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Debt Covenant Violation and Real Earnings Management: Evidence From the U.S.

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Purpose: This article examines the real earnings management activities of U.S. firms after their covenant violations. Design/methodology/approach: Regression discontinuity design is adopted to conduct the analysis. Findings: This study shows that, instead of manipulating accruals, the firms make more real earnings management after their financial covenant violations. When covenant violations are classified on net worth and current ratio covenant restrictions, different patterns of real earnings management are detected. Research limitations/implications: This finding enriches the debt covenant hypothesis on whether managers carry out real earnings management after a covenant violation. Practical implications: This paper provides a new perspective for understanding earnings management and is of great significance to alert stakeholders and the monitoring system to the firm's self-interest behavior and emphasizes the significance of investor protection in the context of covenant violation. Originality/value: The issues investigated in this paper have never been studied in the literature. This study provides a new perspective for understanding earnings management and is of great significance to alert stakeholders and the monitoring system to the firm's self-interest behavior and emphasizes the significance of investor protection in the context of covenant violation.

Keywords: covenant violation, earnings management, real earnings management, regression discontinuity design

Introduction

According to the 2020 Global Research Report of Bank of America, the scale of bonds or loans of U.S. companies has reached a record high of $10.5 trillion, 30 times larger than half a century ago. It is worth noting that half of the investment grade bonds are on the verge of BBB credit rating, and the likelihood of defaults becomes more and more apparent. How would the firms act in such a situation? Would they take action to boost the market at the expense of investors' interest? This paper investigates firms' real earnings management activities after their covenant violations in the U.S. in the hope to shed light on debt covenant violations and investor protections.

Previous research has shown that there is a certain relationship between debt covenant violations and earnings management. On the one hand, positive accounting theory predicts that firms approaching covenant

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violation have the incentive to adjust the future income to the current period[1] to avoid cost of technical default (Watts & Zimmerman, 1986). Moore (1973) and DeAngelo (1988) indicate that new executives intend to take an earning "bath" in poor financial conditions. Defond and Jiambalvo (1994) provide evidence of positive accrual manipulation when covenant violations are about or have occurred. Additionally, Beneish (1997) shows that changing accounting policies to increase profits to avoid violations is widely adopted, especially when firms are engaged in abnormal internal transactions. In addition, managers of covenant-defaulting companies make accounting changes to increase revenue so as to offset the increase of harsh debt covenant restrictions (Sweeney, 1992).

On the other hand, banks are found to supervise and restrict their borrowers to adopt earnings management to reduce information asymmetry (Bharath, J. Sunder, & S. Sunder, 2008), which would reduce the possibility of firms manipulateing their earnings, such as delaying asset write-offs. Banks are likely to increase monitoring of financial officers' accounting choices when firms are in poor financial conditions (Stice, 1991). Notably, as earnings management can extend beyond accruals manipulation (Roychowdhury, 2006) which is easily detected by auditors (Gunny, 2005), will firms manipulate real activities to achieve the expected book surplus[2]? For example, the sales of inventory will be accelerated by increasing price discounts or favorable credit conditions to increase the book surplus of the current period, making it more difficult to be found by external auditors. In practice, chief financial officers prefer to change their firms' operating policies to adjust the financial report rather than risk losing reputation or touching the law resulting from the default (Graham, Harvey, & Rajgopal, 2005).

Literature mainly examines the behavior of earnings management before covenant default but rarely investigates the economic consequences of debt covenant violations. Violations of financial covenants are most often related to breaching the financial protection clauses, also known as technical defaults. Therefore, they are not real defaults but can bring the transfer of control rights and the threat of accelerating the collection of loan from the creditor. Then when the agency cost is reduced, will the firm stop manipulating earnings management? This study contributes to the literature on whether managers carry out earnings management of accruals or actual activities (e.g., cutting R&D expenditures, reducing the unit cost of goods sold) after their covenant violations.

As accounting-based covenant restrictions can affect managerial decision-making and accounting choice (Duke & Franz, 1995), to answer the question of how debt covenant violations impact earnings management, any unified conclusion may be biased. Rather, investigating the earnings management device by mode and clause of debt covenants will be more conducive. This article also provided a more nuanced insight into the impact of debt covenant violations with different restrictive clauses on earnings management patterns.

Furthermore, regression discontinuity design (RDD) is adopted to address the endogeneity problem. Covenant violations are observable and common in financial contracts (Dichev & Skinner, 2002). Replacing the distances between the accounting item and the threshold by covenant violations ensures eliminating the possibility that variables are jointly determined. Additionally, relying on local variation in covenant violations,

[1] Watts and Zimmerman (1986) put forward the debt covenant hypothesis, that is, the debt covenant with financial ratio to construct the default threshold makes enterprises have the motivation to avoid default through accounting policy choice. Healy et al. (1999) point out that unexpected accruals can prove the existence of (accounting) earnings management.

[2] Schipper (1989) first puts forward the concept of real activity earnings management, which is based on actual operational behavior.

which is very close to random and independent events, we can ignore the irrelevant characteristics of firms that fall into the narrow band of the distance to the covenant threshold.

Our results show that upon breaching a covenant, as control rights shift to the creditor brings the reduction of information asymmetry, firms choose to manipulate the financial situation through real activities rather than discretionary accruals. And real earnings management increases in response to a covenant violation at an approximate level of 0.05% per quarter. Specifically, firms in violation of a current ratio covenant are inclined to increase the abnormal production cost while those with a net worth covenant violation engage more in manipulating the cash flow.

These findings are robust when incorporating a control variable matrix, including indicators of firm size, profitability, and operating performance. Further, with the entire sample, we expand the baseline regressions by including the higher-order terms. As for the subsample of observations that fall into the optimal narrow band around the threshold, the function form is relaxed compared to the baseline regression. Additionally, the results from an RD design can be influenced by various choices. We scale the bandwidth from 75% to 150% and select 25% to 75% of sample quantiles within four times the optimal bandwidth as the placebo cutoff points for the robustness test. For both current ratio and net worth samples, the results are statistically robust and enrich the debt covenant hypothesis that once breaching the covenant, executives are motivated to make an upward real earnings management.

Manipulating real activities is more difficult to detect than manipulating abnormal accruals, and can make the firm deviate from the optimal operating and ultimately affect the value of the firm (Cohen & Zarowin, 2010). This paper is therefore of great significance to alert stakeholders and the monitoring system to the managers' self-interest behavior and investor protection.

The paper proceeds as follows. Section 2 presents the hypothesis about debt covenants and earnings management. Section 3 describes the sample selection and measures of variables. Section 4 presents the model construction and the results of our analysis examining the impact of covenant violations on real earnings management. Section 5 reports the robustness test. Section 6 examines the possible cross-sectional variation in the discretionary accrual responses to covenant violations. Section 7 concludes.

Literature Review

Debt Covenant Hypothesis

The debt covenant hypothesis addresses that under the same other conditions, the closer the firm is to violate the debt covenant restrictions, the more likely it is to choose the accounting policy which allows transferring the future earnings to the current period (Watts & Zimmerman, 1986). Most literature comes to empirically verify this hypothesis, providing evidence of upward accrual manipulation when covenant violations are about to occur (Defond & Jiambalvo, 1994; Franz et al., 2014).

With the deterioration of the firm's operating performance and financial condition, various financial and non-financial protection clauses in the debt contract will be triggered first. Violations of covenants most often relate to breaching the financial protection clauses, also known as technical defaults. Principally, covenant violations in finance may bring adverse effects to companies in terms of reputation damage and operation limitation. First, the bank's credibility and commercial credit are damaged, which is likely to affect their future financing conditions. In addition, as technical default is not a real default, creditors may intervene in the operation of the company, which is reflected in the additional debt covenant restrictions.

Executives balance the tax cost caused by the change of accounting procedure and the benefit generated by prolonging technical default to make a better decision (Sweeney & Amy, 1992). Alternatively, executives prefer making accounting changes with lower tax costs. There is evidence that firms use the valuation allowance as an earnings management device, as changes in financial accounting tax reserves and valuation allowances affect the firms' tax expense but not their actual taxes paid (Dyreng, Hanlon, & Maydew, 2008).

