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The aftermath of covenant violations: Evidence from China's corporate debt securities

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ABSTRACT

We document a sharp and persistent decline in bond issuances following covenant violations also called technical defaults. However, we find no evidence that firms' investment and performance change after technical defaults. Furthermore, we document that most of the technical defaults are waived off by bondholders through the debenture holders' meetings. Although covenants serve as tripwires for renegotiation between bond issuers and investors, control rights are rarely transferred from shareholders to bond investors following technical defaults.

1. Introduction

Beginning with Jensen and Meckling (1976), a large body of theoretical and empirical research has examined the effectiveness of bond covenants as a mechanism for alleviating incentive conflicts between bond issuers and investors. Bond covenants are widely used worldwide, especially in developed markets. Although China's bond market is the world's second-largest, bond covenants remain a novelty here. As reviewed by Amstad and He (2020), China's corporate debt-security market directly grew out of its banking sector, making the phenomenon of implicit guarantees prevalent in the early stages of market development. Therefore, at that time, no market participant seriously prioritized bond investor protection. Few legally binding terms of agreements exist between bond issuers and holders in a prospectus, particularly regarding rules for defaults and contingencies.

The introduction of bond covenants in China traces back to the landmark default event of "11 Chaori Bond" on March 5, 2014. This unprecedented event marked the end of implicit guarantees, spurring more focus on bond covenants. In September 2016, the National Association of Financial Market Institutional Investors (NAFMII), a self-regulatory organization in China's interbank market, formally introduced bond covenants in the interbank market.[2]

This study focuses on the subsequent effect of covenant violations in China's interbank market, which accounts for approximately 80 % of debt securities issued in China in recent years. Violations of bond covenants are often referred to as "technical defaults," which correspond to the breach of binding clauses in a prospectus other than the one requiring an interest or principal repayment. These two terms (i.e., "violations of bond covenants" and "technical defaults") are used interchangeably in the following sections of this paper.

Abbreviations: CFETS, China Foreign Exchange Trade System; CSMAR, China Stock Market & Accounting Research Database; CP, Commercial Papers; DiD, Difference-in-Differences; HVPS, High Value Payment System; MTN, Medium-Term Notes; NAFMII, National Association of Financial Market Institutional Investors; SHCH, Shanghai Clearing House.

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[2] See details on NAFMII website: https://www.nafmii.org.cn/ggtz/gg/201609/t20160909_198113.html.

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Our analysis centers on a novel dataset of covenant violations reported in firms' information disclosure filings on the China Foreign Exchange Trade System (CFETS) and Shanghai Clearing House (SHCH), the key infrastructures of the market. Of the 3055 firms that issued 26,733 bonds in the interbank market from 2016 to 2020, 57 firms experienced covenant violations. We document a sharp and persistent decline in bond issuances following covenant violations. The empirical analysis shows that bond issuances decreased by an average of RMB 1.41 billion one year after firms experienced a technical default. This finding is robust across different measurement methodologies.

However, we find no evidence that the investment and performance of firms change after technical defaults. This aftermath of covenant violations in China is in sharp contrast to typical observations of debt securities in the U.S., which may reflect the differences between the institutional environments in these two countries. Although the literature, which we review later, on covenant violations is less conclusive, it mostly finds evidence of more conservative financing and investment policies in developed markets.

After establishing the average effect of covenant violations for bond issuers, our second set of results identifies the underlying mechanism linking subsequent bondholders' responses and covenant violations. An important role of bond covenants is to act as tripwires for the transfer of control rights, lending control to shareholders in good times and transferring it back to creditors in bad times (Gârleanu and Zwiebel, 2009). After a covenant violation, bond investors can reexamine the status quo of the violators.

From the collected data, we see that most violations are waived off by bondholders, even though information regarding bondholders' decisions was missing from the records of a few meetings. Covenant violations have become an incentive for further negotiation between debtors and creditors; however, most bond investors choose to waive off technical defaults owing to the existence of "big players" and "free-riding" among investors in China's bond market. Thus, bondholders face challenges in exerting a substantive influence on firms' investments and operations after technical defaults, given the difficulty of transferring control rights.

Overall, our study not only documents a drastic decrease in bond issuance following covenant violations but also attributes this interesting finding to China's distinct institutional environment and bondholder response.

2. Literature review

Our study contributes to several strands of finance literature. First, it expands the literature on empirical research examining covenant violations and the resolution of technical defaults. A large body of empirical research suggests that violations of bond covenants are associated with a decline in net debt issuance (Roberts and Sufi, 2009), capital expenditure (Chava and Roberts, 2008), research and development, innovation output (Chava et al., 2017), personnel hiring (Falato and Liang, 2016), and dividend payments (Nini et al., 2012). By examining the data on technical defaults published by the U.S. Securities and Exchange Commission, Roberts and Sufi (2009) found that firms, within six months after a technical default, shift from increasing net debt issuances by 0.8 % per quarter to decreasing net debt issuances. Moreover, the decline is consistent, lasting for more than two years after a technical default and leading to a corresponding decline in a firm's leverage of >3 %.

Chava and Roberts (2008) studied the impact of technical defaults on firms' investment policies. Their empirical results showed that firms' investment expenditures decrease by approximately 1 % per quarter after a technical default, which is 13 % lower than in the pre-technical default period. Further research finds a pronounced investment decline in firms with more severe agency and information problems, highlighting the importance of control rights allocation in mitigating distortional behaviors. This study provides new evidence that covenant violations primarily affect firms' subsequent debt financing volumes in emerging markets such as China.

