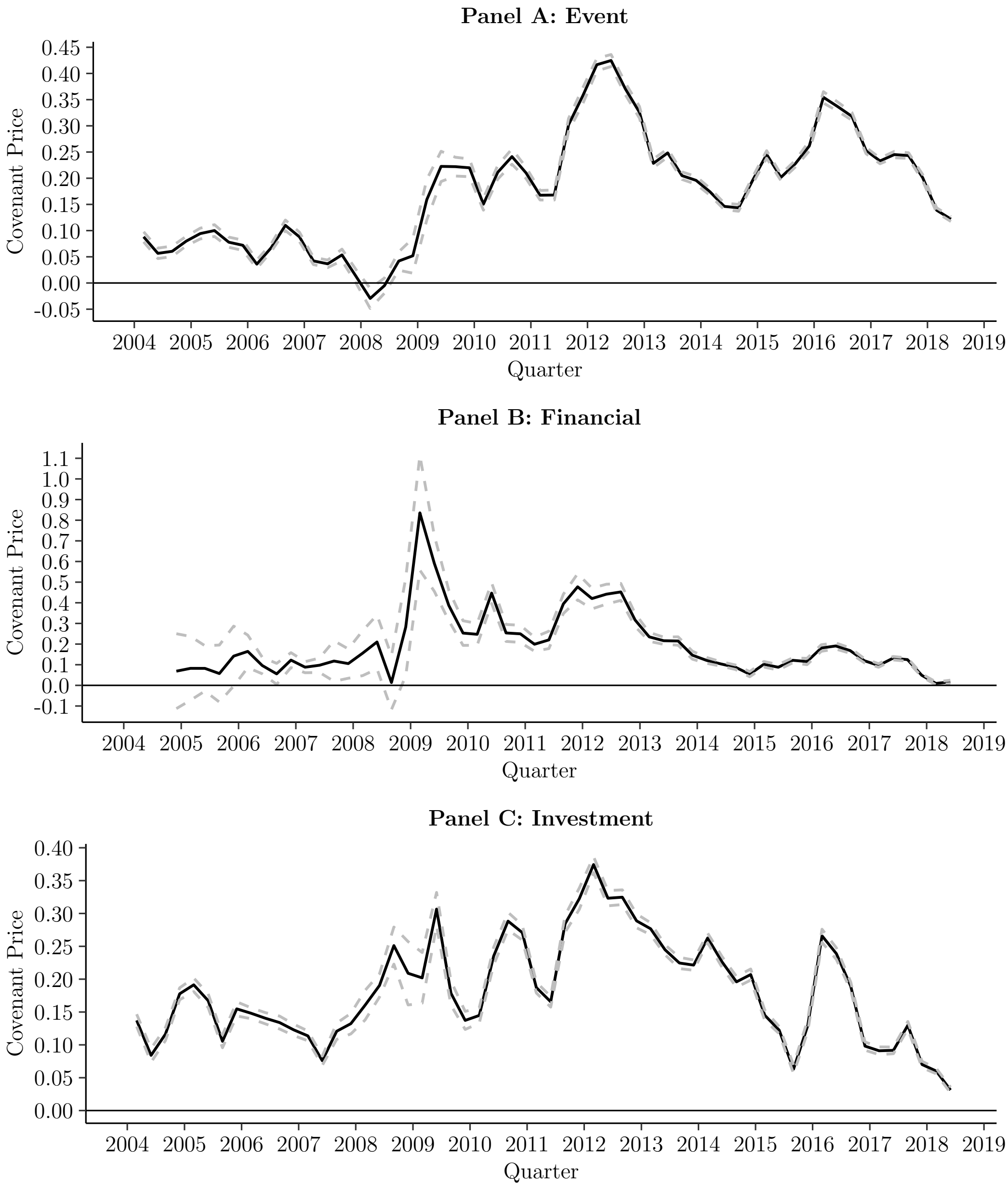


Exploring the covenant price dynamics over time, Figure 1 shows the average covenant prices based on all covenant types. Generally, we find significant variation, especially before and after the crisis. Covenant prices start below average with around 10 bp at the beginning of our sample period in 2004. Prices further decrease and drop to 5 bp just before the onset of the crisis. In the crisis and the subsequent period, covenant prices increase significantly, spiking to around 40 bp. In this period, the covenant prices relative to the prevailing average bond yields are roughly 5%. Thereafter, covenant prices slowly revert to their pre-crisis average. These results indicate a strong dependence on the economic environment.

Next, we analyze the individual covenant types and their price dynamics. Figure 2 shows that, in general, all three types show a similar pattern over time. However, there are differences in the magnitudes. Financial covenants spike to 80 bp, whereas event and investment covenants reach prices of up to 40 bp.[19] After the crisis, covenant prices of all three types remain elevated for several years. Interestingly, Panel A of Figure 2 also reveals that event covenant prices dip into negative territory for a brief period of time at the onset of the crisis. This can be explained by the fact that cross-acceleration and cross-default clauses dominate this covenant type. During financial distress, multiple of these covenants might trigger simultaneously within one firm, allowing multiple lenders to demand early repayment. While this is optimal from the perspective of each lender individually, their joint actions might exhaust the firm's liquidity buffer. This coordination failure among the dispersed bondholders could cause a cascading default (see also Beatty et al., 2012). This risk of coordination failure might result in negative covenant prices during times of heightened default risk and uncertainty.

[19] Note that at the beginning of our sample, virtually all bonds include a financial covenant, and we are unable to identify covenant prices. The high inclusion rate reduces afterwards and makes the price estimation feasible.

Figure 2: Individual Covenant Type Prices over Time.
This graph shows the evolution of the individual covenant prices for event (Panel A), financial (Panel B), and investment covenants (Panel C) from 2004 until 2018 Q2. The covenant price is measured as a yield reduction in percent. We aggregate the weekly observations to quarters. The graph does not show financial covenants from 2004 Q1 until Q3 due to a lack of observations. Alongside the mean, we plot the 99% confidence region (dashed lines) based on heteroskedasticity robust standard errors that are clustered at the firm level.



6.1. Covenant Prices & Bond-Specific Risk Factors

In this section, we investigate whether the covenant prices vary with the three main bond-specific risk factors, i.e., duration, rating and liquidity. Specifically, we are interested if covenants are more beneficial for riskier bonds, which would be reflected in a higher yield reduction. Table 4 shows that covenant prices are increasing in all three bond-risk characteristics for the individual and combined analyses. Recall that these are first difference regressions that remove the impact of unobservable bond- and firm-specific factors.

Next, we turn to the individual characteristics. We find that the yield reduction caused by covenants increases with higher duration. To put the coefficient of the combined sample into context, a reduction in duration of one year implies a drop in the covenant price by 6.0 bp. Economically, this change in covenant prices most likely reflects a reduction of uncertainty with lower bond duration over time.

Table 4: Determinants of Covenant Prices: Bond Risk Variables.
This table shows the results of monthly first difference regressions of covenant prices (in percent) on the bond risk variables duration, rating, and liquidity. First, the results of the individual covenant types are shown, followed by the combined model. The standard errors shown in parenthesis are corrected for heteroscedasticity and clustered at the firm and quarter level. We indicate significance at the 10%, 5%, and 1% level by *, **, and ***, respectively.

	Covenant Type			
	Event	Financial	Investment	Combined
Duration	0.069***	0.050**	0.055***	0.060***
	(0.010)	(0.024)	(0.010)	(0.008)
Rating	0.143***	0.077***	0.142***	0.138***
	(0.008)	(0.012)	(0.007)	(0.006)
Liquidity	0.184***	0.197***	0.303***	0.237***
	(0.018)	(0.044)	(0.020)	(0.014)
Observations	168,355	29,941	169,185	367,481
Adjusted R^2	0.043	0.031	0.053	0.046

The effect itself is of similar magnitude for all covenant types, with event covenants featuring a slightly elevated coefficient and financial covenants showing a marginally lower impact.

A rating change has a significant impact on covenant prices for all three types individually as well as in the combined test. In particular, we find that if rating worsens by one notch, covenant prices increase. While coefficient estimates for event and investment covenants are similar with a magnitude of roughly 14 bp, the covenant price increase due to a rating change for financial covenants is lower at 7.7 bp. Thus, covenants are more important for firms with higher credit risk.

Similar to the other variables, we observe a positive relationship between the covenant price and the liquidity measure. That is, a worsening of a bond's liquidity, i.e., an increase in transaction costs, price impact, or price dispersion, is accompanied by an increase in the covenant price. To give some reference point, the standard deviation of changes in liquidity is equal to 0.14, which results in a covenant price change of around 3.3 bp. This impact is comparable in economic terms to the other two variables, i.e., a one standard deviation move in rating leads to a 3.8 bp move in covenant prices compared to a 1.3 bp move for duration.

Overall, we find that bond-specific risk factors have a significant effect on the covenant price. As theory would suggest, we find that covenants are more valuable for investors when dealing with riskier bonds. When comparing the impact of a one standard deviation change in the bond-specific risk variables, credit risk seems to be the most important driver, followed by liquidity and, then, interest rate risk. However, the economic magnitudes of all three factors are similar.