However, existing literature does not consistently support the debt covenant hypothesis and rarely examines the behavior of earnings management after debt covenant violations. No clear evidence is found to support the point that defaulting firms conduct more positive earnings management compared with non-defaulting firms (Healy & Palepu, 1990; H. DeAngelo, L. DeAngelo, & Skinner, 1994). And no consistent conclusion has been reached on the relationship between debt covenant violations and earnings management (Fields, Lys, & Vincent, 2001). To this end, scholars try to find out more factors that may affect the firm's earnings management decision. Mohrman and Mary (1993) show that affected by FAS No. 19, firms reduce the use of full-cost methods in oil and gas production. Firms with a stronger dependence on covenant restrictions tend to recognize losses and control earnings in time (Nikolaev, 2010). In addition, accounting-based covenant restrictions can affect managerial decision-making and accounting choices (Duke & Franz, 1995).

An Explanation for Debt Covenants

The debt covenant is to state the relationship between the borrower and the creditor. They usually do not sign the terms fully complying with GAAP, but mainly based on their needs (Leftwich, 1983). Investigating the debt issuance of 105 banks between 1979 and 1984, Black, Carnes, Mosebach, and Moyer (2004) find that debt covenants bring a considerable reduction in agency costs.

Generally, in addition to designing the maturity date and term structure of the debt, the creditor and the borrower will also negotiate on restrictive clauses in consideration of moral hazard, of which the financial constraints are of great importance. Evidence has been found that for creditors of small firms with high internal ownership, terms based on the current ratio are regarded as a protection against wealth transfer. In contrast, for those of the larger ones, terms based on tangible assets are adopted, regardless of their internal ownership (Griner & Huss, 1995). Indeed, what debt covenants constrain can also be different with the change of debt nature. While public debts require more non-accounting information (such as sinking funds, guarantees, and seniority), private debts have more stringent financial restrictions (El-Gazzar, 1993). That's why technical defaults often occur in private debt issues (Kahan & Tuckman, 1995).

Development of Earnings Management

Brown (1999) elaborates that firms consciously make the earnings report reflect the expected level of management within the scope permitted by the accounting standards. In other words, it does not represent the actual performance (Levitt & Duncan, 2001; Goel & Thakor, 2008), but plays as a strategic adjustment tool for meeting the requirements of debt terms (Watts & Zimmerman, 1990; Sweeney, 1994) and raising the issue price of shares (Aharony, 2000).

Choosing to manipulate accruals or taking practical actions to achieve the expected book surplus are collectively referred to as earnings management. That is, earnings management includes accrual manipulation and real activity manipulation, the former referring to the use of accounting treatment to adjust the book profit without changing the economic activities of the firm or affecting the cash flow (Zang, 2006). With the improvement of the legal system and accounting standards, managers feel more and more difficult to control

earnings with the use of discretionary accruals (Zhong, Gribbin, & Zheng, 2007; Lee, Lev, & Yeo, 2007). And after the SOX Act was promulgated in 2002 in the United States, earnings management began to shift from accruals to actual activities (Cohen, Dey, & Lys, 2008). On one hand, compared with accrual earnings management, real earnings management is more difficult to detect, and it is difficult for supervisors to distinguish the manipulation of real activities from normal production and operation activities. On the other hand, external auditors can lack basis and standards when identifying the manipulation of real activities, so it is also difficult for the audit mechanism to effectively restrain real earnings management.

Roychowday (2006) divides real activity manipulation into three parts: control of sales, production cost, and discretionary expense. Firstly, upward manipulation of sales is to achieve a temporary increase in revenue by means such as price discounts and relaxation of credit conditions, resulting in lower operating cash flow. Secondly, production cost control refers to carrying out large-scale production beyond usual standards to reduce unit fixed cost, thereby improving reported earnings. Under this circumstance, the actual production cost expands in general and is higher than expected. Thirdly, with the reduction of discretionary costs (such as R&D expenditure and advertising expenses which do not generate income in the current period), the reported earnings can also be improved. Generally speaking, real earnings management improves the firm's income and changes the firm's operating cash flow at the cost of distorting the firm's usual production and operating activities.

Data and Variables

Data and Sample Construction

Our sample is obtained from Compustat, which consists of quarterly accounting data for financial and non-financial firms. This frequency is consistent with most compliance reports to creditors and SEC reporting requirements. To collect the relevant stock and trading data, we select the observation of the last working day of each quarter in CRSP as the quarterly data to construct the merged CRSP-Compustat database, from which we can calculate real earnings management and control variables. Information on covenants such as amount, maturity, and the restrictive threshold is from Loan Pricing Corporation's Dealscan database. By matching *gvkey*, an identification for firms in both Compustat and Dealscan, we draw the current ratio, net worth, or tangible net worth variable and covenant threshold together to measure the violation of a covenant. We then eliminate observations if the firm is financial, if the date is before 1994 (Chava & Roberts, 2008), and if the Compustat accounting data or the Dealscan loan data are unavailable. At the same time, we winsorize all continuous variables on 1% and 99% quantiles to eliminate the influence of outliers on sample robustness.

We finally divide the intersection of Compustat, CRSP, and Dealscan between 1994 and 2015 into two samples based on whether the firm is bound by a current ratio covenant or a net worth covenant. In other words, we focus on covenants restricting the current ratio or net worth and separate them to study in parallel, since although the results for the two subsamples are similar, there are still some differences. Our current ratio sample contains 18,885 firm-year observations from 1,140 firms that entered into 2,320 loans. With regard to the net worth sample, the process results in 60,501 firm-quarter observations corresponding to 3,100 firms with 7,487 loans. We follow Chava and Roberts (2008) in measuring the covenant threshold and covenant violation. The result shows that among the two subsamples, there are 22.7% firm-quarter observations corresponding to a current ratio covenant and 16.9% firm-year observations with a net worth covenant in violation, which is

consistent with previous studies that covenant violations occur fairly common (Dichev & Skinner, 2002; Robert & Sufi, 2009).

Measurement of Real Earnings Management (REM)

Roychowdhury (2006) measures real earnings management with three indicators: abnormal operating cash flow (ABCFO), abnormal production cost (ABPROD), and abnormal discretionary expenses (ABDISEXP). These abnormal values can be obtained by subtracting the corresponding normal numbers calculated by regression from the actual numbers of firms in the current year. Here, the residuals are calculated by the following regression equations.

$$\frac{CFO_{i,t}}{TA_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{TA_{i,t-1}} + \alpha_2 \frac{S_{i,t}}{TA_{i,t-1}} + \alpha_3 \frac{\Delta S_{i,t}}{TA_{i,t-1}} + \varepsilon_{i,t} \quad (1)$$

Abnormal operating cash flow (ABCFO) is measured by estimating the following cross-sectional model for each industry and quarter. $CFO_{i,t}$ is referred to as cash flow from operating activities (Compustat OANCF) of firm *i* in quarter *t*, while $TA_{i,t-1}$ represents the total assets at the beginning of the quarter (AT), $S_{i,t}$, represent revenue in the quarter and $\Delta S_{i,t}$ represents changes in revenue. The residuals are the inverse measures of manipulating scales expenses. The more negative the ABCFO, the higher the curtailment of scale expenses.

Before overproduction is calculated, the normal (expected) production cost by industry-quarter is first estimated as follows.

$$\frac{PROD_{i,t}}{TA_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{TA_{i,t-1}} + \alpha_2 \frac{S_{i,t}}{TA_{i,t-1}} + \alpha_3 \frac{\Delta S_{i,t}}{TA_{i,t-1}} + \alpha_4 \frac{\Delta S_{i,t-1}}{TA_{i,t-1}} + \varepsilon_{i,t} \quad (2)$$

$PROD_{i,t}$ represents the actual production cost of firm *i* in quarter *t* and is calculated by adding changes in inventory (INVT) to the cost of goods sold (COGS). The residual estimated on a firm-quarter basis represents a manipulation of the production schedule. The more positive the residual, the higher the degree of manipulation, indicating that firms improve production levels and allocate the fixed cost to more units to obtain a higher profit margin.

