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ORIGINAL RESEARCH

Bank intervention and firms' earnings management: evidence from debt covenant violations

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Abstract
Earnings management has long been one of the main concerns in accounting and management literature, and the extent to which corporate governance mechanisms can discipline management behaviour and prevent earnings management has attracted increasing interest among policy makers and academic researchers. Differing from previous corporate governance literature that focuses mainly on the board and auditors, we explore the role of creditors in corporate governance. In particular, we examine the effect of bank intervention on earnings management via the lens of debt covenant violations, where control rights are transferred to creditors (banks). Using a Difference-in-Difference approach, we find that firms reduce both their accruals-based and real earnings management following debt covenant violations. The negative effect on earnings management is more prominent when banks possess greater bargaining and monitoring power and when firms are more financially constrained. By identifying a specific channel through which debt providers influence corporate financial reporting, our findings suggest that creditors can play an important role in governing organisations and disciplining management behaviour.

Keywords Corporate governance · Bank intervention · Earnings management · Debt covenant violation

JEL Classification G20 · G30 · M41

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1 Introduction

In this paper we study the impact of corporate governance on firms' earnings management behaviour from a different and unexplored angle. Accounting information plays an important role in facilitating the transaction of resources from capital providers to firms (Christensen et al. 2016). However, firm managers may have strong incentives to manipulate reported earnings (Cornett et al. 2009; Fung and Goodwin 2013), and such an ethically questionable practice leads to not only individual investors' losses but also adverse consequences on investment due to the increased cost of financing (Ullah et al. 2019). Corporate governance, as the mechanism aiming to discipline managers' behaviour, has attracted increasing interest among policy makers and academic researchers. In this paper we aim to investigate the effect of bank intervention on earnings management via the channel of debt covenant violations (DCVs).

Although a growing body of literature has investigated how certain dimensions of corporate governance affect earnings management,[1] the role of creditors has been largely omitted from the discussion of business ethics and neglected in the corporate governance literature (Cowton 2011). From an agency theory perspective, corporate governance research focuses on monitoring as one of the main solutions to the agency problem (Rutherford et al. 2007), while creditors are thought to be passive until firms are in default (Nini et al. 2012). However, creditors can play an active monitoring role even before a payment default.

Earnings management results from managers' unethical behaviour. In the operation of a firm, managers are the one with direct control over, and in a position to filter or distort, the information released to other groups of stakeholders (Hill and Jones 1992). Corporate governance mechanisms are therefore put in place to see whether the business is run and managed properly (Tricker 1984). While it is true that the board and auditors normally play more active roles in monitoring managers' behaviour, debt covenant allows creditors to exert their control rights (Hart 2001; Shleifer and Vishny 1997) and thus engage with the corporate governance process within the organisation. Similar to the contractual exchange resulting from payment defaults, control rights are transferred to creditors (e.g., banks) following DCVs (Nini et al. 2012), and this enables them to affect managers' decision making and firms' financial reporting policy, thereby constraining manipulation in reported earnings. Previous studies on earnings management and debt covenants have been mainly focused on managers' incentives to manage earnings close to DCVs (e.g., Dichev and Skinner 2002; Sweeney 1994), while little is known about reported earnings after the event of DCVs. A DCV is a special event that allows control rights to be transferred to creditors, following which creditors are likely to become more active in governing firms' operation and preventing managers' opportunistic behaviour, such as earnings management, in order to reduce their own credit risk. Therefore, we would expect a reduction in earnings management after the event of DCVs.

[1] The literature on the impacts of different dimensions of corporate governance on earnings management includes, for example, board independence (e.g., Chen et al. 2015; Cornett et al. 2009; Jaggi et al. 2009), board compensation (e.g., Cornett et al. 2009), board size (Ching et al. 2006; Xie et al. 2003), board duality (Ghosh et al. 2010), audit committee (Ghosh et al. 2010; Klein 2002; Sun et al. 2011; Xie et al. 2003), ownership structure (e.g., Bao and Lewellyn 2017; Ching et al. 2006; Ding et al. 2007; Kim and Yi 2006; Sáenz González and García-Meca 2014) and institutional investors (e.g., Hadani et al. 2011; Sáenz González and García-Meca 2014).