6.2. Covenant Prices & Market-Wide Risk Factors

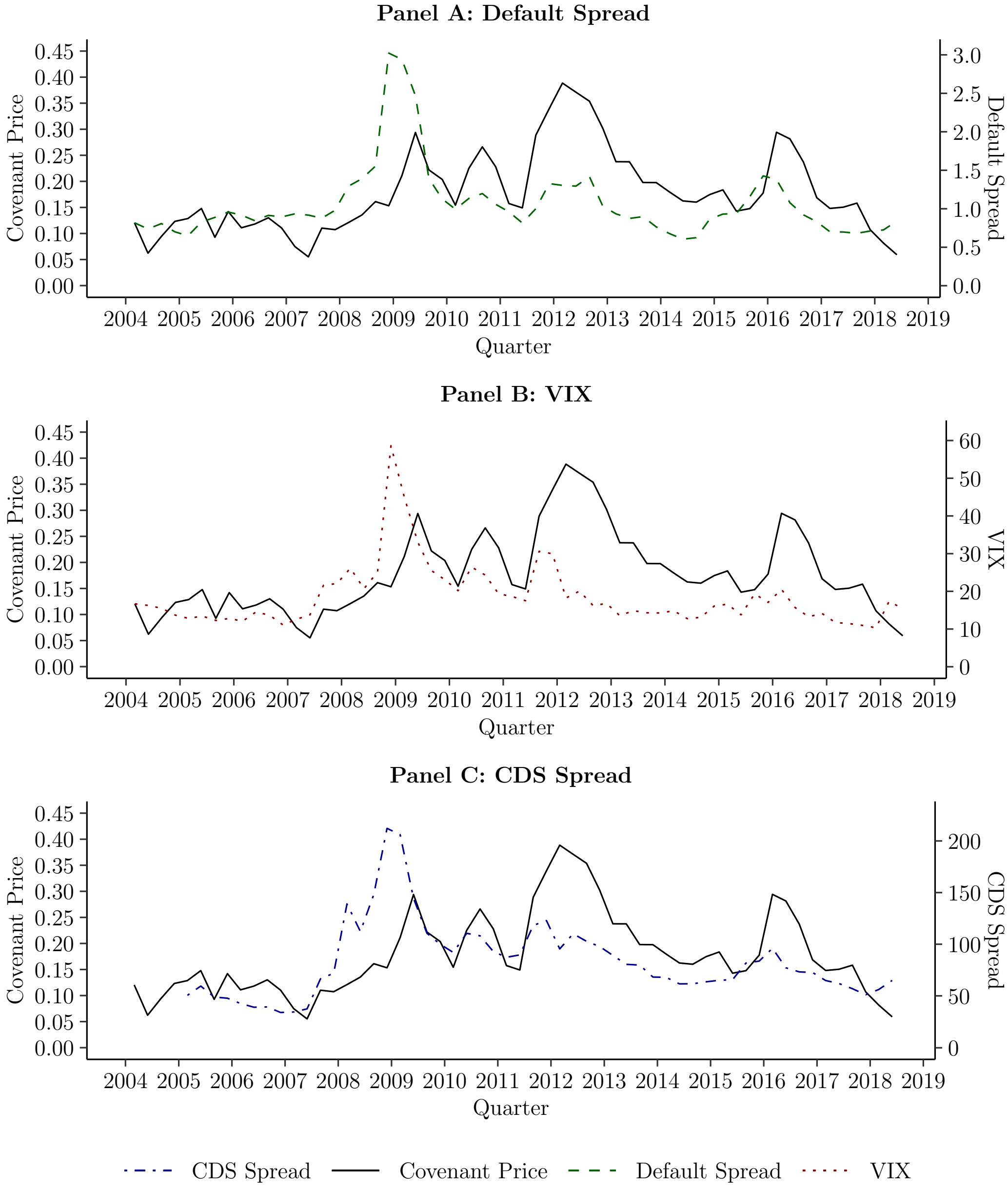
In our next analysis, we add variables measuring market-wide risk to the analysis conducted above and, thus, explore whether changes in covenant price are related to the business cycle. For example, Figure 1 shows that covenant prices experience an upward trend starting with the financial crisis and which might coincide with changes of market-wide risk factors. We focus on the default spread, VIX, and CDS spread as variables that capture market-wide credit risk and uncertainty, see Section 4. However, we also control for other macroeconomic indicators like GDP growth, inflation, term spread, and T-bill rate. We illustrate the relation of these variables in more detail in Figure 3, where we plot the covenant price against the market-related variables, i.e., default spread, VIX, and CDS spread. All three, generally, show similar patterns throughout the entire sample period and, in particular, feature a pronounced spike during the financial crisis. Interestingly, all three market-wide variables spike before the covenant prices. Overall, this comparison suggests a positive correlation between the aforementioned measures and covenant prices.

To formally investigate the potential relationship between market-wide variables and covenant prices, we conduct a series of regression analyses. Specifically, the analyses presented in Table 5 adds the market-wide variables to the previous regression setup. We present four different regressions based on the combined covenant price sample.[20] In the first three specifications, we use the bond-specific and macroeconomic variables and add one of the market-wide credit and uncertainty measures, respectively. In the fourth regression, we add all three variables together.

First, these results confirm the robustness of the statistical analyses concerning the three main bond variables presented in Table 4. Their coefficients are quantitatively similar when adding explanatory variables. Second, regarding the three market-related risk measures, we find that covenant prices are higher in times of increased aggregate risk and volatility. Indeed, we find that all three of these variables have a strong explanatory power individually. A one standard deviation change in the

[20] We show results for individual covenant types in Internet Appendix VI.

Figure 3: Market Risk Measures and Covenant Prices over Time.
This graph shows the evolution of the covenant price (in percent on the left axis) from 2004 until 2018 Q2 plotted alongside different market risk measures (on the right axis). Panel A shows the default spread, Panel B the VIX, and Panel C the CDS spread, respectively. We aggregate the weekly price observations to quarters.



default spread leads to an increase in the covenant price by 2.1 bp, while the effects are 2.8 bp for the VIX and 3.4 bp for the CDS spread, respectively. In the combined model, only one variable (i.e., the VIX) retains its statistical significance, which is unsurprising since Figure 3 suggests that the variables in question seem to capture similar economic forces.

Finally, analyzing the macroeconomic variables, we find that the term spread and inflation show significant parameters. Increases in inflation are accompanied by higher covenant prices for our sample. On the other hand, the coefficient estimated for the term spread indicates a negative relationship. Thus, we find that covenant prices are related to inflation and changes in the interest rate curve. In detail, an increase in inflation by 1% is related to an increase in covenant prices by 1.1 bp and a reduction of the term spread by one standard deviation leads to 6.4 bp higher prices. Neither the GDP growth nor the T-bill rate shows a significant relationship to covenant prices.

Overall, we find novel insights showing that covenant prices change over the business cycle and that the results provide a positive link between adverse economic conditions and covenant prices. That is, covenants appear to be more important in times when the risk of capital outflow, risk-shifting and claim dilution is exceptionally high.

Table 5: Determinants of Covenant Prices: Bond Risk & Market-Wide Variables.
This table shows the results of monthly first difference regressions of combined covenant prices (in percent) on the bond risk variables duration, rating, and liquidity as well as market-wide indicators. Models (1) to (3) add market risk measures, i.e., defaults spread, VIX, and CDS spread individually, followed by a combined model. All specifications include the macroeconomic variables GDP growth, inflation, term spread, and T-Bill rate. The standard errors shown in parenthesis are corrected for heteroscedasticity and clustered at the firm and quarter level. We indicate significance at the 10%, 5%, and 1% level by *, **, and ***, respectively.

	Model Specification			
	(1)	(2)	(3)	(4)
Duration	0.078***	0.078***	0.073***	0.076***
	(0.011)	(0.011)	(0.010)	(0.011)
Rating	0.139***	0.139***	0.142***	0.142***
	(0.006)	(0.006)	(0.006)	(0.006)
Liquidity	0.249***	0.248***	0.249***	0.248***
	(0.014)	(0.014)	(0.015)	(0.015)
GDP Growth	0.001	0.001	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
CPI	0.005***	0.005***	0.004***	0.005***
	(0.002)	(0.002)	(0.002)	(0.002)
Term Spread	−0.077***	−0.079***	−0.079***	−0.076***
	(0.013)	(0.012)	(0.012)	(0.012)
T-Bill Rate	−0.011	−0.009	−0.005	−0.004
	(0.009)	(0.009)	(0.011)	(0.010)
Default Spread	0.043***			0.003
	(0.015)			(0.021)
VIX		0.003***		0.002***
		(0.001)		(0.001)
CDS Spread			0.001***	0.0004
			(0.0003)	(0.0003)
Observations	367,481	367,481	350,487	350,487
Adjusted R^2	0.051	0.053	0.052	0.053

6.3. Covenant Prices & Firm-Specific Factors

In this section, we investigate the relationship between covenant prices and firm characteristics. While the literature shows a connection between firm characteristics and the likelihood that covenants are included, similar evidence for price effects is limited. For example, Nash et al. (2003) and Billet et al. (2007) show higher covenant inclusion rates for firms with more growth opportunities, higher leverage, and smaller size. Additionally, the literature (see, e.g., Simpson and Grossmann, 2017) also discusses that higher tangibility leads firms to include covenant restrictions with an increased likelihood.