Second, our study complements the literature on renegotiating financial contracts and the purpose of covenants. Prior literature has regarded covenants as means to overcome the agency problem inherent in financial contracts by limiting the possible actions taken by the borrower and shifting control to the lender if the borrower's financial condition deteriorates (Aghion and Bolton, 1992; Bradley and Roberts, 2015; Chava et al., 2010; Gârleanu and Zwiebel, 2009; Nini et al., 2009; Helwege et al., 2017). Typically, two possibilities exist after renegotiation. In the first case, a technical default is "waived off" by a creditor; that is, the creditor formally agrees to waive the debtor from any responsibility regarding the violation of covenants. The second involves an adjustment of the debt contractual terms. As a debtor's credit quality has deteriorated by this point, the threshold requirements of financial covenants are sometimes lowered to avoid repeated breaches in subsequent periods. At the same time, however, more stringent borrowing requirements may be imposed on the debtor, for example by reducing the scale of the credit line, increasing the interest rate, or providing additional compensation for creditors.

Chodorow-Reich and Falato (2022), after examining data on technical defaults from a large sample of firms, found that 37 % of firms had their credit lines reduced by banks after technical defaults during the 2008 financial crisis. Our study provides new evidence that bondholders in China's bond market often waive off violations while taking minimal additional action. Most technical defaults receive a waiver from bondholders. The shorter the maturity of the defaulted debt, the higher the coupon rate, the better the liquidity position of the defaulting firm, and the easier it is to obtain a waiver from bondholders. This is consistent with the symmetric view of incomplete contracting in Hart and Moore (1994).

Finally, our study contributes to the rapidly growing literature on China's financial market. Amstad and He (2020) reviewed China's bond market and interbank market. Brunnermeier et al. (2022) proposed a theoretical regime to characterize China's approach to managing the financial system. Ding et al. (2022) documented issuance overpricing of corporate debt securities in China, which contrasts with the underpricing of equity and debt securities in Western countries. Zhang and Zhang (2023) studied the relationship between bond characteristics and corporate bond returns in China's two distinct and segmented bond markets with a large cross-sectional dataset. They found that corporate bonds with large sizes, long maturities, and poor credit ratings tend to earn high monthly returns. As the application of bond covenants is relatively recent and still uncommon in China, there is a lack of localized research compared to studies abroad.

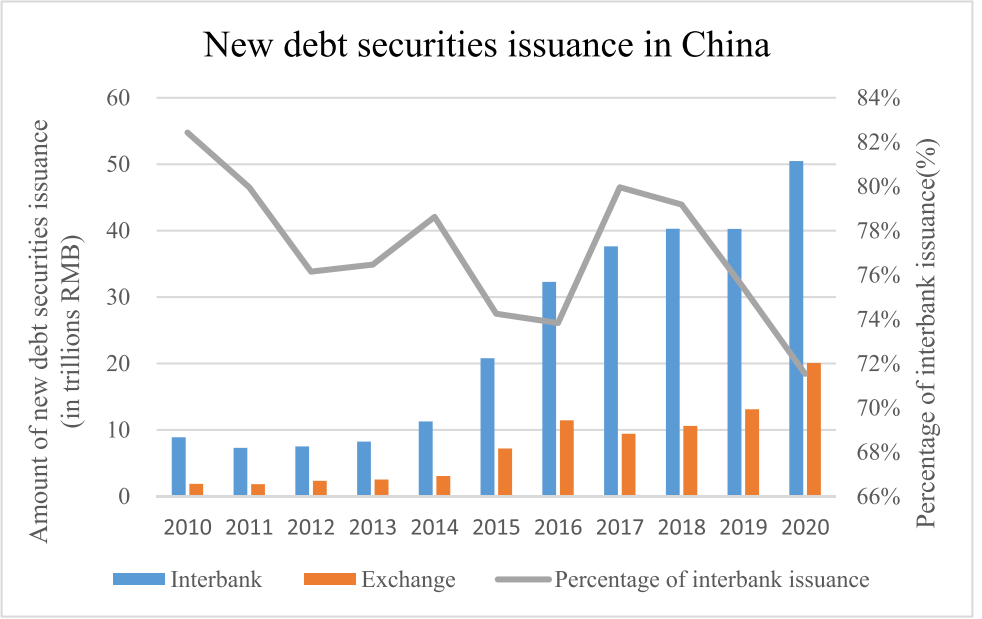

Fig. 1. This figure plots the growth of China's corporate debt-security market from 2010 to 2020. The left axis is the amount of new debt securities issuance in trillions of RMB. The right axis is the percentage of interbank new debt securities issuance to the total issuance.
Source: Wind.

Some scholars have studied the pricing of bond covenants in the Chinese bond market and documented that including covenants could lower the spread of bond yield to maturity (Chen and Li, 2014; Shi and Tian, 2016). Zhang and Wu (2021) showed that bond covenants helped to restrain the over-investment of the corporation. However, none of these studies focus on the ex-post impact of bond covenant violations as this study does. Moreover, China's bond market, in practice, previously tended to define technical defaults from an operational perspective. To the best of our knowledge, this study is the first to examine the effect of standardized technical defaults in China's bond market. Our study shares a common theme with the studies mentioned above in terms of exploring the important characteristics of China's corporate debt-security market; however, it has a distinct focus on bond covenants.

The remainder of this paper is organized as follows. Section 3 introduces the institutional background of China's corporate debt-security market and a variety of covenants. Section 4 summarizes the data and measurement methodology. Section 5 presents the empirical results and examines economic mechanisms. Finally, we conclude the paper in Section 6.

3. Institutional background

This section provides a brief overview of the key features of China's debt-security market, the development of bond covenants, and the occurrence of technical defaults.

3.1. Overview of the corporate debt-security market

A notable feature of China's financial market development over the past decade is the rapid growth of the corporate debt-security market. In 2021, China's corporate debt-security issuance reached RMB 14.8 trillion, and the outstanding amount by the end of the year totaled RMB 31.24 trillion, ranking second highest in the world.[3] As explained by Amstad and He (2020), China's bond market is composed of two distinct markets: the interbank and exchange markets. Nonfinancial corporate debt securities are issued and traded in both markets. As shown in Fig. 1, the interbank market accounted for 82 % of new debt securities issuance in 2010 and the market share of the interbank market remained above 70 %, even at its lowest point in 2020. The People's Bank of China (PBC) oversees the interbank market through NAFMII, which is responsible for formulating rules to govern institutional participants in the market.