Using a comprehensive panel dataset that contains around 60,000 firm-year observations[2] during the period 1995–2008, as used in the study of Nini et al. (2012), we document that increases in violation of debt covenant significantly reduce both accruals-based and real earnings management of firms in the subsequent accounting period. Firms that violate debt covenants on average show lower absolute discretionary accruals (by 1.4 percent of total assets) and also lower total real earnings management (by 19.3 percent of total assets) than firms that do not. We also show that covenant violations are significantly and negatively related to instances of accounting restatement, further confirming that creditor intervention after DCVs can impact firms' accounting policy. To establish causality, we follow the work of Gu et al. (2017) and employ the Difference-in-Difference (DiD) approach. We find that, compared to control firms (that do not violate covenants), treatment firms (that violate debt covenants) experience a 1.62% drop in accruals-based earnings management and a 5.99% decline in real earnings management in the first year after DCVs.

We then examine whether the impact of bank intervention on firms' earnings management happens through the mechanism of financial constraints. A violation of debt covenant often leads to the renegotiation of credit agreement, which could contain more covenants, such as restricting access to credit and increasing interest rates (Nini et al. 2012; Roberts and Sufi 2009a; Sufi 2009). This could have a further negative impact on firms' financial conditions. Given that earnings management can be very costly to firms,[3] we would expect that, following the event of a DCV, financially constrained firms are less likely to be involved in earnings management in order to avoid the associated risk (e.g., increased interest rate or reduction/withdrawal of loan) than their non-constrained counterparts. We conduct several analyses to test this hypothesis.

First, as firms located in states with high levels of bank competition and firms with more bank loan relationships could have alternative financing sources and therefore tend to have fewer financial constraints, we expect that they should be less likely influenced, or influenced to a lesser extent, by bank intervention following DCVs. Second, we expect that the impact of bank intervention on earnings management should be greater for financially constrained firms, as measured by the Kaplan–Zingales index and dependence on industry-external finance (Duchin et al. 2010), than for financially non-constrained firms. Our results confirm these predictions.

Our study makes an important contribution to a growing literature on the governance and control role of creditors. Although theoretical literature suggests that financial intermediaries have advantages in performing monitoring roles on borrowers (e.g., Diamond 1984), empirical evidence on this appears to be limited. Creditors are thought to be passive in monitoring firms until firms are in default (Nini et al. 2012). Ahn and Choi's (2009) work is one of the first studies examining the monitoring role of banks, showing that borrowing firms' earnings management behaviour generally decrease when the strength of bank monitoring increases. They use different loan characteristics as proxies of bank monitoring strength, but their results document only correlation between bank monitoring and firm's earnings management without any inference of causal impact. Moreover, Ahn and Choi (2009) measure earnings management using discretionary accrual only. Although discretionary accruals are most widely used earnings management measure, they may not capture firm's earning management behaviors fully, as firms can also use real earnings

[2] The sample size varies for regressions on different models.

[3] Research has shown that firms' cost of capital is positively associated with the extent of earnings management (Kim and Sohn 2013) or negatively associated with the level of earnings quality (Francis et al. 2008).

management in place of or in conjunction with accrual-based earning management to manage earning (Franz et al. 2014). From a different angle, our study investigates the impact of bank intervention on both accrual-based and real earnings management following a special event (i.e. DCV) in which control rights are shifted to creditors. Using the DiD approach to address the potential endogeneity concern and through a series of tests on the underline channels, we provide robust evidence on the causal impact of bank intervention on firm's earnings management, showing that banks tend to be generally active in performing corporate governance role after the event of DCVs, and their intervention helps discipline firm managers' behaviour and reduce earnings management.

Our study also contributes to the literature on earnings management, which has been largely focused on managers' self-incentives for earnings management (e.g., Dutta and Fan 2014; Dutta and Gigler 2002; Dye 1988; Goldman and Slezak 2006; Greenfield et al. 2008; Laux and Laux 2009; Qiu and Slezak 2019). Although a number of studies have investigated whether managers are motivated to manipulate earnings approaching and/or around the event of DCVs (e.g. DeAngelo et al. 1994; DeFond and Jiambalvo 1994; Dichev and Skinner 2002; Franz et al. 2014; Jaggi and Lee 2002; Jha 2013; Sweeney 1994; Zang 2012), little is known about how creditor intervention after the event of DCVs influences firms' earnings management. For example, Franz et al. (2014) examine management incentives and behaviour when approaching to a DCV and find that firms close to violation or in technical default of debt covenants engage in higher levels of earning management. A close related study is Jha's (2013) work in which they investigate a firm's earnings management behaviour not only approaching the event of a DCV, but also during the periods in which the firm remains in violation. Our study, on the other hand, empirically tests firm's earnings management behaviour after one year of a DCV, showing that the transferred control rights that banks have following a DCV discourage both accruals-based and real earnings management activities.