We analyze the importance of these firm characteristics in an asset-pricing framework by employing market-to-book as a measure for growth opportunities as well as using leverage, firm size, and tangibility directly. First, we sort our bonds into three equally-sized portfolios (low, medium, and high) based on the respective firm characteristic at each point in time. Then, we plot the time-series of the average covenant price for the high and low portfolio in Figure 4 for each of the four firm variables. In addition, we also provide statistical tests for the significance of the graphically observable differences and present these results in Table 6.

We find that growth firms (i.e., firms with higher market-to-book ratios) have significantly higher covenant prices for all covenant types. The difference in the covenant price between high and low market-to-book firms is 7.3 bp on average. This result is stable over time as Panel A in Figure 4 shows a positive price difference for the whole sample. While the theoretical literature also suggests a positive link between leverage and covenant inclusions, we do not find a similar price relation. This hints at the fact that not all differences in inclusion probabilities are mirrored in price differences in the years after the bond was issued. We find evidence that smaller firms have higher yield discounts for the inclusion of covenants than larger firms. Smaller firms are considered less transparent and riskier than larger firms (consider, e.g., the size premium in equity markets), making state-dependent right transfers included in bond indentures more valuable for investors. However, this result is not necessarily equally important for all covenant types, and the magnitude of the difference is lower than the one observed for growth options. Finally, we observe higher covenant prices for bonds issued by firms with more tangible assets, in line with the literature's predictions for the inclusion frequency. Interestingly, this difference narrowed over the more recent years.

Using this analysis, we find an impact of these firm characteristics on covenant prices in the asset pricing setting we explore here. We also included these firm characteristics in our regression setup based on first difference. However, when including these variables in the analysis, we find no statistically robust results for the firm characteristics. Most likely, the higher frequency of bond-risk and market-wide variables is able to explain the variation of covenant prices better than balance-sheet variables, which can only be measured on low frequencies. In first difference regressions, the vast majority of accounting observations is equal to zero or has to be interpolated, which results in identical changes between two observations. Thus, we find no additional explanatory power based on the firm characteristics in our regression setup.[21]

[21] To save space, we only show the regression results including firm characteristics in Internet Appendix VII.

Figure 4: Covenant Price Differences by Firm Characteristics over Time. This graph shows the evolution of the difference in overall covenant prices (in percent) between bonds belonging to the upper versus the lower third of a firm characteristic's distribution at a given point in time from 2004 to 2018 Q2. The solid (dashed) line represents the average covenant price of the upper (lower) third. Regarding characteristics, Panel A considers market-to-book, Panel B leverage, Panel C firm size, and Panel D tangibility. We aggregate the weekly observations to quarters.

Table 6: Covenant Price Differences by Firm Characteristics.
This table shows the results of monthly regressions testing whether the difference in covenant prices (in percent) between bonds belonging to the upper versus the lower third of a firm characteristic's distribution is different from zero at a given point in time. First, the results of the individual covenant types are shown, followed by the combined model. We present the results for market-to-book in Panel A, leverage in Panel B, firm size in Panel C, and tangibility in Panel D. The model includes quarter fixed effects and standard errors shown in parenthesis are corrected for heteroscedasticity and clustered at the firm level. We indicate significance at the 10%, 5%, and 1% level by *, **, and ***, respectively.

	Covenant Type			
	Event	Financial	Investment	Combined
Panel A: Market-to-Book				
Market-to-Book	0.064***	0.184***	0.069***	0.073***
	(0.015)	(0.024)	(0.015)	(0.014)
Observations	86,625	17,472	88,362	192,459
Panel B: Leverage				
Leverage	0.006	0.016	0.001	0.006
	(0.015)	(0.033)	(0.016)	(0.015)
Observations	87,250	17,655	87,586	192,491
Panel C: Firm Size				
Firm Size	−0.054***	0.044	−0.070***	−0.055***
	(0.017)	(0.035)	(0.018)	(0.017)
Observations	99,956	19,001	102,063	221,020
Panel D: Tangibility				
Tangibility	0.073***	0.068**	0.061***	0.067***
	(0.016)	(0.032)	(0.017)	(0.016)
Observations	93,174	16,185	95,652	205,011

6.4. Covenant Frequency Analysis

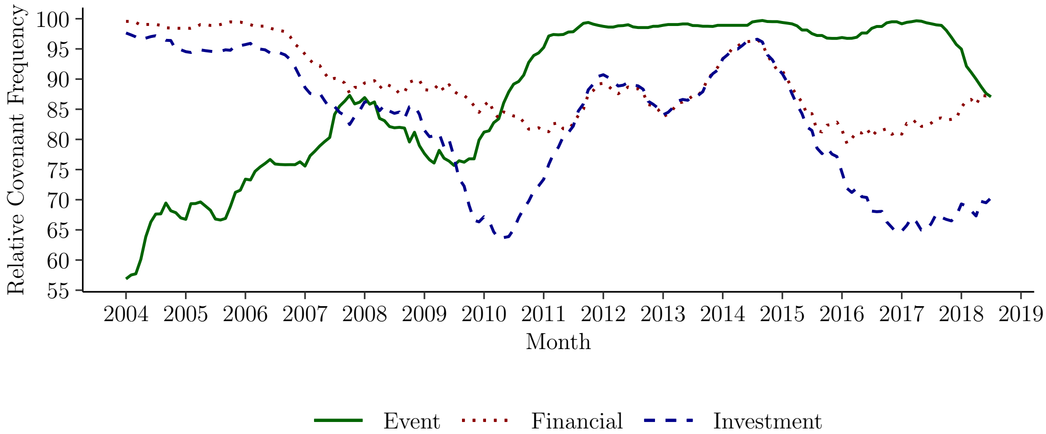
Our final set of results addresses whether covenant prices are related to subsequently issued bonds' covenant structures. Figure 5 shows the relative frequency of the individual covenant types in newly issued bonds. Generally, the use of covenants changes significantly over time and, additionally, there are covenant type-specific developments and common trends across all covenants. We find a reduction in the covenant usage just before and during the onset of the financial crisis. Thereafter, inclusion rates increase significantly with different patterns for the three covenant types. In line with covenant prices, we observe a reduction in the covenant inclusion at the end of our time series. Overall, we find trends related to changes in covenant prices. However, these changes appear rather as long-term trends and not as short-term reactions.

When analyzing the inclusion frequency of individual covenant types, event covenants experience a steady increase from roughly 60% at the beginning of our sample with reduced inclusion during the onset of the crisis and usage in nearly every bond issue from 2011 onward, which drops to 80% at the end of the sample. On the other hand, we see that nearly all bonds include financial and investment covenants initially, but this ratio decreases steadily to 65%. Then, the inclusion rates increase to 95% and fall again from 2015 onward. Overall, these patterns share certain similarities with the covenant price developments depicted in Figure 1.

Nevertheless, it is challenging to find an identification strategy for the inclusion frequencies as bond issuance decisions are not frequent events for the average firm. The typical firm will roll over debt and, thus, will consider the market conditions at that time. In addition, issuing a new bond is a time-consuming process. Thus, managers will not react to short-term covenant price changes but will instead observe the general price levels when deciding on a new bond's covenant structure. Thus, a contemporaneous comparison of covenant prices and inclusion rates will not provide any significant relation.[22]

[22] Indeed, we do not find significant results when regressing covenant prices and inclusion rates.

Figure 5: Covenant Frequencies over Time.
This graph shows the relative inclusion frequency of the different covenant types in newly issued bonds over the last year on a monthly frequency from 2004 until 2018 Q2. The proportion of event covenants in solid green, financial covenants in dotted red, and investment covenants in dashed blue.



To investigate the relationship between the prices of covenants and their relative inclusion frequencies, we compare the prices of a quarter with the inclusion rates within the next year and the next two years. To analyze the observed long-term changes, we split the time series into smaller windows. In Table 7 we show the average covenant price for each covenant type and time period. This numerical exercise reveals a positive correlation between covenant prices and the inclusion of the respective covenant type in newly issued bonds over the following years. Especially, using a two-year period shows the difference before and after the onset of the crisis. For each covenant type, we find an increase in the covenant prices and significantly higher inclusion rates. This is also in line with the results of Bradley and Roberts (2015) who find that loans include covenants more often during recessionary periods. In the following period (2011 to 2014), covenant prices and inclusion rates are both high. For investment and financial covenants, we find a drop in both variables for the last period. Overall, we find a relation between covenant prices and inclusion frequencies for long-term trends. There is no contemporaneous relation between the price effect of covenants and their usage.

Table 7: Relative Covenant Frequencies and Covenant Prices.
This table shows the average covenant price (in percent) and the relative frequency of covenants in new bond issues for different time periods. In each panel, we consider the covenant price in the first row (column names indicate the respective periods) and one- and two-year forward-looking relative covenant frequencies in the subsequent rows. We present averages for event covenants in Panel A, financial covenants in Panel B, and investment covenants in Panel C.