The interbank market is an over-the-counter market. In contrast, the exchange market is a centralized market in which individuals and small- and medium-sized institutions trade debt securities on centralized trading platforms. Only qualified institutions, including commercial banks, mutual funds, insurance companies, and securities companies, are accessible to the interbank market. In December 2020, the total number of the interbank market members reached 27,958.[4]

This study focuses on debt financing instruments issued by nonfinancial firms and administered by NAFMII in the interbank market.

[3] See details of the development of China's corporate debt-security market on PBC website.
[4] See details of the development of China's corporate debt-security market on PBC website.

Debt financing instruments are predominantly categorized as commercial papers (CPs, including super short-term CPs), medium-term notes (MTNs), asset-backed notes (ABNs), and private placement notes (PPNs). Details of different categories of debt financing instruments are clarified by Amstad and He (2020).

3.2. Bond covenants and technical defaults in China

Ever since the first bond default event of "11 Chaori" in 2014, the bond market investors have begun to take the credit risk of corporate debt securities seriously. Through "learning by doing" via tackling various bond default cases, the NAFMII issued the *Model Investor Protection Clauses*[5] in September 2016, introducing a standardized system for bond covenants. The model clauses classify bond covenants into six categories: cross-default, maintenance, restriction, change of control, keepwell and liquidity support deed, and secured debt. Each of them can be further divided into sub-categories. The details of bond covenants in China's interbank market are discussed in the Appendix 1.

Bondholders use covenants as tripwires to constantly monitor an issuing firm's performance. A covenant violation leads to a re-evaluation of borrowers' solvency through a mechanism called "meeting of the debenture holders." Bondholders could take collective actions to waive-off, conditionally waive-off, or not waive-off the technical default. Specifically, a conditional waiver means that bondholders will waive a technical default under the conditions of partial repayment in advance, increasing the coupon rate, providing additional guarantees, and so on. A waiver indicates that bond investors do not request the repayments to be accelerated. By obtaining a waiver, the executives of a bond issuer can retain the control right, and bond investors will not directly intervene in their operational activities.

As bond covenants were only recently introduced in China, market participants used to define technical defaults from an operational perspective. This mainly refers to defaults caused by the failure of an issuer to transfer debt service funds timeously to the custodian due to an improper schedule arrangement of its funds, despite the issuer's solvency to repay the debt. The bond issuer usually arranges redemption within 1–2 working days thereafter. For example, on the evening of November 21, 2017, when the 14 Yili Group MTN002 reached maturity, the SHCH issued a statement stating that it had not received the required amount of funds from the group. The Yili Group then declared that the default occurred because a part of the funds could not get transferred to the SHCH account on time before the High Value Payment System (HVPS[6]) was closed that day. On November 22, the Yili Group completed the transfer of the remaining amount, thus settling a potential default.

In line with common practice in the international market and standardized definitions, this study defines the failure to comply with bond covenants as "technical defaults" rather than defaults caused by operational problems. According to the regulations issued by NAFMII, such as the *Rules for the Disclosure of Information on the Debt Financing Instruments of Non-Financial Enterprises*[7] and the *Procedures for Meetings of Holders of Debt Financing Instruments,*[8] a meeting of the debenture holders shall be convened when certain events have occurred during the bond term. The causes of these events, present conditions, and possible effects should be explained in the information disclosure documents. The violator should send relevant documents to information disclosure service platforms such as the CFETS and SHCH, which should promptly be published on their official website.

4. Data and summary statistics

4.1. Data samples

Our sample period was set from 2016 to 2020 to coincide with the 2016 promulgation of the Model Investor Protection Clauses by NAFMII. Meanwhile, we exclude PPNs since the covenant violations information is not publicly disclosed. ABNs are also excluded because of their different structures. Our initial sample consists of 26,733 CPs and MTNs issued by 3914 firms. As noted by Huang et al. (2023), CPs and MTNs are also among the most liquid products in China's bond market. Bond characteristics, including covenant, volume, maturity, and coupon rate are taken from Wind. We then match the bond issuance data with the financial information of bond issuers, which is extracted from the China Stock Market & Accounting Research Database (CSMAR), another data vendor. Information from various datasets is cross-checked and verified.

Of the firms issuing bonds in the interbank market, not every firm discloses detailed financial statements every year. Retaining only complete financial data will result in a significant loss in the sample size. As a result, we require a leverage ratio for non-missing values and construct the other variable using the latest available historical data. In addition, we require each firm year to have positive assets. As some firms issue multiple bonds in a year or several years, we aggregate them at the firm level, weighing them by the issuing amount. Finally, the regression specification for calculating the effect of technical violation requires a lead value of bond issuance. After imposing all these filters, our final sample consists of 21,140 firm-year observations. To mitigate the impact of data errors and outliers in our analysis, we winsorize all variables at the 1st and 99th percentiles.

Table 1 reports summary statistics for the main variables used in our analysis. The average bond issuance amount in our sample is

[5] See details here: https://www.nafmii.org.cn/ggtz/gg/201609/t20160909_198113.html.

[6] The *High Value Payment System is one of China's most important payment systems, which offers efficient clearing and settlement services for large value and high priority payments.*

[7] See details of the link: https://www.nafmii.org.cn/zlgl/zlgz/hxgll/201712/t20171212_198981.html

[8] See details of the link: https://www.nafmii.org.cn/ggtz/gg/201912/t20191227_198239.html

Table 1
Summary statistics.