We also provide additional evidence on the behaviour of financially constrained firms and add to the body of literature examining management responses to financial distress, for which there have been ambiguous theoretical predictions and empirical evidence. Jaggi and Lee (2002) show that financially distressed firms are likely to use income-increasing discretionary accruals when they expect that waivers would be granted for DCVs, and income-decreasing discretionary accruals when they expect that waivers would not be granted. Our study shows that, due to enhanced bank monitoring role after the DCVs, financially constrained firms in general reduced the intensity of their earnings management significantly after violating their debt covenants, while financially non-constrained firms did not.

The remainder of the paper is organized as follows. Section 2 discusses the relevant literature and hypothesis development. Section 3 describes the process of selecting our sample and constructing variables, and reports descriptive statistics. Section 4 presents our baseline results and addresses potential endogeneity issues. Section 5 explores possible underlying mechanisms. Section 6 concludes the paper.

2 Literature review and hypothesis development

Earnings management as an ethically questionable practice has been one of the main concerns in the areas of accounting and management studies. The separation of ownership and management control, as the main form of the organisation, results in a principal-agency problem between capital providers and firm managers. Accounting information plays an

important role in facilitating the transfer of resources between those two parties (Christensen et al. 2016), but whether the reported information truthfully represents the firm's performance depends largely on managers' decision-making and ethics. If firms could be treated as a nexus of contract, as Jensen and Meckling (1976) proposed in the principal-agency theory, management is the only group that can have the contractual relationships with all other stakeholders (Hill and Jones 1992). Compared to managers, other stakeholders have information and control vulnerabilities (Brown 2013). Corporate governance is expected to alleviate agency problems (Robert and Sufi 2009b), and literature on debt contract highlights theoretically the important role that creditors could play in this regard (e.g., Hart and Moore 1994, 1998; Shleifer and Vishny 1997).

A debt contract with covenants[4] can be used to grant decision rights to the creditor when profit maximization is less efficient or managers of the firm may have inefficient behaviour (Christensen et al. 2016; Robert and Sufi 2009b). A violation of debt covenants often refers to an event of "technical default", upon which the control rights are shifted to the creditor, who has the right to demand early repayment of, or accelerate, the debt (Chava and Roberts 2008; Nini et al. 2012).

The DCV offers a unique opportunity to examine the impacts or economic consequences of creditor control (Chava and Roberts 2008; Nini et al. 2012; Vashishtha 2014). It identifies a special mechanism via which control rights are transferred to creditors. Unlike payment default that leads to firm bankruptcy, such technical defaults occur more frequently in practice, and their potential impacts are not limited to firms facing exceptional circumstances (Chava and Roberts 2008).

A growing number of empirical studies have examined the impacts of creditor control following DCV events (e.g., Bhaskar et al. 2017; Billett et al. 2018; Chava and Roberts 2008; Christensen et al. 2019; Gao et al. 2017; Gu et al. 2017; Jiang and Zhou 2017; Nini et al. 2012; Vashishtha 2014). Chava and Roberts (2008) investigate how covenant violation affects firms' investment. They find that capital investment reduces significantly following a DCV, and the reduction in investment is economically larger for firms with relatively more significant agency and information problems. Their findings suggest that creditor intervention after control rights transfer can influence management's decision making of investment and mitigate investment distortions arising from financing frictions. Nini et al. (2012) provide evidence on the important role that creditors play in the governance of firms following DCVs. They observe a significant improvement on firm operating and stock price performance after DCVs, showing that creditor intervention increases the value of the average violating firm.