Panel A: Event Covenants

	2006 - 2008	2009 - 2010	2011 - 2014	2015 - 2016
Price	0.042	0.205	0.254	0.275
Frequency +1y	0.81	0.97	0.98	0.98
Frequency +2y	0.84	0.99	0.99	0.92

Panel B: Financial Covenants

	2006 - 2008	2009 - 2010	2011 - 2014	2015 - 2016
Price	0.126	0.408	0.256	0.136
Frequency +1y	0.88	0.85	0.88	0.82
Frequency +2y	0.85	0.87	0.87	0.86

Panel C: Investment Covenants

	2006 - 2008	2009 - 2010	2011 - 2014	2015 - 2016
Price	0.150	0.220	0.258	0.157
Frequency +1y	0.78	0.81	0.87	0.66
Frequency +2y	0.74	0.88	0.82	0.72

7. Conclusion

In this paper, we show that covenant provisions are important contractual features and have significant relevance for the prices of US corporate bonds. We develop and apply a novel empirical methodology to analyze this price impact of covenants and derive a large sample of covenant prices with close to one million observations. Our price estimates cover the entire lifetime of bonds and, when compared to the existing literature, are not restricted to issuance prices.

We find that the inclusion of a particular covenant type reduces bond yields by 18 bp on average. Covenant prices increase significantly in the financial crisis and the subsequent period, spiking to around 40 to 80 bp depending on the covenant type. In this time period, covenant prices amount to roughly 5% when compared to overall average bond yields. Our analysis contributes to the literature by providing new insights into the dynamics of covenant prices and, especially, by analyzing the effects of bond-, market, and firm-specific drivers of covenant prices. We find that covenants are more important for riskier bonds, i.e., covenant prices increase with interest rate, credit, and liquidity risk. Furthermore, we demonstrate that market-wide measures as well as macroeconomic variables indicating economic downturns are linked to increasing covenant prices. Thus, covenants are more important in times where the risk of capital outflow, risk-shifting, and claim dilution is exceptionally high.

Considering firm-specific variables, we find that investors pay higher prices for covenants included in bonds issued by growth firms, smaller firms, and firms with more tangible assets. Finally, we find supportive evidence for a link between long-term changes in covenant prices and subsequent covenant inclusion frequencies in newly issued bonds.

Overall, we present a new methodology for analyzing price effects in corporate bonds based on secondary market data and offer important new insights into the prices of covenants, which are important for bond investors as well as firms that issue such securities. These new aspects are relevant for future research on capital structure choices as well as fixed-income asset pricing.

Appendix

In this part we define the main variables used in this paper. We first specify the price and liquidity variables before we move to the equity and accounting metrics. Finally, we discuss the constituents of the four covenant types.

Price and Liquidity Variables

The weekly *volume-weighted price* $\bar{p}$ for bond i in week t is given by:

$$\bar{p}_{i,t} = \frac{\sum_{k=1}^{K_{i,t}} p_{i,t,k} v_{i,t,k}}{\sum_{k=1}^{K_{i,t}} v_{i,t,k}}, \tag{A-1}$$

where $K_{i,t}$ denotes the number of trades for bond i in the given week, $p_{i,t,k}$ the prices of these trades and $v_{i,t,k}$ the respective volumes.

The *Roll measure* for bond i in week t is defined as:

$$\text{Roll}_{i,t} = 2 \cdot \sqrt{-Cov(\Delta p_{i,t,k}; \Delta p_{i,t,k-1})}, \tag{A-2}$$

where $\Delta p_{i,t,k}$ denotes the price change between the consecutive observations k and $k-1$. Note that the measure is only defined if the auto correlation is negative.

The *Amihud measure* for bond i in week t is defined as:

$$\text{Amihud}_{i,t} = \frac{1}{K_{i,t}} \cdot \sum_{k=1}^{K_{i,t}} \frac{|r_{i,t,k}|}{v_{i,t,k}}, \tag{A-3}$$

where $r_{i,t,k}$ is the return w.r.t. to the last price implied by trade k.

The *price dispersion measure* for bond i in week t is defined as:

$$\text{Price Dispersion}_{i,t} = \sqrt{\frac{1}{\sum_{k=1}^{K_{i,t}} v_{i,t,k}} \sum_{k=1}^{K_{i,t}} (p_{i,t,k} - m_{i,t})^2 \cdot v_{i,t,k}}, \tag{A-4}$$

where the fundamental price $m_{i,t}$ is approximated by the volume weighted price $\bar{p}_{i,t}$.

Equity and Accounting Variables

A set of accounting and equity market variables are used in our analysis. We define them in this section by showing their formulas in terms of CRSP and Compustat variables, which we detail in Table A-1. Due to space considerations, we show all of the aforementioned variables in the following list:

- Market-to-book (=(at-be+me)/at),
- Firm size (=log(at)),
- Leverage (= (dltt + dlc)/(be)),
- Tangibility (=ppent/at),
- Beta from rolling CAPM regressions using a sample of daily returns over one year,
- Abnormal earnings (=(epspx$_{t+1}$-epspx$_t$)/prcc_f),
- Asset maturity (=(1-act/at)*(ppegt/dp) + (act/at)*(act/cogs)),
- Altman Z as an indicator equal to one if the Z score is below 1.81 (Z score = 3.3*(ebit/at) + 1.0*(sale/at) + 1.4*(re/at) + 1.2*(wcap/at) + 0.6*(me/(dlc+dltt))),
- Interest coverage (=(oiadp+xint)/xint),
- Retained earnings (=re/at)), and
- Cash balance (=che/at).

Table A-1: CRSP and Compustat Variables.
The abbreviation from CRSP and Compustat are matched with the description of the respective item. Variables from CRSP are written in capital letters. At the bottom we list two variables, that are computed from Compustat variables, but not used directly in any regression.

Abbreviation	Description
act	Current Assets - Total
at	Assets - Total
che	Cash and Short-Term Investments
cogs	Cost of Goods Sold
csho	Common Shares Outstanding
dlc	Debt in Current Liabilities
dltt	Long-Term Debt
dp	Depreciation and Amortization
ebit	Earnings Before Interest and Tax
epspx	Earnings Per Share (Basic) Excluding Extraordinary Items
oiadp	Operating Income After Depreciation
ppegt	Property, Plant and Equipment - Total (Gross)
ppent	Property Plant and Equipment - Total (Net)
prcc_f	Price Close
pstk	Preferred/Preference Stock (Capital)
pstkl	Preferred Stock Liquidating Value (only annual)
pstkrv	Preferred Stock Redemption Value (only annual)
re	Retained Earnings
sale	Sales/Turnover (Net)
seq	Stockholders' Equity
wcap	Working Capital (Balance Sheet)
xint	Interest and Related Expense
RET	Holding Period Return
be	= seq - pstkl (Use pstkrv or pstk alternatively.) + txditc
me	= prcc_f * csho

Covenant Type Definitions

Table A-2: Covenant Type Constituents.
This table shows which covenants are included in the four covenant types; dividend, event, financial, and investment.

Type	Covenant	Type	Covenant
Dividend		**Investment**	
	dividends_related_payments_is		after_acquired_property_clause
	dividends_related_payments_sub		asset_sale_clause
	restricted_payments		consolidation_merger
Event			fixed_charge_coverage_is
	change_control_put_provisions		fixed_charge_coverage_sub
	cross_default		investments
	cross_acceleration		investments_unrestricted_subs
	declining_net_worth		maintenance_net_worth
	rating_decline_trigger_put		sale_xfer_assets_unrestricted
Financial			security_pledge
	borrowing_restricted		stock_transfer_sale_disp
	funded_debt_is		subsidiary_redesignation
	funded_debt_sub		transaction_affiliates
	indebtedness_is		
	indebtedness_sub		
	leverage_test_is		
	leverage_test_sub		
	liens_is		
	liens_sub		
	negative_pledge_covenant		
	net_earnings_test_issuance		
	preferred_stock_issuance		
	refund_protection		
	sale_assets		
	sales_leaseback_is		
	sales_leaseback_sub		
	senior_debt_issuance		
	stock_issuance		
	stock_issuance_issuer		
	subordinated_debt_issuance		
	subsidiary_guarantee		

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Internet Appendix to Covenant Prices of US Corporate Bonds

The Internet Appendix augments the main paper by providing additional insights and robustness tests not included in the paper due to space considerations. In Section I we show additional summary statistics for covenant inclusion frequencies. Section II shows that the three main bond risk variables are not affected by covenant inclusions. Section III analyzes the resulting pricing errors and provides additional results for covenant prices without applying the pricing error restrictions. Sections IV show the main results with speculative-grade bonds included. Section V provides alternative regression specifications. Section VI discusses the regression results with market-wide factors for the individual covenant types. Section VII provides additional results on firm characteristics.

I. Conditional Bond Summary Statistics

This section extends Table 1 and provides additional summary statistics on the inclusion of covenants in bond indentures. Specifically, Table IA-1 shows the same results as in the main table but on a bond-week level. In addition, Table IA-2 shows the total number of covenants types included overall and conditional on a specific covenant type being present. We see that the vast majority includes more than one covenant type and, in particular, basically all bonds that include a dividend covenant also include all other covenants.

Table IA-1: Covenant Frequencies (Bond Weeks)
This table shows, for the 1,498,420 bond weeks included in our sample, how often a covenant of a certain type (dividend, event, financial, and investment) is included in bond indentures. First, the overall number is shown, followed by how often a given covenant is included conditional on the presence of another covenant.