Variable	Obs.	Mean	Std. Dev.	Minimum	Maximum
Bond issuance	10449	3.861	9.451	.1	356
Maturity	10449	2.334	1.593	.041	15
Coupon	10449	4.649	1.374	1.397	9
Leverage	21140	59.812	14.143	22.53	88.99
Current ratio	12617	.528	.564	.018	3.97
EBITDA/Asset	8345	3.147	3.497	−4.613	17.195
Waiver	47	.66	.479	0	1

Note: This table presents summary statistics for the unbalanced panel of outcome variables (bond issuance and waiver) and control variables. For each variable, we report the mean, standard deviation, minimum and maximum. Obs. and Std. Dev. mean observations and standard deviation, respectively.

Table 2
Data of technical violations.

Panel A: Year of Technical Default

Year of Technical Default	Number of firms	Size (billions)	Maturity (years)	Coupon (%)
2017	1	0.5	1.00	3.90
2018	7	13.95	2.43	6.43
2019	17	25.20	2.09	6.35
2020	32	79.36	2.17	5.14
Total	57	119.01	2.15	5.66

Panel B: Technical Defaults

Type of Clauses	Number of firms	Size (billions)	Maturity (years)	Coupon (%)
Cross-default	12	47.46	1.40	6.76
Maintenance	17	23.71	2.33	5.53
Restriction	25	45.54	2.32	5.04
Change of control	3	23.00	2.91	6.71
Total	57	119.01	2.15	5.66

Note: Panel A of this table presents the data on firms that reported covenant violations in the required information disclosure filings between 2016 and 2020. Panel B presents the data on firms that reported covenant violations in the required information disclosure filings by different covenant types.

RMB 3.86 billion. Summary statistics for other bond and firm characteristics, including maturity, coupon rate, leverage ratio, current ratio, and EBITDA/Asset are also reported.

4.2. Data on covenant violations

Currently, no database in China collects data on the technical defaults of bond covenants. As noted above, a firm must make an announcement to explain why bond covenants have been violated. Thus, we use text-search programs from Python to scan every meeting of the debenture holders filed on the CFETS and SHCH websites. More specifically, as each firm has a different way of expressing bond covenant violations in practice, we further scan the following terms, such as “breach,” “waive,” “violation,” “bond covenant,” “restriction,” “not in compliance,” and so on.

By doing this, we document 57 firms violating bond covenants from 2016 to 2020. To verify the accuracy and validity of the technical default data obtained using Python, we screen bonds with financial maintenance covenants from the sample data, especially the ones that have set leverage ratio thresholds. To determine whether a firm is or is not in violation, we compare the threshold to the firm’s actual leverage data. There were 10 firms whose quarterly leverage ratio exceeded the threshold, which subsequently triggered technical defaults. After comparison, all these 10 firms disclosed relevant issues at meetings of the debenture holders, which were accessed using Python, indicating that the data on technical defaults are comparatively valid.

From Table 2, we can see that the occurrence frequency of technical defaults in China’s bond market is much lower than that in developed markets like the U.S. Roberts and Sufi (2009) found that 25.60 % of firms reported technical defaults in 10-K or 10-Q documents from 1996 to 2005. In contrast, only 57 firms in the interbank bond market experienced technical defaults, which was $<$2 % of the total number of firms in the sample. The data indicates an increase in the number of technical defaults per year, with only one firm experiencing technical defaults in 2017 which increased to 32 in 2020. More than 50 % of technical defaults occurred in 2020. The amount of defaulted bonds also indicates a year-on-year increase, growing from a mere RMB 0.5 billion in 2017 to 79.36 billion in 2020, accounting for 66.68 % of the total amount of all defaulted bonds.

In terms of the weighted average maturity, the average maturity of 2.15 years for defaulted bonds bears no significant difference from that of 2.20 years for the total sample, nor does it show any significant yearly or type differences. The weighted average coupon rate of defaulted bonds stands at 5.66 %, which is much higher than that of 4.40 % for the total sample. Moreover, the coupon rate of bonds with technical defaults due to a breach of the cross-default and change of control clause is significantly higher than that of other

Table 3
Decisions at debenture holders' meetings.

Decisions	Number of firms	Percentage
waive-off	31	54.39 %
invalid	12	21.05 %
non-waive	2	3.51 %
conditional waive	4	7.02 %
Indeterminate	8	14.04 %
Total	57	100 %

Note: This table presents the decisions made in meetings of the debenture holders after technical defaults from 2016 to 2020.

technically defaulted bonds.

The highest number of technical defaults (25) fall in the category of the violations of restriction covenants, which amounted to RMB 45.54 billion, accounting for 38.27 % of the overall technical defaults between 2017 and 2020. This is followed by the number of technical defaults due to violations of maintenance covenants (17), which amounted to RMB 23.71 billion, accounting for 19.92 % of the overall technical defaults in this period. The third highest number of technical defaults was due to a breach of the cross-default covenant (12), which amounted to RMB 47.46 billion, accounting for 39.88 % of the overall technical defaults. The number of firms where the above three violations were witnessed accounted for 94.73 % of all the technical defaults. Apart from three firms where technical defaults occurred due to control rights change, no violation of other bond covenants has ever occurred, due to their lesser application.

Table 3 lists the decisions of meetings of the debenture holders after technical defaults. Specifically, 31 firms received waivers from bondholders. A total of 12 firms did not arrive at an effective resolution due to insufficient participation at the debenture holders' meetings, and technical defaults were not resolved timeously. The technical defaults of two firms were not waived off at meetings of the debenture holders, of which one firm further defaulted and the other ceased to raise funds in the bond market after the bond reached maturity. Another four firms were granted conditional waivers, of which two firms were required to increase the coupon rate of the bonds and the other two were required to provide additional guarantees.