To determine curtailment of discretionary costs, Roychowdhury (2006) develops the research of Dechow, Kothari, and Watts (1998) and constructs a new expectation model as follows, where $DISEXP_{i,t}$ represents the actual discretionary expenses of firm *i* in quarter *t*, the sum of SG&A (XSGA) and R&D (XRD). The residuals represent the curtailment of discretionary expenses, of which the properties are similar to that of scale expenses.

$$\frac{DISEXP_{i,t}}{TA_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{TA_{i,t-1}} + \alpha_2 \frac{S_{i,t-1}}{TA_{i,t-1}} + \varepsilon_{i,t} \quad (3)$$

Considering that there may be some compensation between different real manipulative activities (Cohen et al., 2008), we combine the three real activities manipulation indicators into one measurement to reflect the overall real earnings management level:

$$Proxy_{i,t} = -ABCFO_{i,t} + ABPROD_{i,t} + ABDISEXP_{i,t} \quad (4)$$

When firms adopt real earnings management to increase their profits, we are supposed to see lower net cash flow, higher production costs, and lower operating expenses. Thus, the measurement of REM is positive, and vice versa.

Measurement of Covenant Violations

According to Chava and Roberts (2008), there are mainly four challenges in measuring the financial covenant threshold: firms with multiple overlapping loans, dynamic covenants with changing thresholds,

covenants with post-origination amendments that can have an impact, and covenants that are in violation in the quarter of the origination. We adopt hand-coding between the covenants and relevant amendments to adjust the impact of the third challenge and simply ignore the fourth on the premise that the violation is an error. Indeed, their inclusion has an insignificant effect on our results. The specific approaches for addressing the first two challenges are as follows.

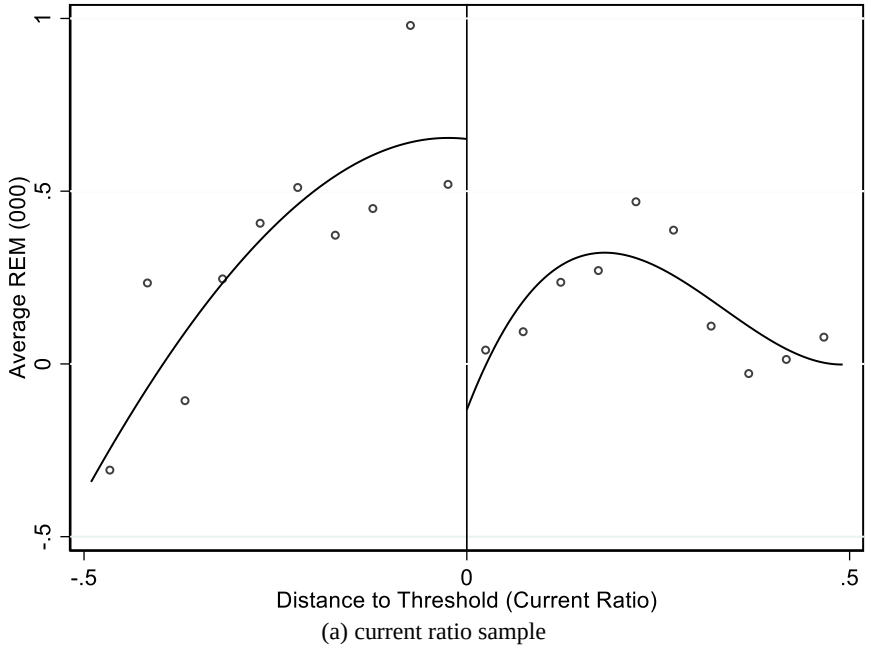
The essential problem for firms that enter into multiple loans is different thresholds in the overlapping period. We first define a firm with a loan as a firm-loan firm. For example, firm A with three loans (loan x, loan y, and loan z) will be split into firm A-x, firm A-y, and firm A-z. Then, we exclude the firm-loan firm beyond the loan life for each split firm. If loan x, loan y, and loan z overlap, we define the relevant threshold as the minimum one in the overlapping period. We finally combine these three firms into one firm.

For firms that enter into dynamic covenants, the initial threshold differs from the final threshold, and it is critical to measure the threshold for each intermediate period. Following Chava and Roberts (2008), we linearly interpolate the covenant thresholds over the loan life. Periodical increase is measured with the difference (between the initial and final value) divided by the total number of periods.

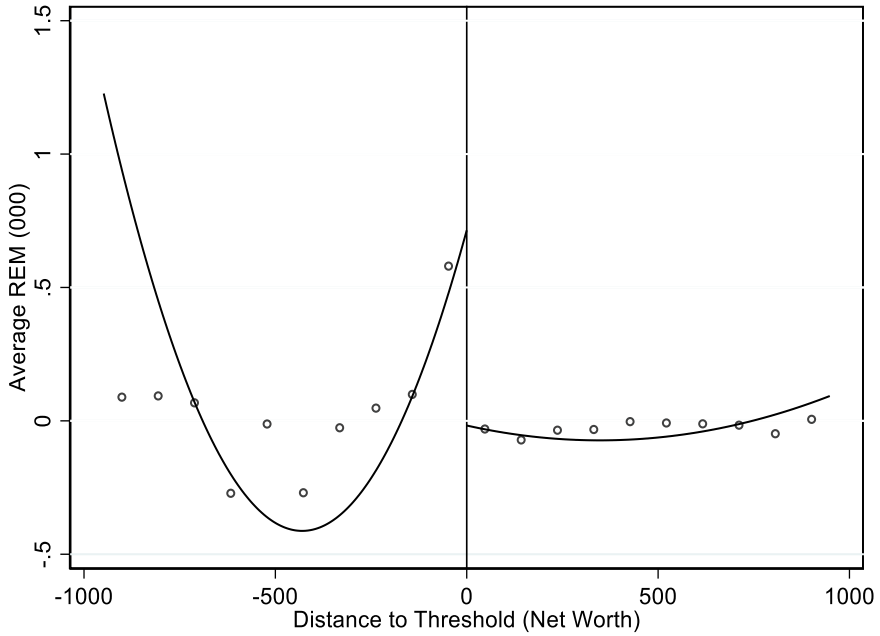
Empirical Results

Graphic Analysis

It has become a standard practice of RD analysis to show the discontinuous relationship between the treatment effect of the driving variable and the outcome variable through graphics, which helps us understand it intuitively (Lee & Lemiues, 2010). Figure 1 presents the relationship between the distance to the covenant threshold and the real earnings management. With several smooth lines obtained by estimating local polynomials on both sides of the threshold, we can see that, for both current ratio and net worth samples, the level of real earnings management has a noticeable jump at 0, precisely where technical default occurs.



(a) current ratio sample



(b) net worth sample

Figure 1. Upward level of REM caused by technical default.

Notes. The figure presents the relationship between real earnings management and covenant violations around the threshold with two selected samples in the optimal bandwidth, 0.491 and 948.834 for the current ratio and net worth sample, respectively. The Current Ratio (Net Worth) sample consists of selected firm-quarter observations for non-financial firms in the intersection sample of Compustat, CRSP, and Dealscan from 1994 to 2015 corresponding to a covenant restricting the current ratio (net worth).

The Regression Discontinuity Design

> Inference on the causal effects of treatment is one of the basic aims of empirical research. In observational studies, where controlled experimentation is not available, applied work relies on quasi-experimental strategies carefully tailored to eliminate the effect of potential confounders that would otherwise compromise the validity of the analysis. (Matias, Brigham, & Roc ́o, 2015, p. 1)

The regression discontinuity design is generally considered a quasi-experiment as there seems to be random grouping near the cutoff, bringing strong internal effectiveness. In this study, we follow Chava and Robert (2008) to use RDD to address the issue of endogeneity and establish causality. Specifically, our application of RDD to REM focuses on capturing local variation at the threshold. Firms falling into the narrow band of the distance to the covenant threshold are supposed to have no differences in other characteristics. Therefore, the only reason why the conditional expectation function jumps at the threshold is the treatment effect of the locally random violations. The treatment variable, $Treat_{i,t}$, is defined as:

$$Treat_{i,t} = \begin{cases} 1, & d_{i,t} < 0 \\ 0, & \text{otherwise} \end{cases} \tag{5}$$

where $d_{i,t}$ represents the distance between the observed accounting variable and the corresponding covenant threshold of firm *i* in quarter *t*, and is equal to either the observed current ratio or net worth minus the value of the corresponding threshold.