		Conditional %			
	%	$\|D$	$\|E$	$\|F$	$\|I$
Dividend	16.95	-	21.43	17.53	18.39
Event	78.55	99.29	-	78.44	79.22
Financial	96.67	99.93	96.54	-	99.38
Investment	91.79	99.59	92.57	94.36	-

Table IA-2: Number of Covenants.
This table shows, for the 12,904 traded bonds included in our sample, how many covenant types are included in a certain bond. First, the unconditional number is shown and afterwards the number conditional on a certain covenant being present is shown.

		Conditional Number			
	N	$\|D$	$\|E$	$\|F$	$\|I$
1	695	0	454	230	11
2	2,942	3	668	2,900	2,313
3	6,904	39	6,876	6,904	6,893
4	2,311	2,311	2,311	2,311	2,311

II. Covenant Effects on Bond Risk Variables

As discussed in Section 5, we provide a robustness test analyzing whether the three bond-risk variables used in the matching of bonds are affected by the covenant choice. Thus, we use a regression setup explaining our bond-risk variables with dummy variables indicating the presence of covenant types, while controlling for other bond- and firm-specific variables. We conduct this analysis across bonds for the time of issuance. Our dependent variables are the bond rating and maturity at issuance and the liquidity of the bond in its first year of trading. The additional controls include firm characteristics motivated by the previous literature explaining similar bond-specific risk variables (i.e., market-to-book, firm size, leverage, tangibility, equity beta, abnormal earnings, asset maturity, Altman Z scores, interest coverage ratio, retained earnings, and cash balance) as well as bond-specific variables (coupon and amount issued). Table IA-3 shows that the covenants have no power in explaining the three bond-risk characteristics, and we find insignificant coefficients in all models.[1]

[1] We also run these regressions for the covenants individually and find qualitatively similar results.

Table IA-3: Bond Risk Variables and Covenants.
This table shows the results of regressions of bond-risk variables on dummy variables marking the presence of the four covenant types across bonds for the time of issuance. The dependent variables are maturity and rating at issuance and the liquidity within the first year of trading. Additional controls include firm characteristics (i.e., market-to-book, firm size, leverage, tangibility, equity beta, abnormal earnings, asset maturity, Altman Z scores, interest coverage ratio, retained earnings, and cash balance) and bond-specific variables (coupon and amount issued). The regressions include issuance year fixed effects and the standard errors shown in parenthesis are corrected for heteroscedasticity and clustered at the firm level. We indicate significance at the 10%, 5%, and 1% level by *, **, and ***, respectively.

	Dependent Variable		
	Maturity	Rating	Liquidity
Dividend	−0.45	−0.28	−0.08
	(0.42)	(0.29)	(0.05)
Event	0.08	0.25	−0.02
	(0.20)	(0.16)	(0.02)
Financial	0.31	0.66	0.02
	(0.24)	(0.43)	(0.02)
Investment	−0.24	0.23	0.00
	(0.16)	(0.16)	(0.01)
Controls:			
Firm Characteristics	Yes	Yes	Yes
Bond Characteristics	Yes	Yes	Yes
Observations	2,302	2,302	2,302
Adjusted R^2	0.58	0.59	0.72

III. Pricing Errors And Results Without the Pricing Error Restrictions

Table IA-4 and Figure IA-1 show the pricing errors estimated based on our methodology with matched covenant structures, i.e., the control set $J_{i,t}$ consists of bonds that have exactly the same covenant structure as the replicated bond. The results show that our methodology provides unbiased price estimates. In fact, the overall and quarterly pricing errors are basically always close to zero and statistically insignificant. Nevertheless, there is a spike in the volatility of the errors during the financial crisis, which is a phenomenon already observed in the main covenant price analysis. Overall, this robustness analysis shows that our methodology is a suitable extension to previous methods for analysing yield differentials.

Table IA-4: Summary Statistics for Pricing Errors.
This table shows summary statistics for the pricing error (in percent), measured as yield difference in percent, over the entire sample from 2004 to 2018 Q2. First, the table shows how many pricing errors were identified, followed by the 10% quantile, mean, 90% quantile, and standard deviation.

	Observations	Q_{10}	Mean	Q_{90}	SD
Pricing Error	1,424,416	−0.84	0.001	0.84	1.98

Additionally, we show that, in general, our main results are similar when we do not include restrictions on the pricing error. In Table IA-5 we show the summary statistics for these alternative covenant prices. We find an increased number of observations as we drop fewer cases and find similar results, which is also evident from the time series of covenant prices from the combined sample shown in Figure IA-2. Then, we also provide the regression analyses of bond-specific risk factors (see Table IA-6) and market-wide indicators (see Table IA-7). The firm characteristics are shown in Table IA-8. All these results show that the pricing error restrictions are not affecting our results.

Figure IA-1: Pricing Errors over Time.
This graph shows the evolution of the pricing errors, measured as a yield difference in percent, from 2004 until 2018 Q2. We aggregate the weekly observations to quarters. Alongside the mean, we plot the 99% confidence region (dashed lines) based on heteroskedasticity robust standard errors that are clustered at the firm level.

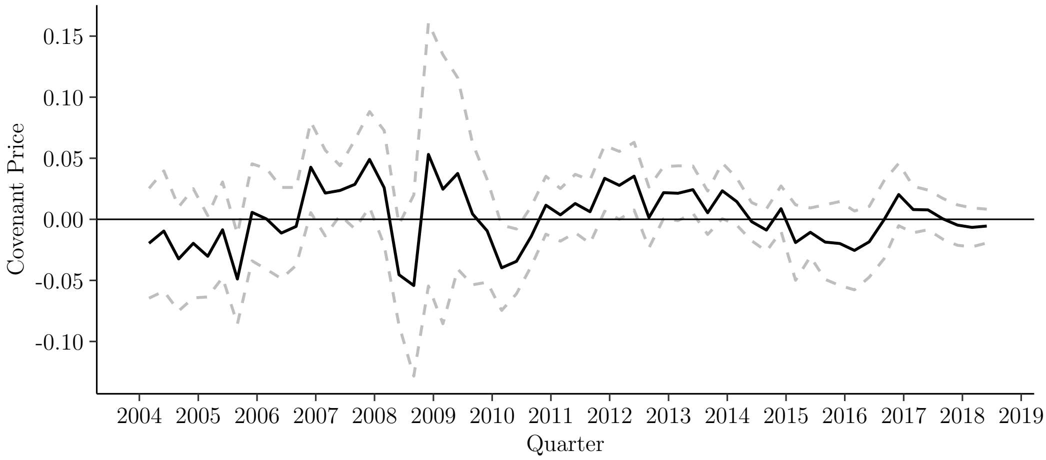

Figure IA-2: Covenant Prices over Time (Without Pricing Error Restrictions).
This graph shows the evolution of the overall covenant prices, measured as a yield reduction in percent, from 2004 until 2018 Q2. We aggregate the weekly observations to quarters. Alongside the mean, we plot the 99% confidence region (dashed lines) based on heteroskedasticity robust standard errors that are clustered at the firm level.

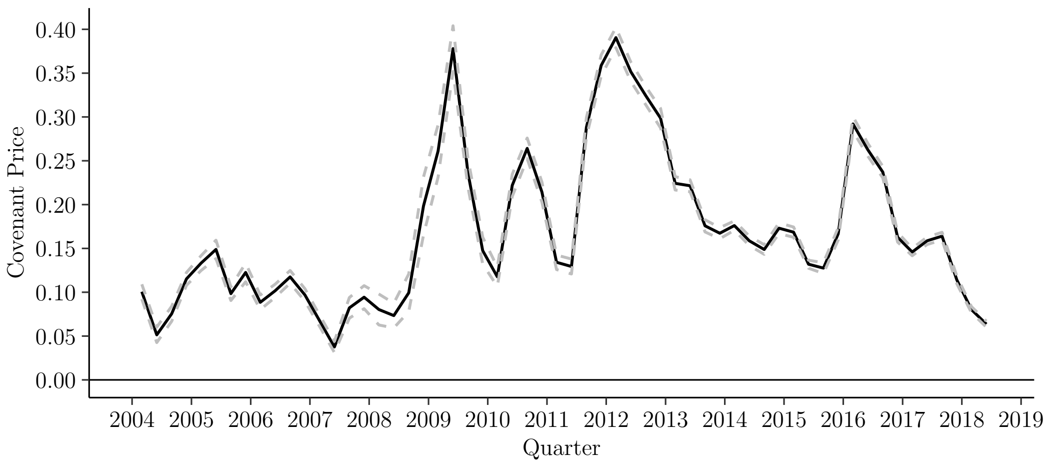

Table IA-5: Summary Statistics for Covenant Prices (without Pricing Error Restrictions).
This table shows summary statistics for the identified covenant prices, measured as a yield reduction in percent, over the entire sample period from 2004 to 2018 Q2. In the first row we shows how many covenant prices were identified overall, followed by their mean, standard deviation, median, and interquartile range. Afterwards, we present the same information for each covenant type individually.