For example, due to a violation of the restriction covenant for a substantial asset transfer transaction, a firm held a meeting of the debenture holders, in which it proposed to increase the coupon rate of medium-term notes by 30 basis points or to provide an additional guarantee. All bond investors present at the holders' meeting of this firm unanimously approved the proposal to increase the guarantee and thus conditionally waived off the technical default. A total of eight firms were unable to obtain the decision of their meetings of the debenture holders due to a lack of relevant information disclosure documents.

As a technical default may require several meetings of the debenture holders, we only discuss the result of the first meeting to simplify the analysis. While analyzing the waiver decisions of technical defaults, we excluded samples in which the decisions of the debenture holders' meetings were unknown.

5. Methodology, results, and robustness tests

5.1. Methodology and main results

We estimate the average partial effect of bond covenant violations using a two-way fixed effects model that includes both year and industry effects. The methodology is similar to that of Nini et al. (2009), Roberts and Sufi (2009), and Demiroglu and James (2010) estimating the effects of capital structure and expenditure after technical defaults. The advantage of the fixed effects model is its ability to mitigate biases in coefficient estimates caused by an unobserved effect of a given firm, thus producing consistent estimates of the average partial effects of covariates under the relatively weak assumption that the mean of the error term, conditional on the covariates and unobserved effect, is zero (Wooldridge, 2002). We begin our analysis of whether covenant violations affect financing behaviors by illustrating the relationship between violations and bond issuances.

$$\triangle Y_{it} = \alpha_{\mathrm{i}} + \sum_{2015}^{2021} \delta_t + \beta_1 * VIO_{it} + \beta_2 * VIO_{it-1} + \varphi * \mathrm{f}(X_{it-1}) + \varepsilon_{\mathrm{it}} \quad (1)$$

where $\triangle Y_{it}$ refers to the annual change in bond issuances in the interbank market after a covenant violation, α_{i} and δ_t represent the individual industry and year-fixed effects of the panel data, respectively, and ε_{it} refers to the heterogeneous random error terms assumed to be associated with the within-firm observation data (Petersen, 2009). Following previous empirical studies (e.g., Rajan and Zingales, 1995), X_{it-1} stands for the control variable matrix, including the lagged dependent variable and the lagged value of firm leverage ratio, EBITDA-to-asset-ratio (Earnings Before Interest, Taxes, Depreciation, and Amortization), current ratio, and industry indicator variable. In particular, the lagged dependent variable is used to control for the mean reversion effect (Flannery and Rangan, 2006; Kayhan and Titman, 2007). We focus on the coefficients β_1 and β_2 of the explanatory variables VIO_{it} and VIO_{it-1}, which respectively indicate the extent to which technical defaults affect the explanatory variables of the current and following years.

Table 4 presents the estimation results of fixed effects and the first difference regressions of bond issuance on covenant violation indicators and control variables. Columns (1)–(4) show the results of the regression analysis using the fixed effect specification, while

Table 4
Covenant violations and bond issuance.

	Fixed Effect				First Difference			
Dependent Variable	Bond Issuance				Change in Bond Issuance			
VIO_{it}	0.336		−0151		0.453**		0.143	
	(0.239)		(0.218)		(0.182)		(0.294)	
VIO_{it-1}		**−0.772****		**−1.414*****		**−0.698****		**−1.061*****
		(0.356)		(0.395)		(0.299)		(0.382)
lag dependent/ change in lag dependent	0.031***	0.031***	0.023***	0.022***	−0.023***	−0.023***	−0.024***	−0.024***
	(0.027)	(0.027)	(0.047)	(0.047)	(0.024)	(0.024)	(0.053)	(0.038)
borrower risk controls	NO	NO	YES	YES	NO	NO	YES	YES
Year & Industry effect	NO	NO	YES	YES	NO	NO	YES	YES
Number of observations	18,120	18,120	7903	7903	15,100	15,100	3239	6320
R-sq.	0.09	0.09	0.12	0.12	0.05	0.05	0.07	0.07

This table presents the coefficient estimates of the fixed effects regressions (Columns 1–4) and first difference regressions (Columns 5–8) of bond issuances on covenant violations.
Note: ***, **, and * represent significance at the 1 %, 5 %, and 10 % levels, respectively; the robust standard error is presented in parentheses.

Columns (5)–(8) are of the first difference model. Columns (1), (2), (5), and (6) present the results neither with firm characteristics control variables nor with industrial and yearly effects. However, Columns (3), (4), (7), and (8) control for the industrial and yearly effects, and include control variables with firm characteristics.

The results show that regardless of the regression model adopted, the estimates of VIO_{it-1} are all negative at the 1 % or 5 % confidence level, indicating that the bond issuance of the firm declines significantly in the year after a covenant violation. Specifically, Column (1) shows that, on average, bond issuances decline by RMB 0.77 billion a year after a covenant violation. The standard errors in parentheses imply a t-statistic of 3.5, even after removing fixed effects and accounting for within-firm correlations (Petersen, 2009). By including firm characteristic variables and fixed effects, the adjusted R-square increases to 12 % relative to the baseline specification. Meanwhile, the violation coefficient declines dramatically to 1.41 and is still statistically significant. In addition, we present the estimates from the first difference analogous to the fixed effects specification in Columns (5)–(8). Specifically, the specifications reported in Columns (5)–(8) examine the change in bond issuances for a given firm as a function of covenant violations after controlling for changes in the covenant control variables. As shown, the estimates from the first difference specification are similar to the fixed-effects estimates.

The impact of covenant violations on current-year bond issuances is less conclusive, given that the estimates of VIO_{it} are statistically insignificant, except in Column (5). However, after controlling for firm characteristics as well as year and industry effects, the estimate becomes insignificant in Column (7). Moreover, the coefficients are not in the same direction, which means that it is difficult to infer the impact of covenant violations on contemporaneous bond issuances.