DCVs could be very costly to firms. Although in practice a violation of debt covenants often leads to the renegotiation of credit agreement rather than immediate repayment of loan or termination of further lending commitments (Nini et al. 2012), the renegotiated agreement could contain further covenants, such as restricting access to credit and increasing interest rates (Roberts and Sufi 2009a; Sufi 2009). Firms with a violation of debt covenants are also likely to face significantly tougher audit actions, such as higher auditor fees, a greater likelihood of receiving a going-concern opinion, and a greater likelihood of an auditor resignation (Bhaskar et al. 2017; Jiang and Zhou 2017).

We are interested in the role of creditor control on earnings management, motivated by the lack of research in this area. As the mechanism through which the conflict of interests

[4] Debt covenants are normally based on accounting information, in which there are restrictions on the levels of borrowing firms' risk and performance measures, such as leverage, interest coverage, current ratio, capital expenditures, dividend, etc. (Gao et al. 2017; Nini et al. 2012).

between principals and agents could be mitigated, corporate governance traditionally refers to equity holders' ability to influence management's decision making through the board of directors (Nini et al. 2012). A number of studies have investigated the impacts of board characteristics on earnings management, including board independence (e.g., Chen et al. 2015; Cornett et al. 2009; Jaggi et al. 2009), board compensation (e.g., Cornett et al. 2009), board size (e.g., Ching et al. 2006; Xie et al. 2003), board duality (e.g., Ghosh et al. 2010), board gender diversity (e.g., Lai et al. 2023), audit committee (e.g., Ghosh et al. 2010; Klein 2002; Sun et al. 2011; Xie et al. 2003), ownership structure (e.g., Ching et al. 2006; Bao and Lewellyn 2017; Ding et al. 2007; Kim and Yi 2006; Sáenz González and García-Meca 2014) and institutional investors (e.g., Hadani et al. 2011; Sáenz González and García-Meca 2014; Gunny and Pollard 2023), Senior managers(e.g., Qiao et al. 2023). However, how creditors could affect firms' earnings management has been ignored in the literature, as the prevailing view of corporate governance is that creditors play a very limited role in influencing the decision making of firms unless there is a payment default (Nini et al. 2012; Roberts and Sufi 2009b). Roberts and Sufi (2009b, p. 216) argue that "an explicit consideration of creditors is important even for the grand majority of firms that are current on debt payments".

Against such a background, we investigate the impact of bank intervention on earnings management and develop three hypotheses. First, as control rights are transferred to creditors when debt covenants are violated, banks are likely to become more active in governing firms' operation and preventing managers' opportunistic behaviour, such as earnings management, in order to reduce their own credit risk. Ahn and Choi (2009) observe that a decrease of borrowing firms' earnings management behaviour is associated with increased bank monitoring. Moreover, a violation of debt covenants often leads to the renegotiation of credit agreement (Nini et al. 2012). Banks would require more verified financial information to facilitate their decision making around possible changes in the loan terms. Such a demand and the improved access to accounting information provided by control right transfer would result in fewer opportunities for managers to manipulate the reported earnings. Therefore, we propose the following hypothesis:

H1: Bank intervention following DCVs will reduce firms' accruals-based and real earnings management.

If the reduced earnings management is due to bank intervention, we would expect that such an impact will be more significant for financially constrained firms. Nini et al. (2012) find that changes of loan terms following a covenant violation could include reduced amount of lending, higher interest rate, shorter maturity and the involvement of fewer lenders in the lending syndicate. Compared to financially non-constrained firms, financially constrained firms depend more heavily on bank loans, and thereby have less ability to bear increases in loan cost or decreases in credit. Hence, managers would have the incentive to reduce potential risk associated with unethical behaviour, such as earnings management, to avoid further punishment posed by banks. Therefore, we develop the second hypothesis:

H2: Financially constrained firms are more likely to reduce earnings management following DCVs than those that are less financially constrained.

Firms' access to financial resources tends to depend on external markets and their relationship with lenders. Therefore, we propose further hypotheses to test the mechanism through which bank intervention affects firms' earnings management. Our third hypothesis is concerned with the effect of competition level on the relationship between bank intervention and earnings management. In a high competition state, firms find it would be relatively easier for them to find alternative financing source, which could increase their bargaining power during the renegotiation process following DCVs, thereby mitigating the impact of

bank intervention on earnings management. Before the 1990s, the U.S. banking market was highly segmented. The deregulation process was applied in a staggered approach across different states with different levels of openness. Although interstate banking acquisitions were permitted since 1995 and out-of-state branching started from 1 June 1997, after the Interstate Banking and Branching Efficiency Act of 1994, states were allowed to adopt a range of approaches to form entry barriers for out-of-state banks.[5] By 2004, almost half of all bank branches in the U.S. were owned by banks with branch operations in more than one state (Rice and Strahan 2010). Our sample shows variation in the levels of competition for different states resulting from the staggered deregulation process in the U.S. and allows us to examine the potential moderating effect of competition level. We therefore propose the third hypothesis as:

H3: Firms in states with lower levels of bank competition are more likely to reduce earnings management following DCVs than firms located in high-bank-competition states.