	Observations	Mean	SD	Median	IQR
Combined	1,169,520	0.17	0.47	0.16	0.46
Event	548,086	0.20	0.47	0.19	0.47
Financial	85,859	0.11	0.37	0.11	0.40
Investment	535,575	0.16	0.47	0.14	0.46

Table IA-6: Determinants of Covenant Prices: Bond Risk Variables (Without Pricing Error Restrictions).
This table shows the results of monthly first difference regressions of covenant prices (in percent) identified without the pricing error restriction on the bond risk variables duration, rating, and liquidity. First the results of the individual covenant types are shown, followed by the combined model. The standard errors shown in parenthesis are corrected for heteroscedasticity and clustered at the firm and quarter level. We indicate significance at the 10%, 5%, and 1% level by *, **, and ***, respectively.

	Covenant Type			
	Event	Financial	Investment	Combined
Duration	0.187***	0.050*	0.150***	0.153***
	(0.019)	(0.028)	(0.019)	(0.017)
Rating	0.195***	0.081***	0.192***	0.185***
	(0.012)	(0.015)	(0.009)	(0.008)
Liquidity	0.280***	0.263***	0.416***	0.339***
	(0.021)	(0.063)	(0.027)	(0.021)
Observations	197,660	32,755	199,538	429,953
Adjusted R^2	0.065	0.030	0.069	0.064

Table IA-7: Determinants of Covenant Prices: Bond Risk & Market-Wide Variables (Without Pricing Error Restrictions).
This table shows the results of monthly first difference regressions of combined covenant prices (in percent) identified without pricing error restrictions on the bond risk variables duration, rating, and liquidity as well as market-wide indicators. Models (1) to (3) add market risk measures, i.e., defaults spread, VIX, and CDS spread individually, followed by a combined model. All specifications include the macroeconomic variables GDP growth, inflation, term spread, and T-Bill rate. The standard errors shown in parenthesis are corrected for heteroscedasticity and clustered at the firm and quarter level. We indicate significance at the 10%, 5%, and 1% level by *, **, and ***, respectively.

	Model Specification			
	Event	Financial	Investment	Combined
Duration	0.185***	0.193***	0.183***	0.189***
	(0.015)	(0.016)	(0.014)	(0.016)
Rating	0.187***	0.188***	0.194***	0.194***
	(0.008)	(0.008)	(0.008)	(0.008)
Liquidity	0.370***	0.367***	0.375***	0.374***
	(0.019)	(0.019)	(0.020)	(0.020)
GDP	0.001	0.003	0.003	0.003
	(0.002)	(0.002)	(0.003)	(0.003)
CPI	0.013***	0.014***	0.014***	0.015***
	(0.002)	(0.002)	(0.002)	(0.002)
Term Spread	−0.081***	−0.077***	−0.083***	−0.084***
	(0.019)	(0.015)	(0.017)	(0.016)
T-Bill Rate	0.038***	0.048***	0.048***	0.047***
	(0.014)	(0.014)	(0.016)	(0.016)
Default Spread	0.026			−0.018
	(0.022)			(0.023)
VIX		0.004***		0.004***
		(0.001)		(0.001)
CDS Spread			0.001*	0.0001
			(0.0004)	(0.0004)
Observations	429,953	429,953	411,743	411,743
Adjusted R^2	0.071	0.074	0.073	0.075

Table IA-8: Covenant Price Differences by Firm Characteristics (Without Pricing Error Restrictions).
This table shows the results of monthly regressions testing the difference in covenant prices (in percent) between bonds belonging to the upper versus the lower third of a firm characteristic's distribution at a given point in time. First the results of the individual covenant types are shown, followed by the combined model. We present the results for market-to-book in Panel A, leverage in Panel B, firm size in Panel C, and tangibility in Panel D. The model includes quarter fixed effects and standard errors shown in parenthesis are corrected for heteroscedasticity and clustered at the firm level. We indicate significance at the 10%, 5%, and 1% level by *, **, and ***, respectively.

	Covenant Type			
	Event	Financial	Investment	Combined
Panel A: Market-to-Book				
Market-to-Book	0.155***	0.267***	0.172***	0.167***
	(0.027)	(0.030)	(0.029)	(0.026)
Observations	101,895	19,296	104,165	225,356
Panel B: Leverage				
Leverage	−0.010	0.013	−0.025	−0.013
	(0.026)	(0.038)	(0.031)	(0.026)
Observations	102,341	19,301	103,305	224,947
Panel C: Firm Size				
Firm Size	−0.045	0.061	−0.070**	−0.049*
	(0.029)	(0.044)	(0.032)	(0.029)
Observations	116,607	20,907	119,663	257,177
Panel D: Tangibility				
Tangibility	0.127***	0.111***	0.112***	0.119***
	(0.027)	(0.038)	(0.027)	(0.025)
Observations	109,253	17,779	111,694	238,726

IV. Results with Speculative-Grade Bonds

This section shows that, in general, our main results are basically identical when speculative-grade bonds are included in the sample. We show the main summary statistics of covenant prices in Table IA-9 and their evolution over time in Figure IA-3. Thereafter, we present the the regression results of bond-specific risk factors (see Table IA-10) and market-wide indicators (see Table IA-11), before we show our evidence on firm characteristics in Table IA-12.

Table IA-9: Summary Statistics for Covenant Prices (with Speculative-Grade Bonds).
This table shows summary statistics for the identified covenant prices, measured as a yield reduction in percent, over the entire sample period from 2004 to 2018 Q2. In the first row we shows how many covenant prices were identified overall, followed by their mean, standard deviation, median, and interquartile range. Afterwards, we present the same information for each covenant type individually.

	Observations	Mean	SD	Median	IQR
Combined	1,022,914	0.18	0.33	0.15	0.39
Event	481,090	0.20	0.34	0.18	0.40
Financial	78,362	0.13	0.30	0.12	0.37
Investment	463,462	0.16	0.33	0.14	0.39

Figure IA-3: Covenant Prices over Time (with Speculative-Grade Bonds). This graph shows the evolution of the overall covenant prices, measured as a yield reduction in percent, from 2004 until 2018 Q2. We aggregate the weekly observations to quarters. Alongside the mean, we plot the 99% confidence region (dashed lines) based on heteroskedasticity robust standard errors that are clustered at the firm level.

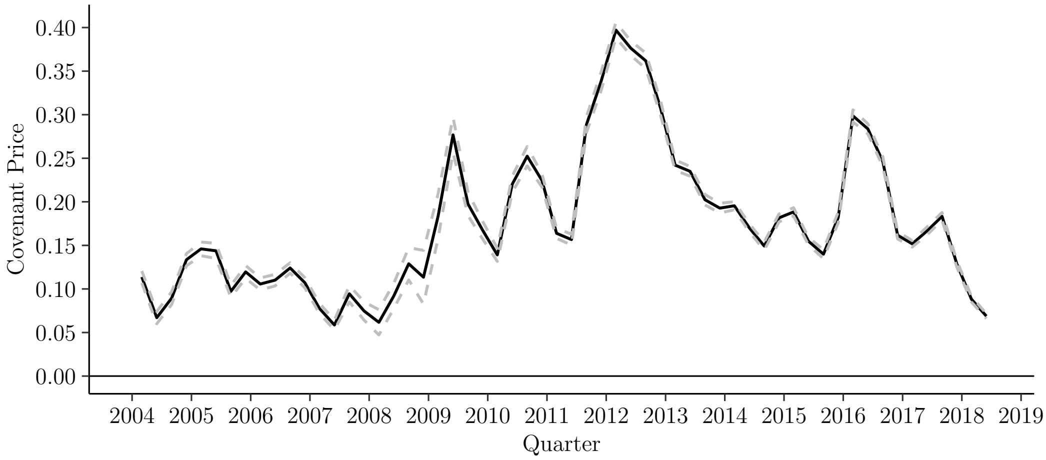

Table IA-10: Determinants of Covenant Prices: Bond Risk Variables (with Speculative-Grade Bonds).

This table shows the results of monthly first difference regressions of covenant prices (in percent) identified with speculative-grade bonds on the bond risk variables duration, rating, and liquidity. First the results of the individual covenant types are shown, followed by the combined model. The standard errors shown in parenthesis are corrected for heteroscedasticity and clustered at the firm and quarter level. We indicate significance at the 10%, 5%, and 1% level by *, **, and ***, respectively.

	Covenant Type			
	Event	Financial	Investment	Combined
Duration	0.088***	0.051**	0.058***	0.071***
	(0.009)	(0.025)	(0.011)	(0.008)
Rating	0.128***	0.086***	0.136***	0.129***
	(0.007)	(0.012)	(0.007)	(0.006)
Liquidity	0.182***	0.206***	0.305***	0.236***
	(0.018)	(0.045)	(0.021)	(0.014)
Observations	182,560	30,469	178,810	391,839
Adjusted R^2	0.038	0.032	0.047	0.041

Table IA-11: Determinants of Covenant Prices: Bond Risk & Market-Wide Variables (with Speculative-Grade Bonds).
This table shows the results of monthly first difference regressions of combined covenant prices (in percent) identified with speculative-grade bonds on the bond risk variables duration, rating, and liquidity as well as market-wide indicators. Models (1) to (3) add market risk measures, i.e., defaults spread, VIX, and CDS spread individually, followed by a combined model. All specifications include the macroeconomic variables GDP growth, inflation, term spread, and T-Bill rate. The standard errors shown in parenthesis are corrected for heteroscedasticity and clustered at the firm and quarter level. We indicate significance at the 10%, 5%, and 1% level by *, **, and ***, respectively.