To estimate this treatment effect, we construct our baseline regression as:

$$Proxy_{i,t} = \alpha_0 + \beta d_{i,t} + \delta Treat\_rem_{i,t} + \gamma d_{i,t} Treat_{i,t} + \alpha_1 X_{i,t} + \eta_i + \nu_t + \varepsilon_{i,t} \tag{6}$$

where $Proxy_{i,t}$ is the overall real earnings management level at the end of the period, $X_{i,t}$ is a vector of control variables, η_i is firm fixed effect, ν_t is a year-quarter fixed effect, and $\varepsilon_{i,t}$ is a random error of the model. The interaction term $d_{i,t}Treat_{i,t}$ is introduced to allow more flexibility of the slope of the regression line on both sides of the cutoff. Our focus is parameter δ, the estimator of the treatment effect at either the observed current ratio or net worth equals the corresponding threshold value, representing the impact of a covenant violation on the overall real earnings management.

Control variables are also included. Rajan and Zingales (1995) suggest that the information asymmetry faced by small and medium-sized investors in large firms (*Size*, firm size) can be severe. When the firm's performance (*Roe*, the return on net assets of the firm) is not ideal, especially in the case of losses, managers may adopt upward earnings management to increase revenue. With longer operating cycles (*Turnover*, the reciprocal of the operating cycle), firms have poorer accruals quality (Francis, LaFond, Olsson, & Schipper, 2005). Real earnings management is measured with the manipulation of actual activities. In this regard, we also introduce *Cost* (firms' investment in fixed assets) and *Loss* (a state of loss), which are closely related to operating performance. Specifically, we introduce *Fcfi*, the firm's financing needs.

Table 1 presents descriptive statistics for these variables, stratified by whether the firm is (Treat) or is not (Well) in violation of the covenant in the current ratio and net worth samples. We can see a statistically significant increase in REM, both in terms of averages and medians, when firms violate covenants. Noticeable differences can also be seen from other firm characteristics, for example, for both current ratio and net worth samples, Roe, Loss, and Grow are significantly lower when a violation of covenants occurs. However, Turnover and Fcfi turn out to be heterogeneous across the Treat and Well groups in the two samples. To this, we will control some of them for variation when estimating. For control variables, we include Size, Roe, Cost, Turnover, Loss, and Fcfi, but not Ocf or Grow in Equation (6). All these variables constructed are defined in the Appendix.

When using the entire sample of firms for estimation, the regression function may contain higher-order terms, thus resulting in the deviation of the missing variable. At the same time, drawing third or higher-order terms into global regression may lead to inconsistent regression results (Gelman & Imbens, 2016). Therefore, quadratic terms are added into our baseline model to further ensure the accuracy:

$$Proxy_{i,t} = \alpha_0 + \beta_1 d_{i,t} + \delta Treat_{i,t} + \gamma_1 d_{i,t} Treat_{i,t} + \beta_2 d_{i,t}^2 + \gamma_2 d_{i,t}^2 Treat_{i,t} + \alpha_1 X_{i,t} + \eta_i + \nu_t + \varepsilon_{i,t} \quad (7)$$

Because the discontinuity is the source of identifying information, we also relax our basic regression to estimate Equation (8) on the selected samples which are close to the cutoff：

$$Proxy_{i,t} = \alpha_0 + \delta Treat_{i,t} + \alpha_1 X_{i,t} + \eta_i + \nu_t + \varepsilon_{i,t} \quad (8)$$

The distance between the selected sample and the cutoff is called bandwidth in RD literature. The smaller the bandwidth is, the lower the requirements for control variables and function forms are, but at the same time, more observations will be lost, and the estimation error will be increased (Angrist & Pischke, 2008). Therefore, we are supposed to find an optimal bandwidth to isolate the effect of the violation. The optimal bandwidth is widely discussed in recent literature, among which Ludeing and Miller (2007) propose the cross-validation method, and Imbens and Kalyanaraman (2009) make further contributions. We turn to the literature on nonparametric density estimation (Calonico, Cattaneo, & Titiunik, 2014; Calonico et al., 2016) to identify a robust measure of optimal bandwidth selection. For the current ratio sample, the optimal bandwidth is 0.394, and for the net worth sample, it is 948.843.

Table 1

Summary Statistics for Variables

	Current ratio				Net worth			
	Treat		Well		Treat		Well	
Variables	Mean [Median]	(SE)	Mean [Median]	(SE)	Mean [Median]	(SE)	Mean [Median]	(SE)
Size	5.416	(0.025)	5.313	(0.012)	5.177	(0.017)	5.849	(0.007)
	[5.333]		[5.316]		[5.148]		[5.855]	
Roe	-0.038	(0.005)	0.003	(0.001)	-0.062	(0.003)	0.009	(0.000)
	[0.009]		[0.022]		[-0.001]		[0.022]	
Cost	0.544	(0.005)	0.332	(0.002)	0.296	(0.002)	0.297	(0.001)
	[0.604]		[0.266]		[0.242]		[0.229]	
Turnover	0.250	(0.004)	0.351	(0.002)	0.367	(0.002)	0.344	(0.001)
	[0.151]		[0.305]		[0.317]		[0.295]	
Loss	0.501	(0.008)	0.264	(0.004)	0.587	(0.005)	0.235	(0.002)
	[1]		[0]		[1]		[0]	
Fcfi	-0.057	(0.002)	-0.032	(0.001)	-0.019	(0 .001)	-0.023	(0.000)
	[-0.031]		[-0.016]		[-0.006]		[-0.007]	
REM (000)	0.531	(0.104)	0.002	(0.048)	0.449	(0.087)	-0.030	(0.022)
	[-0.006]		[-0.001]		[0.024]		[-0.005]	
Ocf	0.037	(0.002)	0.034	(0.001)	0.005	(0.001)	0.036	(0.000)
	[0.035]		[0.030]		[0.011]		[0.034]	
Grow	0.900	(0.831)	3.088	(0.497)	1.703	(0.692)	3.473	(0.307)
	[2.178]		[3.297]		[0.941]		[3.850]	
Firm-Quarter Obs	4295		14590		10213		50288	

Notes. The table presents summary statistics—averages, [medians], and (standard errors) for two samples. The Current Ratio sample consists of all firm-quarter observations for nonfinancial firms in the intersection sample of Compustat, CRSP, and Dealscan from 1994 to 2015 corresponding to a covenant restricting the current ratio. The Net Worth sample consists of all firm-quarter observations for nonfinancial firms in the intersection sample of Compustat, CRSP, and Dealscan from 1994 to 2015 corresponding to a covenant restricting the net worth. Two samples are stratified by whether or not the firm is (Treat) or is not (Well) in violation of the covenant. For better readability of the data, here we expand REM by 1,000 times. All these variables are defined in Appendix A.

Primary Results

Panel A and Panel B of Table 2 present the global regression results for the current ratio and net worth samples, respectively. All specifications include both firm and year-quarter fixed effects, as shown at the bottom of the table. The first column of the two panels shows that after eliminating these two fixed effects, the key variable of covenant violations, it has a significant positive association with REM at levels of 0.058% for the current ratio sample and 0.051% for the net worth sample. It indicates that firms are inclined to engage in upward real earnings management when they violate covenants.