Moreover, the connection with lenders can affect a firm's access to financial resources and is therefore likely to impact the relationship between bank intervention and firms' earnings management. Firms that have relationships with more potential lenders would more easily find alternative financing resources when needed, and thus rely less on the renegotiation of credit agreements in the event of DCVs. The effect of bank intervention on managers' decision making for such firms would be less significant. Therefore, we propose the fourth hypothesis as follows:

H4: Firms with connections to more lenders are less likely to reduce earnings management following DCVs than those with fewer lenders.

3 Data, sample and summary statistics

3.1 Data and sample formation

We obtained our sample from the Compustat database, covering the years 1995 to 2008 inclusive, and then matched them with the data of DCVs that were hand-collected by Nini et al. (2012) from 10-Q or 10-K SEC filings.[6] Nini et al.'s (2012) dataset is considered one of the most comprehensive datasets for DCVs and has been used by several subsequent studies, such as Bhaskar et al. (2017), Gao et al. (2017) and Gu et al. (2017). We restrict the sample to non-financial firms and require at least ten observations per year in each two-digit SIC industry group. Further, we require each firm-year to have sufficient Compustat data to compute the accruals metrics and real earnings management proxies (for detailed measurements see Sect. 3.2). Our final sample consists of about 60,000 firm-year observations.

[5] The law controls four areas: (1) minimum age for a target institution, (2) de novo out-of-state branching, (3) acquiring individual branches and (4) a state-wide deposit cap.

[6] The sample starts in 1996 and covenant violations are disclosed in the 10-Q or 10-K SEC filings. This dataset is available at Professor Amir Sufi's website: http://faculty.chicagobooth.edu/amir.sufi/, and more detailed description of sample selection can be found in Nini et al.'s (2012) study.

3.2 Measuring corporate earnings management

Literature has shown that reported earnings can be manipulated in two ways. The first way is based on discretionary accrual choices. Following Dechow et al. (2011) and Linck et al. (2013), we calculate discretionary accruals using a modified Jones model, where for each year we estimate the model for each industry classified by two-digit SIC code in order to account for industry-level economic changes that may affect accruals. The model is estimated as follows:

$$\frac{TA_{i,t}}{Asset_{i,t-1}} = \beta_0 \frac{1}{Asset_{i,t-1}} + \beta_1 \frac{\Delta Sales_{i,t} - \Delta AR_{i,t}}{Asset_{i,t-1}} + \beta_2 \frac{PPE_{i,t}}{Asset_{i,t-1}} + \varepsilon_{i,t} \tag{1}$$

where $TA_{i,t}$ is total annual accruals of firm i in year t, defined as change in non-cash current assets (change in current assets (ACT) minus changes in cash held (CHE)) and in current liability (LCT) and then plus change in debt in current liability (DLC) minus depreciation (DP).$\Delta Sales_{i,t}$ is the change of sales revenue (SALE) from the preceding year. $\Delta AR_{i,t}$ is the change in accounts receivable (RECT) from the preceding year. $PPE_{i,t}$ is the change in property, plant and equipment (PPENT). Discretionary accruals are calculated as the difference between $TA_{i,t}$ (scaled by lagged total assets) and the fitted value of the model.