In addition, in unreported results, we find that covenant violations are associated with increasing leverage ratio and decreasing EBITDA/Asset. However, it is difficult to infer that covenant violations lead to a deterioration in a firm's financial and operational performance. As it occurred in the same year as the technical default, it is possible that the deterioration of the firm's operational efficiency led to an increase in the leverage ratio and a decrease in EBITDA/Asset, and later to the technical default.

The results of the empirical analysis show that covenant violations negatively impact the subsequent bond market financing of a firm. From the perspective of investors, the occurrence of technical defaults marks a possible deterioration in a firm's operational performance. This event alone allows bond investors to rethink and evaluate investment decisions and, in turn, affects firms' subsequent financing activities.

5.2. Waiver decision

To further explore the influence of bond covenant violations, we turn to the perspective of creditors. Prior studies suggest that creditors' decision to waive technical default is affected by the extent to which borrowers' characteristics and debt features reduce agency costs (Chen and Wei, 1993; Hassabelnaby, 2006). Following previous empirical studies, we examine the waiver decision of bond investors by using a Logit model:

$$Waiver_i = \alpha_0 + \alpha_1 FirmCharacteristics_i + \alpha_2 BondCharacteristics_i + \varepsilon_i \quad (2)$$

Waiver is a binary dummy variable that takes the value of 1 in the case of a waiver of technical defaults by bond investors, otherwise 0. In the following empirical analysis, as for the $FirmCharacteristics_i$, we use the leverage ratio, current ratio, EBITDA/Asset as proxy variables. In particularly, a higher leverage ratio signifies a higher default risk in the future as well as higher agency cos. Meanwhile, a higher current ratio and EBITDA/Asset imply a lower default risk and higher current value of the bond issuer. Chen and Wei (1993) explored creditors' waiver decisions using the option-pricing framework, and argued that secured debt, debt size, and debt maturity were important factors in the waiver decisions. For the $BondCharacteristics_i$, bond size, maturity, and coupon rate are used as proxy variables as in Chen and Wei (1993). See detailed analysis in the Appendix 2.

Table 5 presents the results of waiver decisions. Column (1) reports the results of the logit regression of the waiver decision on bond characteristics. Column (2) reports the results for firm characteristics. Columns (3) and (4) present the results after controlling for the

Table 5
Waiver Decisions.

	(1) Waiver	(2) Waiver	(3) Waiver	(4) Waiver	(5) Waiver
Amount	0.007		−0.029		−0.146
	(−0.81)		(−0.71)		(−1.03)
Maturity	−0.025		−0.697**		−2.210**
	(−0.12)		(−2.05)		(−2.07)
Coupon	0.293		0.921**		3.492*
	(−1.35)		(−2.22)		(−1.75)
Leverage		0.034		0.083	0.127
		(−0.85)		(−1.31)	(−1.27)
Current_ratio		1.408		3.495	22.530*
		(−1.21)		(−1.12)	(−1.67)
EBIDTA/Asset		0.222		0.740***	2.193*
		(−1.24)		(−2.68)	(−1.68)
Industry dummy	NO	NO	YES	YES	YES
Year dummy	NO	NO	YES	YES	YES
N	47	36	37	28	28
P.R-sq.	0.035	0.062	0.265	0.369	0.558

Note:***, **, and * represent significance at the 1 %, 5 %, and 10 % levels, respectively; the robust standard error is presented in parentheses. P.R-sq. refers to pseudo-R-square.

yearly and industrial effects. Column (5) reports the results incorporating all the control variables.

For the logit regression, we focus on the sign of the estimated coefficients instead of a specific value. In Columns (1) and (2), all the estimated coefficients are insignificant, and the value of the pseudo-R-square is relatively small, implying that it is difficult to fully explain the waiver decision of bond investors using bond characteristics or firm characteristics alone. After controlling for yearly and industrial effects, the coefficient of maturity in Column (3) is negative and that of the coupon rate is positive. All of them are statistically significant at the 5 % confidence level, suggesting that a waiver is more likely to be granted the shorter the maturity of the defaulted bonds and the higher the coupon rate.

Under the same circumstances, the coefficient of EBITDA/Asset in Column (4) is positive and significant at the 1 % confidence level, indicating that the technical defaults of firms with a higher EBITDA/Asset are more likely to be waived off. The pseudo-R-square values of Columns (3) and (4) are 0.265 and 0.369, respectively, which are much higher than those of Columns (1) and (2). This suggests that the overall explanatory power of the model is greatly improved after controlling for yearly and industrial effects.

The regression results in Column (5) show that the coefficient of maturity is negative and statistically significant at the 5 % confidence level. However, the coefficients of the coupon rate, current ratio and EBITDA/Asset are all positive and statistically significant at the 10 % confidence level. The results from the above analysis imply that waiver decisions are positively related to the coupon rate of a defaulted bond and the current ratio and EBITDA/Asset of a defaulted firm, and negatively related to maturity.

Not surprisingly, firms with a higher current ratio and EBITDA/Asset are associated with lower bankruptcy risk and are thus more likely to be granted a waiver. Additionally, a bond with a shorter maturity has a higher relative value and is therefore more likely to be granted a waiver. A high coupon rate implies that the opportunity loss from losing a client is relatively high, which also leads to a more likely waiver. Unlike the findings of Chen and Wei (1993) that the technical defaults of firms with a lower leverage ratio are more likely to be waived off in the U.S. bond market, the regression results in Table 5 show that in no model does the leverage ratio have a statistically significant effect on the decision of the waiver. This could be because a firm's leverage ratio undergoes a significant increase in the year of a technical default; this causes a sudden change that makes the leverage ratio less effective as a measure of the firm's insolvency. Thus, it is not a significant determinant of investors' decisions regarding a waiver.