Columns 2nd through 5th report the results of including control variables, at least four of which in the two samples attain significance at conventional levels and are broadly consistent with existing literature studying real earnings management. However, the estimators of covenant violations are robust with their inclusion, which leads to average levels of 0.05% for the current ratio sample and 0.035% for the net worth sample. Concerning *Cost* and *Turnover*, the coefficients are significantly negative for the two samples, indicating that firms with

longer operating cycles and fewer capital expenditures have a higher degree of manipulation. The inclusion of Loss and Fcfi tests our hypothesis that firms in poor financial condition, especially in financing, are likely to manipulate the reports. Nevertheless, this result also shows poor financial condition is distinct from covenant violations which means the transfer of control rights. The final column in the two panels is based on estimating Equation (7), which attempts to address possible omitted higher-order term concerns and further isolate the treatment effect to the cutoff. While quadratic terms have little effect on covenant violations, which stay still at the levels of 0.05% and 0.035%, estimators of them turn out to be different but significant with the two samples, respectively, which enables us to address some differences between the covenants restricting the current ratio and the net worth.

Table 2

Global Regression Results

Panel A: Entire Current Ratio Sample						
	Specification					
	(1)	(2)	(3)	(4)	(5)	(6)
Treat	0.580***	0.534***	0.585***	0.444**	0.437**	0.465**
	(3.33)	(3.06)	(3.33)	(2.55)	(2.53)	(2.51)
d	0.129*	0.109	0.034	0.107	0.108	-0.125**
	(1.71)	(1.42)	(0.39)	(1.39)	(1.34)	(-2.29)
Treat * d	-0.329	-0.148	0.016	-0.004	-0.090	0.667
	(-1.04)	(-0.46)	(0.05)	(-0.01)	(-0.29)	(1.38)
Size		-0.242***	-0.274***	-0.205***	-0.235***	-0.262***
		(-3.77)	(-4.31)	(-3.22)	(-3.74)	(-4.10)
Roe		-0.889**	-0.642*	-0.374	-0.426	-0.875**
		(-2.53)	(-1.82)	(-1.01)	(-1.27)	(-2.49)
Cost			-2.415***			
			(-4.81)			
Turnover			-3.398***			
			(-7.52)			
Loss				0.847***		
				(7.21)		
Fcfi					-8.864***	
					(-15.04)	
d^2						0.008***
						(6.74)
Treat * d^2						0.229**
						(2.28)
Intercept	-1.507*	-0.373	1.804*	-0.685	-0.627	0.216
	(-1.68)	(-0.41)	(1.81)	(-0.75)	(-0.68)	(0.24)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year-quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Obs	18337	18337	18337	18337	18337	18337
Adj. R^2	0.080	0.083	0.091	0.086	0.113	0.087

Panel B: Entire Net Worth Sample						
	Specification					
	(1)	(2)	(3)	(4)	(5)	(6)
Treat	0.514***	0.344***	0.360***	0.214**	0.465***	0.358***
	(5.40)	(3.71)	(3.91)	(2.28)	(5.11)	(3.81)
d	0.000**	0.000***	0.000***	0.000***	0.000***	0.000***
	(2.35)	(3.77)	(3.66)	(3.84)	(4.45)	(5.55)
Treat * d	-0.000	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(-1.42)	(-3.44)	(-3.40)	(-3.66)	(-4.03)	(-4.96)
Size		-0.076**	-0.098***	-0.055*	-0.031	-0.091***
		(-2.37)	(-3.11)	(-1.74)	(-1.02)	(-2.68)
Roe		-1.926***	-1.804***	-1.472***	-1.068***	-1.924***
		(-6.57)	(-6.17)	(-4.67)	(-3.80)	(-6.57)
Cost			-1.442***			
			(-6.82)			
Turnover			-1.168***			
			(-4.19)			
Loss				0.539***		
				(7.64)		
Fcfi					-10.372***	
					(-25.37)	
d^2						-0.000***
						(-5.81)
Treat * d^2						0.000***
						(5.97)
Intercept	-0.404	0.165	1.256***	-0.090	-0.446	0.248
	(-1.23)	(0.44)	(3.06)	(-0.24)	(-1.18)	(0.65)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year-quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Obs	57831	57831	57831	57822	57831	57831
Adj. R^2	0.028	0.030	0.029	0.065	0.028	0.028

Notes. (1) The table presents regression results for the entire two samples, with Panel A presenting the current ratio sample and Panel B for the net worth ratio sample. The Current Ratio sample consists of all firm-quarter observations for nonfinancial firms in the intersection sample of Compustat, CRSP, and Dealscan from 1994 to 2015corresponding to a covenant restricting the current ratio. The Net Worth sample consists of all firm-quarter observations for nonfinancial firms in the intersection sample of Compustat, CRSP, and Dealscan from 1994 to 2015 corresponding to a covenant restricting the net worth. For better readability, here we expand every coefficient by 1,000 times. All these variables are defined in Appendix A. (2) *, **, *** represent significance at the levels of 10%, 5%, and 1% respectively.

The regression results with the two Discontinuity Samples are presented in Table 3. Recall that this estimation is based on Equation (8), of which the function form is relaxed compared to the baseline regression. The sample used contains only those discontinuous firm-quarter observations that fall into the optimal bandwidth around the threshold for the current ratio sample, which is 0.394, and for the net worth sample, 840.398.

Table 3

Regression Results with Discontinuity Sample

	Current ratio					Net worth				
	Specification					Specification				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Treat	0.406***	0.350**	0.382**	0.309**	0.327**	0.532***	0.344***	0.361***	0.206**	0.460***
	(2.58)	(2.24)	(2.44)	(1.98)	(2.12)	(5.43)	(3.61)	(3.81)	(2.14)	(4.93)
Size		-0.243**	-0.240**	-0.221**	-0.247**		-0.087**	-0.114***	-0.064*	-0.043
		(-2.45)	(-2.42)	(-2.23)	(-2.50)		(-2.48)	(-3.26)	(-1.83)	(-1.27)
Roe		-0.705	-0.594	-0.417	-0.470		-2.009***	-1.880***	-1.530***	-1.127***
		(-1.35)	(-1.14)	(-0.76)	(-0.94)		(-6.66)	(-6.24)	(-4.71)	(-3.89)
Cost			-2.973***					-1.533***		
			(-3.08)					(-6.86)		
Turnover			-1.728***					-1.249***		
			(-2.94)					(-4.27)		
Loss				0.480***					0.575***	
				(2.81)					(7.78)	
Fcfi					-6.099***					-10.760***
					(-6.30)					(-25.45)
Intercept	-1.993	-0.982	1.632	-1.172	-0.980	-0.503	0.157	1.334***	-0.127	-0.458
	(-1.09)	(-0.53)	(0.84)	(-0.62)	(-0.50)	(-1.48)	(0.40)	(3.07)	(-0.32)	(-1.14)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	6464	6464	6464	6464	6464	54062	54058	54058	54058	54049
Adj. R^2	0.145	0.148	0.153	0.150	0.164	0.026	0.030	0.031	0.031	0.068

Notes. (1) The table presents regression results with the two discontinuity samples. The Current Ratio (Net Worth) sample consists of selected firm-quarter observations for nonfinancial firms in the intersection sample of Compustat, CRSP, and Dealscan from 1994 to 2015 corresponding to a covenant restricting the current ratio (net worth). For better readability, here we expand every coefficient by 1,000 times. All these variables are defined in Appendix A. (2) *, **, *** represent significance at the levels of 10%, 5%, and 1%, respectively.

Consistent with our expectation, the results of Table 3 reinforce our findings that real earnings management increases sharply in response to a covenant violation at a statistically significant range of level from 0.05% to 0.02% across all of the specifications for both samples. Overall, covenant violations have a significant positive impact on real earnings management.

Nonparametric Analysis

In addition to the parameter estimation mentioned above, another choice for the estimator of $Treat_{i,t}$ is to use nonparametric estimation. Hahn, Todd, and Klaauw (1999) note that "the nonparametric estimator is numerically equivalent to" the parametric estimator. The local polynomial regression method is adopted to calculate the impact of covenant violations on real earnings management because the simple kernel regression

method will lead to a large deviation (Imbens & Lemieux, 2008). The same bandwidth is used in Figure 1 (0.491 for the current ratio sample and 948.834 for the net worth sample).