Apart from accruals-based earnings management through discretionary accrual choice, earnings can be also manipulated by distorting real activities (Kim and Sohn 2013). Based on the extant literature (e.g., Cohen et al. 2008), we measure real earnings management from three dimensions. First, firms can accelerate sales through dropping prices or extending credit terms so as to temporarily boost earnings in the current period, but this could reflect in uncommonly reduced cash flow. We could therefore identify such real earnings management through an unusual level of cash flow from operations (CFO). We estimate the normal level of CFO using the following regression model for each year and each industry:

$$\frac{CFO_{i,t}}{Asset_{i,t-1}} = \beta_0 \frac{1}{Asset_{i,t-1}} + \beta_1 \frac{Sales_{i,t}}{Asset_{i,t-1}} + \beta_2 \frac{\Delta Sales_{i,t}}{Asset_{i,t-1}} + \varepsilon_{i,t} \tag{2}$$

The Abnormal CFO can be then calculated as actual CFO ($CFO_{i,t}$, scaled by lagged total assets) minus the assumed normal level of CFO obtained from Eq. (2).

Second, firms can manage their reported earnings through increasing production more than necessary. This can be achieved, for example, by spreading fixed overhead cost among a larger number of units, thereby lowering the fixed cost per unit. However, reducing the fixed cost per unit can reduce the reported cost of goods sold. Therefore, such manipulations can be detected through abnormally decreased production cost per-unit. The normal level of production cost is then estimated using the following model for each year and each industry:

$$\frac{Prod_{i,t}}{Asset_{i,t-1}} = \beta_0 \frac{1}{Asset_{i,t-1}} + \beta_1 \frac{Sales_{i,t}}{Asset_{i,t-1}} + \beta_2 \frac{\Delta Sales_{i,t}}{Asset_{i,t-1}} + \beta_3 \frac{\Delta Sales_{i,t-1}}{Asset_{i,t-1}} + \varepsilon_{i,t} \tag{3}$$

The actual production cost ($Prod_{i,t}$) equals cost of goods sold plus change in inventory. Abnormal production cost is the actual production cost (scaled by lagged total assets) minus the assumed normal level of production cost from Eq. (3).

Table 1 Summary statistics

Panel A						
Variable	N	Mean	SD	p25	p50	p75
AEM	56,689	0.1263	0.2339	0.0240	0.0572	0.1251
ABS_DCFO	57,407	0.2360	0.4398	0.0477	0.1071	0.2273
ABS_DPROD	51,256	0.2443	0.4448	0.0546	0.1344	0.2766
ABS_DEXP	46,565	0.3433	0.8232	0.0781	0.176	0.3271
REM	46,080	0.7505	1.0886	0.2966	0.4717	0.7537
Violation	57,407	0.1385	0.3454	0.0000	0.0000	0.0000
Competition	57,407	2.8696	1.3152	2.0000	3.0000	4.0000
Market to Book	57,407	2.6421	9.2124	0.8459	1.7861	3.4729
Sales growth	57,407	0.1403	0.5689	−0.0321	0.0595	0.2238
Size	57,407	4.6232	2.5634	2.9812	4.6934	6.3977
Finance	57,407	0.0833	0.0658	0.0433	0.0644	0.1125
Leverage	57,407	0.2220	0.3737	0.0000	0.0895	0.3042
Market equity	57,407	2.8143	8.0948	0.5000	1.0162	2.1320
ROA	57,407	−0.3972	1.9174	−0.1999	0.0107	0.0735
Current ratio	57,407	1.5577	5.1686	0.3161	0.5433	0.9185

Panel B	*Violation*		*No violation*			
Variable	Mean	Median	Mean	Median	Mean Diff	Median Diff
AEM	0.1206	0.0725	0.1396	0.0582	−0.0189***	0.0143***
ABS_DCFO	0.1494	0.0815	0.2730	0.1157	−0.1235***	−0.0342***
ABS_DPROD	0.1954	0.1245	0.2416	0.1373	−0.0462***	−0.0128***
ABS_DEXP	0.2366	0.1573	0.3533	0.1828	−0.1167***	−0.0255***
REM	0.5717	0.4202	0.8232	0.4887	−0.2515***	−0.0685***

This table summarizes the variables used in our study. The sample period is 1995–2008. The variables are defined in Appendix A1. *, ** and *** denote significance at the 10%, 5%, and 1% levels, respectively

Third, discretionary expenses such as advertising expense, research and development (R&D) expenses, and selling, general and administrative (SG&A) expenses can also be used to manage earnings,[7] as reducing them can boost reported earnings. We estimate the normal level of discretionary expenses using the following model for each year and each industry:

$$\frac{DiscExp_{i,t}}{Asset_{i,t-1}} = \beta_0 \frac{1}{Asset_{i,t-1}} + \beta_1 \frac{Sales_{i,t-1}}{Asset_{i,t-1}} + \varepsilon_{i,t} \tag{4}$$

Abnormal discretionary expenses can then be identified as the actual discretionary expenses ($DiscExp_{i,t}$, scaled by lagged total assets) minus the assumed normal level of discretionary expenses from Eq. (4).