	Model Specification			
	Event	Financial	Investment	Combined
Duration	0.095***	0.095***	0.090***	0.093***
	(0.012)	(0.012)	(0.011)	(0.012)
Rating	0.130***	0.130***	0.134***	0.134***
	(0.005)	(0.005)	(0.005)	(0.005)
Liquidity	0.250***	0.249***	0.250***	0.249***
	(0.014)	(0.014)	(0.015)	(0.015)
GDP	0.002	0.002	0.003	0.003
	(0.002)	(0.002)	(0.002)	(0.002)
CPI	0.006***	0.006***	0.005***	0.006***
	(0.002)	(0.002)	(0.002)	(0.002)
Term Spread	−0.095***	−0.098***	−0.096***	−0.094***
	(0.012)	(0.013)	(0.011)	(0.012)
T-Bill Rate	−0.017*	−0.017*	−0.010	−0.009
	(0.009)	(0.010)	(0.011)	(0.010)
Default Spread	0.042***			0.005
	(0.015)			(0.021)
VIX		0.003***		0.002**
		(0.001)		(0.001)
CDS Spread			0.001***	0.001
			(0.0003)	(0.0003)
Observations	391,839	391,839	373,979	373,979
Adjusted R^2	0.047	0.048	0.048	0.049

Table IA-12: Covenant Price Differences by Firm Characteristics (with Speculative-Grade Bonds).

This table shows the results of monthly regressions testing the difference in covenant prices (in percent) between bonds belonging to the upper versus the lower third of a firm characteristic's distribution at a given point in time. First the results of the individual covenant types are shown, followed by the combined model. We present the results for market-to-book in Panel A, leverage in Panel B, firm size in Panel C, and tangibility in Panel D. The model includes quarter fixed effects and standard errors shown in parenthesis are corrected for heteroscedasticity and clustered at the firm level. We indicate significance at the 10%, 5%, and 1% level by *, **, and ***, respectively.

	Covenant Type			
	Event	Financial	Investment	Combined
Panel A: Market-to-Book				
Market-to-Book	0.075***	0.191***	0.071***	0.078***
	(0.015)	(0.024)	(0.015)	(0.014)
Observations	93,648	17,867	93,145	204,660
Panel B: Leverage				
Leverage	0.0004	0.015	0.002	0.004
	(0.015)	(0.033)	(0.016)	(0.014)
Observations	94,233	17,974	92,481	204,688
Panel C: Firm Size				
Firm Size	−0.041**	0.049	−0.066***	−0.046***
	(0.017)	(0.036)	(0.018)	(0.017)
Observations	107,536	19,305	107,794	234,635
Panel D: Tangibility				
Tangibility	0.071***	0.065**	0.059***	0.066***
	(0.016)	(0.033)	(0.017)	(0.015)
Observations	100,853	16,587	101,307	218,747

V. Bond-Specific Factors - Alternative Specifications

This section shows the alternative regression specifications discussed in Section 5. First, we show the results of our main specification on a weekly basis in Table IA-13. We find that our results align with the insights we gained from aggregating the weekly observations to months.

Table IA-13: Determinants of Covenant Prices: Bond Risk Variables (Weekly).
This table shows the results of weekly first difference regressions of covenant prices (in percent) on the bond risk variables duration, rating, and liquidity. First the results of the individual covenant types are shown, followed by the combined model. The standard errors shown in parenthesis are corrected for heteroscedasticity and clustered at the firm and quarter level. We indicate significance at the 10%, 5%, and 1% level by *, **, and ***, respectively.

	Covenant Type			
	Event	Financial	Investment	Combined
Duration	0.091***	0.058**	0.067***	0.076***
	(0.010)	(0.024)	(0.010)	(0.008)
Rating	0.152***	0.078***	0.144***	0.144***
	(0.008)	(0.012)	(0.007)	(0.006)
Liquidity	0.243***	0.189***	0.374***	0.297***
	(0.020)	(0.037)	(0.021)	(0.015)
Observations	442,813	75,615	433,077	951,505
Adjusted R^2	0.026	0.020	0.037	0.030

Additionally, we consider the results of two different regression specifications. Specifically, instead of first differences, we consider a bond fixed-effects model as well as differences with respect to bond characteristics at issuance. For the latter model, we compute the initial covenant price and the initial bond risk variables as the average over the first 90 days after issuance. The results for the bond-risk variables in Tables IA-14 (bond fixed effects) and IA-16 (bond-level changes) are basically identical as our main results. Moreover, the results for the market-wide variables in Tables IA-15 (bond fixed effects) and IA-17 (bond-level changes) show again that market-wide variables that indicate heightened financial turmoil are associated with significantly higher covenant prices.

Table IA-14: Determinants of Covenant Prices: Bond Risk Variables (Bond Fixed Effects).
This table shows the results of monthly bond fixed effects regressions of covenant prices (in percent) on the bond risk variables duration, rating, and liquidity. First the results of the individual covenant types are shown, followed by the combined model. The standard errors shown in parenthesis are corrected for heteroscedasticity and clustered at the firm and quarter level. We indicate significance at the 10%, 5%, and 1% level by *, **, and ***, respectively.

	Covenant Type			
	Event	Financial	Investment	Combined
Duration	0.014**	0.038***	0.004	0.012**
	(0.007)	(0.008)	(0.005)	(0.006)
Rating	0.098***	0.037***	0.101***	0.099***
	(0.007)	(0.014)	(0.008)	(0.007)
Liquidity	0.069***	0.074**	0.181***	0.127***
	(0.018)	(0.036)	(0.023)	(0.017)
Observations	174,225	31,648	175,754	381,627
Adjusted R^2	0.386	0.563	0.389	0.342

Table IA-15: Determinants of Covenant Prices: Bond Risk & Market-Wide Variables (Bond Fixed Effects).

This table shows the results of monthly bond fixed effects regressions of combined covenant prices (in percent) on the bond risk variables duration, rating, and liquidity as well as market-wide indicators. Models (1) to (3) add market risk measures, i.e., defaults spread, VIX, and CDS spread individually, followed by a combined model. All specifications include the macroeconomic variables GDP growth, inflation, term spread, and T-Bill rate. The standard errors shown in parenthesis are corrected for heteroscedasticity and clustered at the firm and quarter level. We indicate significance at the 10%, 5%, and 1% level by *, **, and ***, respectively.

	Model Specification			
	(1)	(2)	(3)	(4)
Duration	−0.008***	−0.009***	−0.007***	−0.007***
	(0.002)	(0.002)	(0.002)	(0.002)
Rating	0.028***	0.028***	0.029***	0.029***
	(0.004)	(0.004)	(0.004)	(0.004)
Liquidity	0.002	0.005	−0.018	−0.018
	(0.021)	(0.020)	(0.020)	(0.020)
GDP	0.001	−0.005	0.004	0.004
	(0.004)	(0.005)	(0.004)	(0.004)
CPI	−0.002**	−0.003***	−0.004***	−0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
Term Spread	−0.035**	−0.059***	−0.065***	−0.062***
	(0.016)	(0.017)	(0.018)	(0.019)
T-Bill Rate	−0.054***	−0.069***	−0.071***	−0.067***
	(0.014)	(0.015)	(0.014)	(0.015)
Default Spread	0.097***			−0.001
	(0.034)			(0.040)
VIX		0.003**		−0.002
		(0.002)		(0.002)
CDS Spread			0.001***	0.002**
			(0.0004)	(0.001)
Observations	381,627	381,627	364,322	364,322
Adjusted R^2	0.062	0.060	0.070	0.070

Table IA-16: Determinants of Covenant Prices: Bond Risk Variables (Changes Relative to Issuance).
This table shows the results of monthly regressions of covenant prices (in percent) on the bond risk variables duration, rating, and liquidity. We compute differences to the average characteristics observed within the first three months after issuance on both sides of the equation. First the results of the individual covenant types are shown, followed by the combined model. The standard errors shown in parenthesis are corrected for heteroscedasticity and clustered at the firm and quarter level. We indicate significance at the 10%, 5%, and 1% level by *, **, and ***, respectively.

	Dependent Variable			
	Event	Financial	Investment	Combined
Duration	0.027***	0.046***	0.004	0.018***
	(0.007)	(0.010)	(0.007)	(0.007)
Rating	0.090***	0.057***	0.091***	0.090***
	(0.009)	(0.021)	(0.009)	(0.008)
Liquidity	0.100***	0.050	0.234***	0.148***
	(0.022)	(0.099)	(0.028)	(0.021)
Observations	112,937	13,194	87,230	213,361
Adjusted R^2	0.070	0.050	0.088	0.071

Table IA-17: Determinants of Covenant Prices: Bond Risk & Market-Wide Variables (Changes Relative to Issuance).
This table shows the results of monthly regressions of covenant prices of the combined sample (in percent) on the bond risk variables duration, rating, and liquidity as well as market-wide indicators. We compute differences to the average characteristics observed within the first three months after issuance on both sides of the equation. Models (1) to (3) add market risk measures, i.e., defaults spread, VIX, and CDS spread individually, followed by a combined model. All specifications include the macroeconomic variables GDP growth, inflation, term spread, and T-Bill rate. The standard errors shown in parenthesis are corrected for heteroscedasticity and clustered at the firm and quarter level. We indicate significance at the 10%, 5%, and 1% level by *, **, and ***, respectively.