Table 4 presents the local polynomial regression results using the above identification strategy. Specification (2) of both current ratio and net worth samples incorporates additional control variables (*Size*, *Roe*, *Cost*, *Turnover*) while specification (1) does not. Nevertheless, except for some differences in the height of the coefficient, the estimators are all statistically significant and positive with real earnings management and are close to those by parameter estimation. For example, for the current ratio (net worth) sample, in Table 4, the local polynomial estimator of Treat is 0.585 (0.360) with the inclusion of four control variables, the corresponding parameter in Table 2 is estimated to be 0.527 (0.396). The absolute deviation is 0.058 (0.036), and the relative deviation is about 10% (10%). Both fall within the confidence interval, which further proves that the estimation results of this model are statistically appropriate.

Table 4

Local Polynomial Regression Results

	Current ratio		Net worth	
	Specification		Specification	
	(1)	(2)	(1)	(2)
Treat	0.602**	0.527**	0.669***	0.396***
	-0.602		-0.669	
	-2.301		-5.026	
	(2.30)	(2.03)	(5.02)	(8.28)
Conf. interval	(1.115, 0.089)	(1.036, 0.017)	(0.930, 0.408)	(0.490, 0.303)
Obs	7835	7836	54493	55916

Notes. (1) The table presents local polynomial regression results with the two samples. The Current Ratio (Net Worth) sample consists of selected firm-quarter observations for nonfinancial firms in the intersection sample of Compustat, CRSP, and Dealscan from 1994 to 2015 corresponding to a covenant restricting the current ratio (net worth). For better readability, here we expand every coefficient by 1,000 times. All these variables are defined in Appendix A. (2) *, **, *** represent significance at the levels of 10%, 5%, and 1% respectively. (3) The confidence level of the interval in the table is 95%.

Regression Discontinuity Design of Three Indicators

Specifically, real earnings management is measured by three indicators: abnormal operating cash flow (ABCFO), abnormal production cost (ABPROD), and abnormal discretionary expenses (ABDISEXP). To test in which way the companies are more willing to carry out the real earnings management, Equation (6) is employed to obtain the regression results with the entire sample.

As shown in Table 5, when conducting upward real earnings management, firms with a lower than standard current ratio are inclined to engage more in expanding production to reduce unit product cost, which is reflected in the increase of inventory cost (abnormal production cost). Firms may also increase profits by increasing discounts and relaxing credit sales, thus affecting cash flow. But this is more with the firms whose net worth is lower than a certain level. However, in case of violation, reducing R&D and advertising expenditure is not necessarily adopted. One possible reason is that the violation can damage the reputation, and financial difficulties may be a result of poor organizational management. Therefore, it is not recommended to manipulate discretionary expenses arbitrarily.

Table 5

Regression Results of Three REM Indicators With Entire Sample

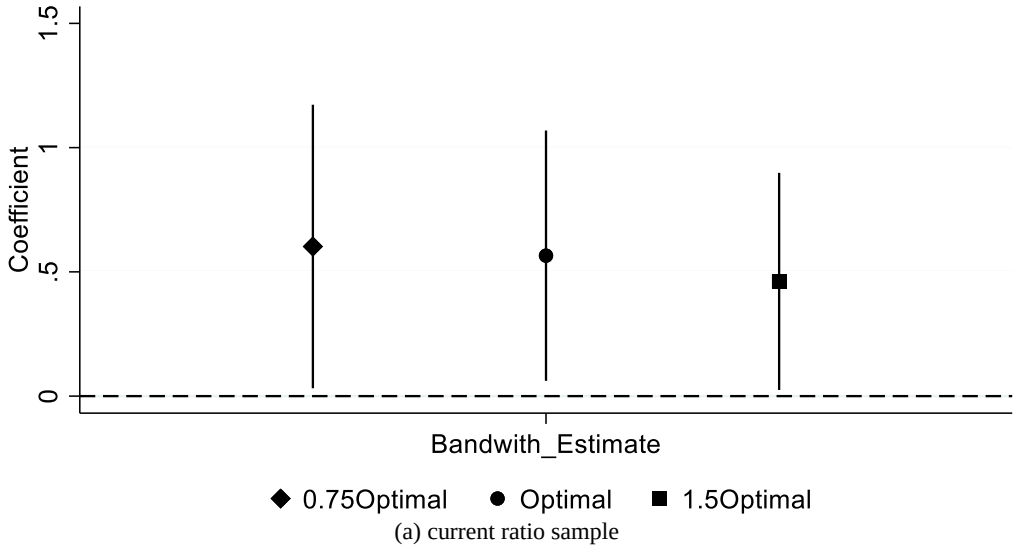
	Current ratio			Net worth		
	Specification			Specification		
	(1)	(2)	(3)	(1)	(2)	(3)
	CFO	PROD	DISEXP	CFO	PROD	DISEXP
Treat	-0.878	2.481**	-1.881	-1.404**	-0.834	0.781
	(-0.519)	(2.380)	(-0.384)	(-2.541)	(-1.392)	(0.535)
d	0.611***	-0.280**	-3.964	0.000	-0.000***	0.000
	(2.708)	(-2.392)	(-1.511)	(0.731)	(-3.693)	(0.532)
Treat * d	-0.265	0.370	-2.169	-0.000	0.000**	-0.000
	(-0.108)	(0.137)	(-0.347)	(-0.579)	(2.202)	(-0.316)
Size	1.772**	-0.220	-3.453	1.131***	0.609***	-0.966***
	(2.402)	(-0.297)	(-0.969)	(5.978)	(5.023)	(-2.814)
Cost	11.814***	-7.141***	-17.613*	13.417***	-3.451***	-1.953
	(2.741)	(-3.495)	(-1.825)	(8.393)	(-4.420)	(-0.597)
Intercept	-10.904*	4.783	31.332	-12.651***	-1.558	6.919**
	(-1.869)	(1.117)	(1.470)	(-5.699)	(-1.003)	(2.447)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year-quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Obs	18873	18873	18873	59305	59305	59305
Adj. R^2	0.018	-0.001	0.009	0.014	0.004	0.015

Note. (1) The table presents regression results of three real earnings management indicators with the two entire samples. The three real earnings management indicators are abnormal operating cash flow (ABCFO), abnormal production cost (ABPROD), and abnormal discretionary expenses (ABDISEXP). The Current Ratio (Net Worth) sample consists of selected firm-quarter observations for nonfinancial firms in the intersection sample of Compustat, CRSP, and Dealscan from 1994 to 2015 corresponding to a covenant restricting the current ratio (net worth). For better readability, here we expand every coefficient by 100 times. All these variables are defined in Appendix A. (2) *, **, *** represent significance at the levels of 10%, 5%, and 1%, respectively.

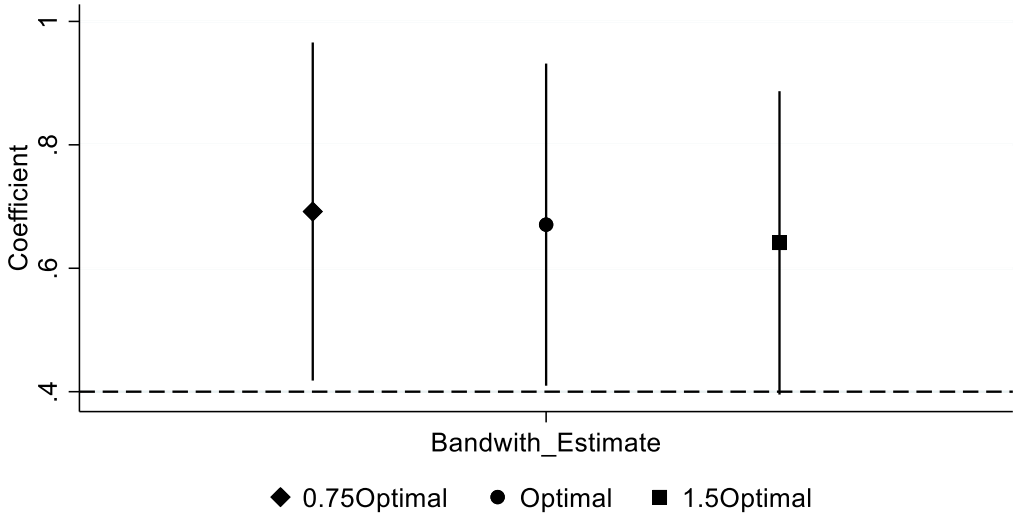
Robustness Tests

Sensitivity Test of Bandwidth

A general concern in RDD settings is that the regression results can be driven by the choice of the window around the threshold. This section sets the optimal bandwidth to 75% and 150% for both the current ratio and net worth samples to see whether the regression results are still significant. Figure 2 presents the regression coefficient giving the 95% confidence interval and shows that the regression results remain substantial, indicating that the conclusions are reliable.