As we are interested in how bank intervention affects the *intensity* of firms' earnings management, we compute the absolute terms of the abnormal values estimated from the four models described above as our proxies for accruals-based earnings

[7] Because SG&A expenses usually include R&D and advertising expenses, we set advertising and R&D expenses to zero when SG&A expenses are reported to avoid double counting.

management and real earnings management. Specifically, our measure of accruals-based earnings management (*AEM*) is the absolute value of discretionary accruals, while total real earnings management (*REM*) is the sum of the absolute values of abnormal CFO (*ABS_DCFO*), abnormal production cost (*ABS_DPROD*) and abnormal discretionary expenses (*ABS_DEXP*).

3.3 Summary statistics

Table 1 provides summary statistics for our sample (definitions of variables are presented in Appendix Table 9). We winsorize all continuous variables at the 1% level in order to address the influence of potential outliers. It can be seen from Panel A of Table 1 that the mean value of accruals-based earnings management (AEM) is 0.1263 and its median value is 0.0572, while the mean value of total real earnings management (REM) is 0.7505 and its median value is 0.4717.

Panel B of Table 1 presents the mean and median differences in earnings management intensity between firms that violate debt covenants and those without DCVs. It shows that mean of both accruals-based and real earnings management are significantly larger among firms that do not violate their debt covenants. The four in five median differences in earnings-management proxies are less among firms that violate their debt covenant. Although the mean and median difference could depict preliminary evidence how variables distribute, further evidence based on regression analysis is needed to support H1 in order to eliminate other confounding factors, which will be discussed in Sect. 4.

4 Empirical results

4.1 Baseline results

In this section, we examine the effect of bank intervention following DCVs on the intensity of firms' earnings management. Following the extant literature on earnings management (e.g. Cohen et al. 2008; Linck et al. 2013; Gao et al. 2018), we control for some common firm-specific variables that may affect firms' earnings management, including market-to-book equity ratio, sales growth, the natural logarithm of the book value of total assets (*Size*), leverage, the percentage of finance companies in the state (*Finance*), market value of equity, return on assets (*ROA*) and current ratio. We also include industry-fixed effects to control for time-invariant industry heterogeneity, and year-fixed effects to control for nationwide macroeconomic trends.

Specifically, we apply the following firm-year panel regression model to assess how firms' earnings management behaviour changes after DCVs:

$$\begin{aligned} EarningsManagement_{i,t} = {} & \beta_0 + \beta_1 Violation_{i,t-1} + \beta_2 MarkettoBook_{i,t} \\ & + \beta_3 Salesgrowth_{i,t} + \beta_4 Size_{i,t} + \beta_5 Finance_{s,t} \\ & + \beta_6 Leverage_{i,t} + \beta_7 Marketequity_{i,t} + \beta_8 ROA_{i,t} \\ & + \beta_9 CurrentRatio_{i,t} + IndustryFE + YearFE + \varepsilon_{i,t} \end{aligned} \tag{5}$$