	Model Specification			
	(1)	(2)	(3)	(4)
Duration	0.068***	0.067***	0.064***	0.068***
	(0.007)	(0.007)	(0.007)	(0.007)
Rating	0.096***	0.095***	0.093***	0.096***
	(0.008)	(0.008)	(0.008)	(0.008)
Liquidity	0.023	0.032*	0.056***	0.021
	(0.019)	(0.019)	(0.018)	(0.019)
GDP	−0.001	−0.006*	−0.009***	−0.001
	(0.004)	(0.003)	(0.004)	(0.004)
CPI	0.007***	0.006***	0.005***	0.007***
	(0.002)	(0.001)	(0.001)	(0.002)
Term Spread	−0.073***	−0.099***	−0.101***	−0.078***
	(0.015)	(0.013)	(0.013)	(0.015)
T-Bill Rate	−0.066***	−0.081***	−0.084***	−0.068***
	(0.012)	(0.011)	(0.010)	(0.012)
Default Spread	0.093***			0.067***
	(0.021)			(0.026)
VIX		0.004***		0.002
		(0.001)		(0.001)
CDS Spread			0.0003	0.0001
			(0.0004)	(0.0004)
Observations	213,361	213,361	212,308	212,308
Adjusted R^2	0.129	0.127	0.123	0.129

VI. Market-Wide Factors - Covenant Types

This section augments Table 5 and provides the same results for the individual covenant types in Tables IA-18, IA-19, and IA-20.

Table IA-18: Determinants of Covenant Prices (Event): Bond Risk & Market-Wide Variables.

This table shows the results of monthly first difference regressions of event covenant prices (in percent) on the bond risk variables duration, rating, and liquidity as well as market-wide indicators. Models (1) to (3) add market risk measures, i.e., defaults spread, VIX, and CDS spread individually, followed by a combined model. All specifications include the macroeconomic variables GDP growth, inflation, term spread, and T-Bill rate. The standard errors shown in parenthesis are corrected for heteroscedasticity and clustered at the firm and quarter level. We indicate significance at the 10%, 5%, and 1% level by *, **, and ***, respectively.

	Model Specification			
	(1)	(2)	(3)	(4)
Duration	0.071***	0.077***	0.070***	0.072***
	(0.015)	(0.014)	(0.015)	(0.016)
Rating	0.144***	0.144***	0.145***	0.146***
	(0.008)	(0.008)	(0.009)	(0.009)
Liquidity	0.189***	0.187***	0.184***	0.184***
	(0.019)	(0.019)	(0.020)	(0.020)
GDP	−0.001	−0.0002	0.00004	−0.0005
	(0.002)	(0.002)	(0.003)	(0.002)
CPI	0.001	0.002	0.001	0.002
	(0.002)	(0.002)	(0.002)	(0.003)
Term Spread	−0.097***	−0.092***	−0.095***	−0.098***
	(0.019)	(0.016)	(0.018)	(0.017)
T-Bill Rate	−0.034***	−0.026**	−0.027*	−0.030**
	(0.013)	(0.012)	(0.014)	(0.014)
Default Spread	0.022			−0.023
	(0.019)			(0.025)
VIX		0.004***		0.004***
		(0.001)		(0.001)
CDS Spread			0.001**	0.0001
			(0.0004)	(0.0005)
Observations	168,355	168,355	160,736	160,736
Adjusted R^2	0.049	0.052	0.049	0.051

Table IA-19: Determinants of Covenant Prices (Financial): Bond Risk & Market-Wide Variables.

This table shows the results of monthly first difference regressions of financial covenant prices (in percent) on the bond risk variables duration, rating, and liquidity as well as market-wide indicators. Models (1) to (3) add market risk measures, i.e., defaults spread, VIX, and CDS spread individually, followed by a combined model. All specifications include the macroeconomic variables GDP growth, inflation, term spread, and T-Bill rate. The standard errors shown in parenthesis are corrected for heteroscedasticity and clustered at the firm and quarter level. We indicate significance at the 10%, 5%, and 1% level by *, **, and ***, respectively.

	Model Specification			
	(1)	(2)	(3)	(4)
Duration	0.131***	0.134***	0.129***	0.129***
	(0.034)	(0.032)	(0.032)	(0.032)
Rating	0.078***	0.079***	0.079***	0.079***
	(0.011)	(0.012)	(0.011)	(0.011)
Liquidity	0.206***	0.203***	0.200***	0.201***
	(0.043)	(0.044)	(0.044)	(0.044)
GDP	0.003	0.003	0.004	0.003
	(0.004)	(0.003)	(0.003)	(0.003)
CPI	0.015***	0.016***	0.016***	0.015***
	(0.004)	(0.003)	(0.004)	(0.004)
Term Spread	−0.065**	−0.068**	−0.057**	−0.064**
	(0.031)	(0.027)	(0.025)	(0.029)
T-Bill Rate	0.012	0.007	0.018	0.011
	(0.031)	(0.031)	(0.030)	(0.032)
Default Spread	0.040			−0.030
	(0.043)			(0.050)
VIX		0.004***		0.002*
		(0.001)		(0.001)
CDS Spread			0.002***	0.001**
			(0.0004)	(0.001)
Observations	29,941	29,941	29,912	29,912
Adjusted R^2	0.039	0.045	0.047	0.048

Table IA-20: Determinants of Covenant Prices (Investment): Bond Risk & Market-Wide Variables.

This table shows the results of monthly first difference regressions of investment covenant prices (in percent) on the bond risk variables duration, rating, and liquidity as well as market-wide indicators. Models (1) to (3) add market risk measures, i.e., defaults spread, VIX, and CDS spread individually, followed by a combined model. All specifications include the macroeconomic variables GDP growth, inflation, term spread, and T-Bill rate. The standard errors shown in parenthesis are corrected for heteroscedasticity and clustered at the firm and quarter level. We indicate significance at the 10%, 5%, and 1% level by *, **, and ***, respectively.

	Model Specification			
	(1)	(2)	(3)	(4)
Duration	0.077***	0.074***	0.068***	0.072***
	(0.014)	(0.014)	(0.014)	(0.014)
Rating	0.143***	0.143***	0.148***	0.148***
	(0.007)	(0.007)	(0.007)	(0.007)
Liquidity	0.328***	0.329***	0.334***	0.333***
	(0.020)	(0.019)	(0.021)	(0.021)
GDP	0.003	0.003	0.004	0.004
	(0.003)	(0.003)	(0.003)	(0.003)
CPI	0.007***	0.006***	0.006***	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)
Term Spread	−0.063***	−0.072***	−0.069***	−0.061***
	(0.017)	(0.017)	(0.016)	(0.017)
T-Bill Rate	0.012	0.006	0.016	0.022
	(0.014)	(0.013)	(0.015)	(0.016)
Default Spread	0.060**			0.031
	(0.023)			(0.027)
VIX		0.003***		0.001
		(0.001)		(0.001)
CDS Spread			0.001***	0.001*
			(0.0003)	(0.0003)
Observations	169,185	169,185	159,839	159,839
Adjusted R^2	0.059	0.059	0.061	0.061

VII. Firm Characteristics

This section enhances the results presented in Section 6.3 and shows additional regression results when adding firm-characteristics to our main specification in Table IA-21. As discussed in the main part of the paper, the table does not reveal any consistent dependencies.

Table IA-21: Determinants of Covenant Prices: Bond Risk, Market-Wide, & Firm-Specific Variables.
This table shows the results of monthly first difference regressions of covenant prices (in percent) on the accounting variables market-to-book, leverage, firm size, and tangibility while controlling for the bond risk variables (duration, rating, and liquidity) as well as the macroeconomic indicators (GDP, inflation, term spread, T-Bill rate, default spread, VIX, and CDS spread). Coefficients for control variables are not shown below. The standard errors shown in parenthesis are corrected for heteroscedasticity and clustered at the firm and quarter level. We indicate significance at the 10%, 5%, and 1% level by *, **, and ***, respectively.

	Covenant Type			
	Event	Financial	Investment	Combined
Market-to-Book	0.004	−0.018	0.025*	0.010
	(0.018)	(0.019)	(0.013)	(0.012)
Leverage	−0.0001	0.002	−0.001	−0.0001
	(0.002)	(0.004)	(0.002)	(0.002)
Firm Size	0.009	−0.059***	0.039*	0.017
	(0.026)	(0.021)	(0.022)	(0.019)
Tangibility	−0.038	−0.372*	−0.141	−0.099
	(0.085)	(0.208)	(0.111)	(0.083)
Controls:				
Bond-Risk	Yes	Yes	Yes	Yes
Market-Wide	Yes	Yes	Yes	Yes
Observations	113,442	22,106	113,282	248,830
Adjusted R^2	0.051	0.043	0.060	0.052