(a) current ratio sample



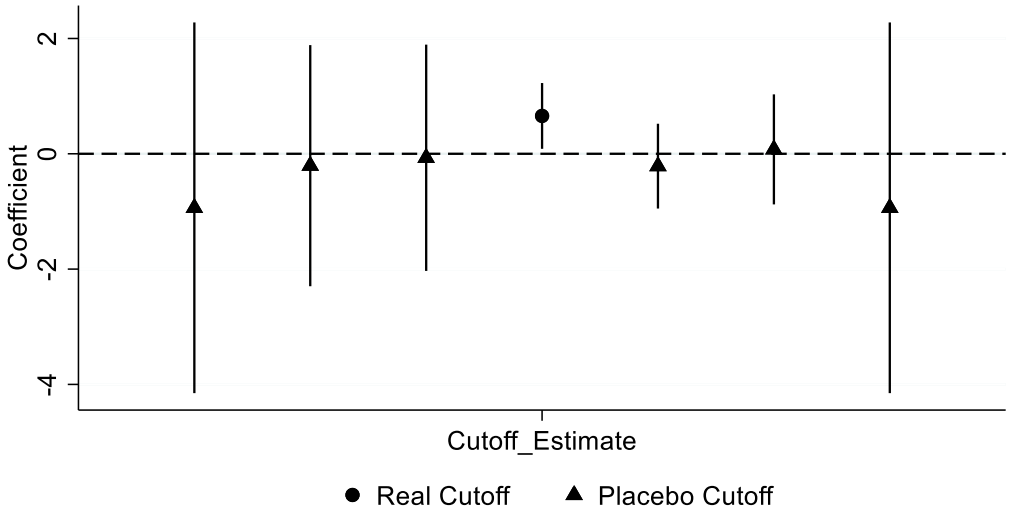
(b) net worth sample

Figure 2. Sensitivity test of bandwidth from 75% to 150% of the optimal.

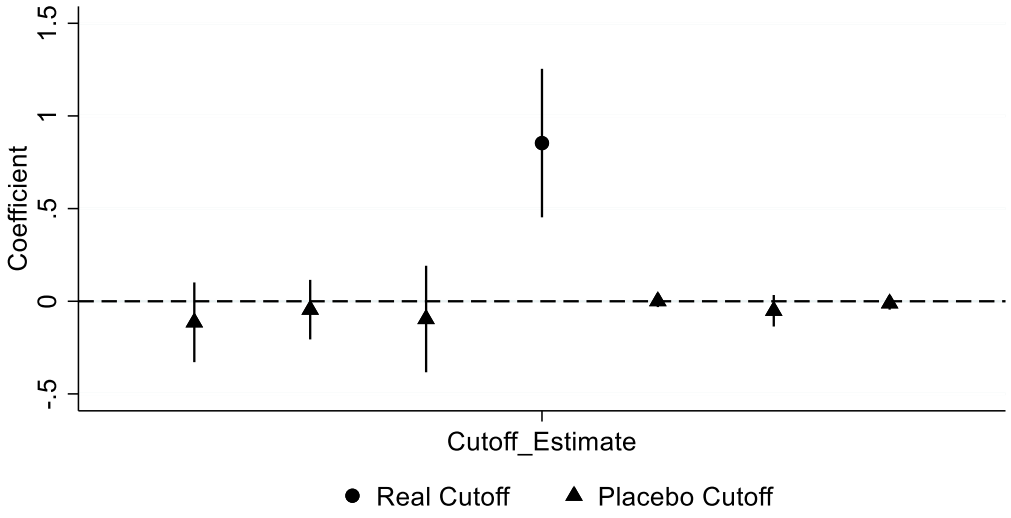
Notes. The figure presents the regression coefficient and the 95% confidence interval of the nonparametric regression, setting the bandwidth from 75% to 150% of the optimal for both the current ratio and net worth samples. The Current Ratio (Net Worth) sample consists of selected firm-quarter observations for nonfinancial firms in the intersection sample of Compustat, CRSP, and Dealscan from 1994 to 2015 corresponding to a covenant restricting the current ratio (net worth). For better readability, here we expand the coefficient by 1,000 times.

Placebo Test for Cutoff

Another natural idea of the robustness test is to choose values different from the real cutoff point as the placebo cutoff points. If the outcome variable also has a significant jump, the results of the real cutoff point regression model are not reliable. To this, we choose 25%, 50%, and 75% sample quantiles within four times the optimal bandwidth on both sides of the real cutoff point (where over 95% observations fall into) as the placebo cutoff points for regression. As shown in Figure 3, for both two samples, the regression coefficients of six placebo cutoffs are not significantly different from 0, indicating no treatment effect at these points. Therefore, the conclusion of the real cutoff point regression model is statistically stable.



(a) current ratio sample



(b) net worth sample

Figure 3. Placebo test for 25%, 50%, and 75% sample quantiles as cutoffs.

Notes. The figure presents the regression coefficient and the 95% confidence interval of the nonparametric regression by setting the 25%, 50%, and 75% sample quantiles within four times the optimal bandwidth on both sides of the real cutoff point as the placebo cutoff points for both the current ratio and net worth samples. The Current Ratio (Net Worth) sample consists of selected firm-quarter observations for nonfinancial firms in the intersection sample of Compustat, CRSP, and Dealscan from 1994 to 2015 corresponding to a covenant restricting the current ratio (net worth). For better readability, here we expand the coefficient by 1,000 times.

Further Research

Firms usually make a trade-off based on the corresponding cost-benefit when implementing earnings management (Roychowdhury, 2006). Although accruals manipulation, such as delaying asset write-offs, is easier to be detected by auditors, it is notable that changing accounting policies costs less than taking real operating activities does (Gunny, 2005). Subsequently, we are concerned that earnings management of discretionary accruals (DACC) is also adopted in response to a covenant violation.

Following the Modified Jones Model (Dechow, Sloan, & Sweeny, 1995), we define the discretionary accruals as:

$$\frac{TAC_{i,t}}{TA_{i,t-1}} = \alpha_1 \frac{1}{TA_{i,t-1}} + \alpha_2[\frac{\Delta REV_{i,t} - \Delta REC_{i,t}}{TA_{i,t-1}}] + \alpha_3 \frac{PPE_{i,t}}{TA_{i,t-1}} + \varepsilon_{i,t} \quad (9)$$