5.3. Robustness and endogeneity

In this subsection, we conduct several robustness checks on the main results. First, we test the robustness of our results by excluding sample firms that fail to pay interest or principle after a technical default occurs. Firms' insolvency may induce a decline in bond issuances and the non-waiver decision of creditors. By examining the later development of covenant violators, we noticed that 12 firms failed to repay the bond at maturity. The alternative sample data shows that, on average, bond issuance falls by 0.69 to 1.39 billion the year after a covenant violation using different specifications. Meanwhile, creditors make waiver decisions regarding maturity, coupon rate, current ratio, and EBITDA/Asset. These findings are similar to those described in Sections 5.1 and 5.2.

Second, our primary measure of the subsequent effect of a covenant violation is the annual change in a defaulting firm's bond issuance in the interbank market. However, as noted above, firms issue debt securities in both the interbank and exchange markets. A firm may decrease its bond issuance in the interbank market while increasing it in the exchange market after technical defaults. By replacing the interbank market's bond issuances with the total amount of bond issuances in both markets, we find that bond issuances fall by 0.98 to 1.59 billion the year after a covenant violation. These results confirm that covenant violations negatively affect subsequent bond market financing.

Third, a large sample of covenant violations is likely to be driven by exogenous events rather than self-selection or the reverse relationship. For example, in some technical default cases, the reason behind the default was the rearrangement of the provincial

Table 6
Difference-in-Differences (DiD) Analysis of Covenant Violations.

	(1) Bond issuance	(2) Bond issuance	(3) Bond issuance
$VIO_{it} \times Post_{it}$	−0.558	−1.308***	−1.041***
	(−0.162)	(−0.372)	(−0.457)
Control variables	NO	NO	YES
Industry dummy	NO	YES	YES
Year dummy	NO	YES	YES
N	8533	8519	3505
P.R-sq.	0.01	0.04	0.13

Note: ***, **, and * represent significance at the 1 %, 5 %, and 10 % levels, respectively; the robust standard error is presented in parentheses. P.R-sq. refers to pseudo-R-square.

government's shareholdings in provincial state-owned enterprises, which led to the restructuring of shareholdings and thus to the breach of restriction covenants. We further utilize these exogenous shocks to employ the difference-in-differences (DiD) analysis. As covenant violations occur at different times in different firms, we refer to Beck et al. (2010) and adopt the heterogeneous timing DiD approach, setting separate dummy variables for different firms in the treatment group according to the treatment time. Specifically, the heterogeneous-timing DiD model is set as follows:

$$Y_{it} = \alpha_i + \sum_{2015}^{2021} \delta_t + \beta * VIO_{it} \times Post_{it} + \varphi * f(X_{it-1}) + \varepsilon_{it} \quad (3)$$

where, $Post_{it}$ is the treatment variable where i and t are index firm and year observations, respectively. Let us assume that in 2019, a firm experienced a technical default, then $Post_{it} = (0,0,0,0,1,1,1)$. If a firm has never experienced a technical default during the sample interval, $Post_{it} = (0,0,0,0,0,0,0)$. The other variables are defined as above.

The results in Table 6 show that the estimated coefficients of the interaction term between $VIO_{it} \times Post_{it}$, which are the key variables of interest, are qualitatively the same as the baseline results in Table 4. This indicates that the conclusions of this section on the financing effect of technical defaults are relatively robust.

While referring to the issue of endogeneity, we acknowledge the limitations of our research design, which arise from the fact that bond issuers do not include covenants at random and do not violate covenants randomly. As noted, we adopt fixed-effects regressions to eliminate any unobserved time-invariant component in covenant violations. Additionally, we use lagged variables to measure the effect of covenant violations to mitigate reverse causality. However, non-random violations are particularly difficult to overcome because covenants are designed precisely to identify at-risk borrowers. Our research design mitigates this concern; however, in the absence of a true random assignment of covenant violation status, we cannot fully rule it out.

6. Conclusions

In this paper, we explore the aftermath effect of technical defaults in China's corporate debt-security market using a unique data set from years 2016 through 2020. After a technical default, it becomes difficult for firms to refinance in the bond market, and bond issuance drops significantly. However, unlike in the U.S. market, apart from the difficulties in refinancing, technical defaults do not have a significant impact on firms' subsequent investment and operation activities in China. This may be because bond covenants are not yet sufficiently bound in the country. Bondholders can influence the behavior of bond-issuing firms through meetings of the debenture holders after technical defaults. However, based on the decisions taken in such meetings, the proportion of firms that obtain waivers is high, with 65 % of technical defaults being waived-off through such meetings. While technical defaults of some firms were not waived off, there were very few cases in which bond investors gained control rights through renegotiation.

Thus, although bond covenants serve as tripwires for renegotiation between bond investors and issuers, at least based on current market practices, it is difficult to materially transfer control from shareholders and management to bondholders. The most direct way for bond investors to exert influence is to "vote with their feet" and avoid investing in the bonds of firms that have experienced technical defaults, making their refinancing difficult.

Furthermore, our study encourages future research to examine the comprehensive arrangement of investor protection mechanisms in China's bond market. We expect that a few more years of experience, including a spate of technical defaults, are necessary to generate enough data to answer these questions properly.

CRediT authorship contribution statement

Guang Xu: Writing – review & editing, Writing – original draft, Software, Methodology, Formal analysis. **Xiaoyan Zhang:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Investigation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Declaration of generative AI in scientific writing

None.

Appendix 1

Cross-default

Cross-default is a provision in a bond indenture that puts an issuer in default if it fails to fulfill other obligations. The minimum requirements for the obligations set by the *Model Investor Protection Clauses* are various types of bonds, including debt financing instruments, corporate bonds, enterprise bonds, or offshore bonds. Additionally, the issuer can choose whether to include other obligations, such as loans, leases, asset management plans, and so on. If a bond issuer defaults on one of its obligations other than the debt financing instrument by not paying principal or interest on time, a cross-default clause in the prospectus triggers an event of default as well.