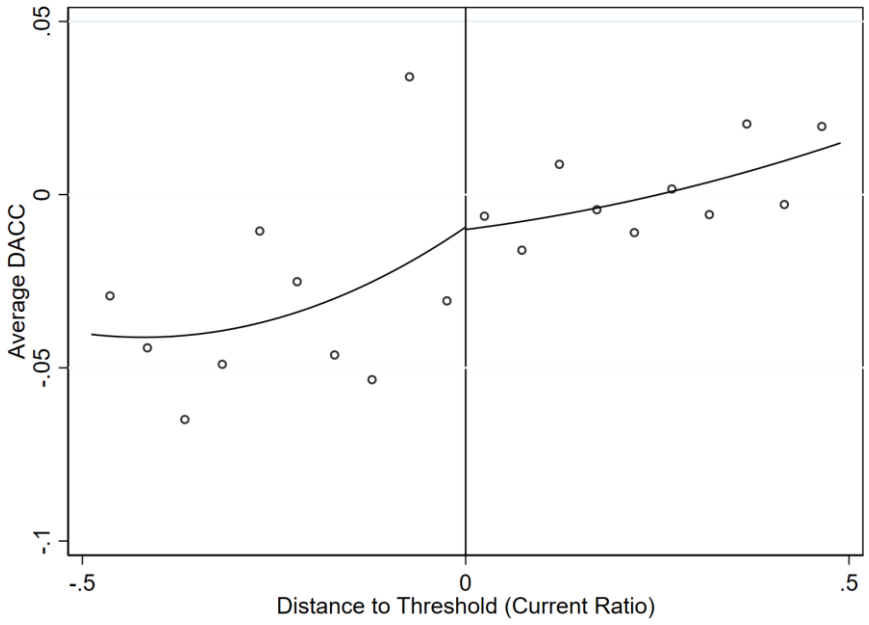
where, $TA_{i,t-1}$ represents total assets at the beginning of the quarter (AT), $\Delta REV_{i,t}$ in the model referrs to increment of operating revenue of firm *i* in quarter *t*, $PPE_{i,t}$ represents fixed assets in the quarter, $\Delta REC_{i,t}$ represents changes in accounts receivable, and $TAC_{i,t}$ is the total accruals, calculated as:

$$TAC_{i,t} = \Delta Current\ \ Asset_{i,t} - \Delta Cash_{i,t} - \Delta Current\ \ Liabilities_{i,t} - Dep\ \ Expense_{i,t} \quad (10)$$

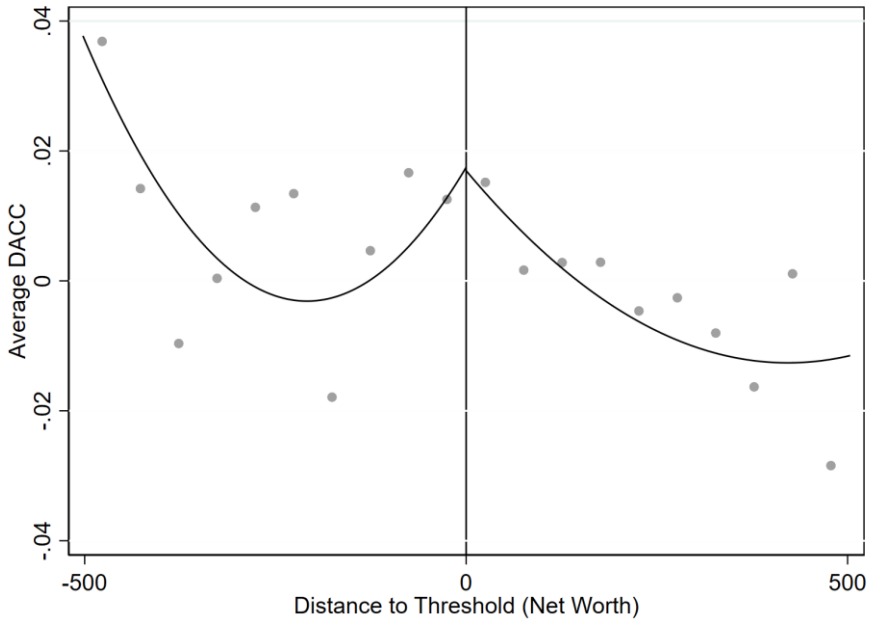
And the residual ($\varepsilon_{i,t}$) is the inverse of discretionary accrual ($DACC_{i,t}$).

Graphic Analysis

To intuitively see whether there is a discontinuous relationship between the treatment effect of the violation and the outcome variable, an RD graphic analysis is employed. Figure 4 presents the relationship between the distance to the covenant threshold and the discretionary accruals. Several smooth lines obtained by estimating local polynomials on both sides of the threshold show that, for both current ratio and net worth samples, there is no noticeable change in the level of discretionary accruals at 0, where technical default occurs.



(a) current ratio sample



(b) net worth sample

Figure 4. No obvious jump of discretionary accruals at technical default.

Notes. The figure presents the relationship between accrual earnings management and covenant violations around the threshold with two selected samples in the optimal bandwidth, 0.489 and 503.396 for the current ratio and net worth sample, respectively. The Current Ratio (Net Worth) sample consists of selected firm-quarter observations for nonfinancial firms in the intersection sample of Compustat, CRSP, and Dealscan from 1994 to 2015 corresponding to a covenant restricting the current ratio (net worth). Each observation (circle) presents average accrual earnings management relevant to every average value of the distance to the covenant threshold. The line reports the fitted value from a regression on the distance to the DACC.

Results of Regression Discontinuity Design

The baseline model, Equation (6), is employed to estimate the treatment effect with discontinuity sample, and the results are reported in the 3rd column of both samples. The entire sample of firms is also used for estimation in Equation (7). The first and the second columns in Table 6 present the global regression for the current ratio and net worth samples results, respectively. All specifications include both firm and year-quarter fixed effects, as shown at the bottom of the table. However, neither of the estimators has a significant association with DACC. It indicates that firms don't conduct discretionary accruals when covenant violation occurs.

Table 6

Regression Results of Discretionary Accruals

	Current ratio			Net worth		
	Specification			Specification		
	(1)	(2)	(3)	(1)	(2)	(3)
Treat	-0.941	-0.515	-0.348	0.503	0.516	0.362
	(-1.205)	(-0.595)	(-0.461)	(1.367)	(1.388)	(0.943)
D	-0.002	-0.164		-0.000	-0.000	
	(-0.014)	(-0.921)		(-1.331)	(-0.733)	
Treat * d	1.086	3.464*		0.000*	0.000	
	(0.934)	(1.846)		(1.662)	(1.066)	

Table 6 to be continued

d^2		0.006			0.000	
		(1.497)			(0.025)	
Treat * d^2		0.928*			0.000	
		(1.679)			(0.081)	
Intercept	3.477	3.844	73.704	-0.803	-0.809	-1.581
	(0.296)	(0.327)	(1.584)	(-0.242)	(-0.244)	(-0.394)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year-quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Obs	18574	18574	7496	58360	58360	50151
Adj. R^2	0.090	0.090	0.149	0.051	0.051	0.052

Notes. (1) The table presents regression results with both the discontinuity and entire samples. The Current Ratio (Net Worth) sample consists of selected firm-quarter observations for nonfinancial firms in the intersection sample of Compustat, CRSP, and Dealscan from 1994 to 2015 corresponding to a covenant restricting the current ratio (net worth). For better readability, here we expand every coefficient by 10 times. All these variables are defined in Appendix A. (2) *, **, *** represent significance at the levels of 10%, 5%, and 1%, respectively.

Conclusion

This paper enriches the debt covenant hypothesis with the regression discontinuity design to examine the impact of covenant violations on real earnings management. Our result shows that real earnings management increases in response to a covenant violation at an approximate level of 0.05% per quarter. Specifically, firms with current ratio covenant violations are inclined to increase production costs to boost earnings, whereas firms with lower net worth manipulate more cash flow. Moreover, this paper provides a unique scenario of the economic consequences of debt covenant violations. In a practical sense, it provides a new perspective for understanding the earnings management of companies, which is helpful in understanding the borrowers' accounting choices.

After the breach of the debt covenant, firms choose to manipulate the financial situation through real activities rather than discretionary accruals. Though more difficult to detect, a change in real activities can make the firm deviate from the optimal operating and ultimately affect the firm's value (Cohen & Zarowin, 2010). This paper is therefore of great significance to alert stakeholders and the monitoring system to the firm's self-interest behavior. It also emphasizes the importance of investor protection in the context of covenant violation.

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Appendix A. Variable definitions

Variable	Description
Current ratio	The ratio of current assets to current liabilities.
Net worth	Total assets minus total liabilities.
Size	The natural logarithm of total assets.
Roe	The ratio of net income to net worth.
Cost	The ratio of fixed assets to total assets.
Turnover	The ratio of sales revenue to total assets.
Loss	A dummy variable, if the net income of the previous quarter is negative, Loss = 1, otherwise, Loss = 0.
Fcfi	The ratio of the difference between net cash flow from operating activities and net cash flow from investing activities to total assets.
Ocf	The ratio of net cash flow from operating activities to total assets.
Grow	The ratio of the change in sales revenue to sales revenue of the previous quarter.