Maintenance

Maintenance covenants predominantly involve clauses on the maintenance of financial conditions, unqualified audit opinions, rating grades, and operations. The clause on the maintenance of financial condition is the most widely used among them. The financial maintenance covenants are used to align incentives ex-ante and restrict additional debt to ensure the firms maintain a specific level of leverage, return on equity, minimum net profit, debt growth, and so on. The bond issuer can specify monitoring these financial thresholds on an annual or quarterly basis in the prospectus. As an illustrative example, the prospectus announced by State Grid International Leasing Company on October 14, 2019, contains the following clause:

"5.1.5 Commitment to the financial condition. During the term of the debt financing instrument, the issuer shall ensure that, on the issuer's consolidated financial statements, the leverage ratio is under 85 % at the end of each year. The issuer and underwriter shall monitor it quarterly."

On April 30, 2020, State Grid International Leasing Company announced in its annual financial statements that the leverage ratio reached 90.10 % on a consolidated basis at the end of 2019. Owing to the covenant's violation, the company held a meeting of the debenture holders on June 4, 2020, and received a waiver from the bondholders.

Restriction

Restriction covenants primarily involve clauses restricting or limiting asset sales, debt restructuring, risky investments, and affiliate transactions. The clause on sales of assets is the most widely used among them. Specifically, the sales of asset covenant refers to restriction or limitation on large sales and the transfer or other disposition of property. As an illustrative example, the prospectus prepared by Jilin Province Water Industry Investment Group on April 11, 2018, contains the following clause:

"2.1 Terms on sales of assets. If the issuer intends to take the following actions during the term of the debt financing instrument, it shall convene a meeting of the debenture holders in advance: The issuer intends to sell or transfer substantial assets or subsidiaries or exclude them from the consolidated financial statements through entrusted management agreements or other forms. Such assets alone or cumulatively exceed 10 % or more of the issuer's audited consolidated financial statements for the most recent year or quarter. Further, such subsidiaries alone or cumulatively contribute 30 % or more of the issuer's audited financial statements for the most recent year."

On July 15, 2020, Jilin Province Water Industry Investment Group announced that it planned to transfer its subsidiary Daan Company to another local state-owned enterprise, which accounts for 11.58 % of the equity. Owing to the covenant's violation, the company held a meeting of the debenture holders on July 16, 2020. However, the bondholders disagreed to waive off the technical default formally at the meeting.

Change of control

A change of control clause specifies procedures to be handled when the issuer undergoes a specific type of change in its ownership and/or structure. As an illustrative example, the prospectus released by Taizhou Huaxin Pharmaceutical Investment Company on February 16, 2017, contains the following clause:

"12.3.6 Change of controlling shareholder, actual controller, and senior management. During the term of the debt financing instrument, if there is a change in the issuer's actual controller (or controlling shareholder, senior management), or if the chairman of the board is unable to perform duties, the issuer shall make a public announcement within 2 working days from the date of the occurrence of the above situation, and convene a meeting of the debenture holders."

On July 19, 2019, Taizhou Huaxin Pharmaceutical Investment Company announced that the chairman, director, chief executive officer, and chief financial officer have been adjusted. Owing to the covenant violation, the company held a meeting of the debenture holders on August 6, 2019, and received a waiver from the bondholders.

Keepwell and liquidity support deed

Keepwell and liquidity support deed is a provision to ensure that a related party (predominantly a parent company) agrees to maintain financial backing and liquidity support if the issuer encounters solvency problems throughout the term of the debt financing instrument. Such a covenant is uncommon in plain vanilla bonds. However, a keepwell and liquidity support deed agreement is frequently used in asset-backed securities as a credit enhancement method.

Secured debt

A secured debt provision means that an issuer agrees to offer collateral or a pledge to back the bond's repayment. Such a covenant is rarely used in debt financing instruments.

Appendix 2

According to Chen and Wei (1993), the waiver decision can be analyzed by using the Black-Scholes-Merton option-pricing framework (Black and Scholes, 1973; Merton, 1974); that is, the creditors are viewed as owning the firm and selling a call option to the stockholders. In this way, at any time t before maturity, the value of the debt (D) is equal to the value of the firm (V, assume as a random variable) minus the value of the stock, which is a call option with V as the underlying asset. As a result, the current value of the debt, D, can be derived from the Black-Scholes-Merton option-pricing formula as follows:

$$D = V \cdot N\left[\frac{-\ln\left(\frac{V}{F}\right) - \left(r + \frac{\sigma^2}{2}\right)\tau}{\sigma\sqrt{\tau}}\right] + F \cdot \exp(-r\tau) \cdot \left[\frac{\ln\left(\frac{V}{F}\right) + \left(r - \frac{\sigma^2}{2}\right)\tau}{\sigma\sqrt{\tau}}\right] \tag{4}$$

where N (·) is the cumulative standard normal distribution function, V is the firm's value, F is the face value of debt, σ^2 is the instantaneous variance of V, r is risk-free interest rate, and τ is the time to maturity.

If a waiver is granted when a technical default occurs at any time before maturity, the value of debt remains as D derived above. If bond investors require immediate repayment (non-waive), they receive the expected value of the bond:

$$D' = \min[V', F \cdot \exp(-r\tau)] - OL \tag{5}$$

The opportunity loss is the investor's ability and cost to reallocate a comparable investment (OL). Eq. (5) indicates that, by calling the bond, the creditors receive the lesser of the firm's value (V') upon the call and the discounted value of the face amount, after subtracting a term representing the opportunity loss. The magnitude of V' is always unknown and could be lower than V (the value of firm without the call) since calling the loan will increase the firm's bankruptcy.

Therefore, the decision rule of waivers can be summarized as follows: if $D >$ D', waive; if $D <$ D', do not waive. From the above two equations, we can see that the decision to waive the violation depends on the relative value of D, F and OL. In addition, the waiver decision is affected by the leverage ratio (inverse of V/F), τ (maturity), and r (interest rate).

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