Table 2 Baseline regression results

	AEM (1)	*ABS_DCFO* (2)	*ABS_DPROD* (3)	*ABS_DEXP* (4)	*REM* (5)	*AEM* (6)	*ABS_DCFO* (7)	*ABS_DPROD* (8)	*ABS_DEXP* (9)	*REM* (10)
Violation t−1	−0.0160***	−0.0941***	−0.0405***	−0.1248***	−0.1994***	−0.0144***	−0.0965***	−0.0381***	−0.1203***	−0.1929***
	(0.003)	(0.005)	(0.005)	(0.009)	(0.013)	(0.003)	(0.005)	(0.005)	(0.009)	(0.013)
Market to book						−0.0009***	0.0006	−0.0004	−0.0031***	−0.0016
						(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Sales growth						0.0787***	0.1110***	0.1476***	0.2464***	0.4535***
						(0.004)	(0.007)	(0.007)	(0.021)	(0.021)
Size						−0.0373***	−0.0703***	−0.0465***	−0.1077***	−0.1823***
						(0.001)	(0.002)	(0.002)	(0.005)	(0.006)
Finance						−0.0472**	−0.1347***	−0.0629	−0.0448	−0.1980*
						(0.021)	(0.039)	(0.041)	(0.085)	(0.116)
Leverage						0.0002*	0.0007**	0.0001	0.0027**	0.0026**
						(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Market equity						0.0000	0.0000**	0.0000	0.0000	0.0000
						(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ROA						−0.0001***	−0.0001*	−0.0001	−0.0001	−0.0003*
						(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Current ratio						0.0000**	0.0000	0.0000	0.0000	0.0000
						(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.0272***	0.0244**	0.0326***	−0.0264	0.0640**	−0.0144***	−0.0965***	−0.0381***	−0.1203***	−0.1929***
	(0.009)	(0.010)	(0.012)	(0.021)	(0.029)	(0.003)	(0.005)	(0.005)	(0.009)	(0.013)
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	57,263	59,268	52,758	47,894	47,261	56,689	57,407	51,256	46,565	46,080
R-squared	0.041	0.068	0.045	0.048	0.075	0.228	0.238	0.139	0.173	0.286

This table reports Ordinary Least-Squares (OLS) regression estimates for the baseline regressions. The dependent variables are proxies for accruals-based and real earnings management. Columns (1)–(5) report the regressions estimates without any controls, and we include several firm-internal variables as control variables in columns (6)–(10). The variables are defined in Appendix A1. Heteroscedasticity-robust standard errors are reported in parentheses and clustered at the firm level. *, ** and *** denote significance at the 10%, 5%, and 1% levels, respectively

Table 3 Performance-adjusted earnings management results

	AEM (1)	*ABS_DCFO* (2)	*ABS_DPROD* (3)	*ABS_DEXP* (4)	*REM* (5)
Violation t−1	−0.0200***	−0.0703***	−0.0337***	−0.1082***	−0.0667***
	(0.003)	(0.005)	(0.005)	(0.009)	(0.007)
Market to book	−0.0009***	−0.0005	−0.0005	−0.0029***	−0.0028***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)
Sales growth	0.0846***	0.1270***	0.1461***	0.2380***	0.2942***
	(0.004)	(0.008)	(0.007)	(0.021)	(0.021)
Size	−0.0393***	−0.0723***	−0.0477***	−0.1092***	−0.0871***
	(0.001)	(0.002)	(0.002)	(0.004)	(0.004)
Finance	−0.0424*	−0.1427***	−0.0536	−0.0326	−0.0592
	(0.024)	(0.043)	(0.040)	(0.083)	(0.074)
Leverage	0.0002	0.0008**	0.0002	0.0027**	0.0046***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Market equity	0.0000	0.0000**	0.0000	0.0000	0.0000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ROA	−0.0001***	−0.0001*	−0.0001	−0.0001	−0.0000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Current ratio	0.0001**	0.0000	0.0000	0.0000	0.0000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.2183***	0.4241***	0.2447***	0.5552***	0.4574***
	(0.029)	(0.046)	(0.038)	(0.068)	(0.060)
Industry FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
N	56,689	57,407	51,256	46,565	46,080
R-squared	0.207	0.179	0.142	0.170	0.204

This table reports OLS regression estimates for performance-adjusted earnings management. Following Kothari et al. (2005), we adjust firms' earnings management proxies for past accounting performance. Each year we divide firms within a two-digit SIC industry into quartiles measured by return on assets (ROA) in the previous financial year. We then assume abnormal earnings management for each firm-year to be the firm's earnings management minus the average earnings management of other firms in the benchmark quartile. The dependent variables in columns (1)–(5) are proxies for performance-adjusted accruals-based earnings management and real earnings management. The variables are defined in Appendix A1. Heteroscedasticity-robust standard errors are reported in parentheses and clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively

where *i* denotes the individual firm, and *t* denotes time. The dependent variables in Eq. (5) are accruals-based earnings management (*AEM*), total real earnings management (*REM*) and various components of *REM* (*ABS_DCFO*, *ABS_DPROD* and *ABS_DEXP*). *Violation* is a dummy variable which equals one if a firm violates debt covenants in year *t* and zero otherwise. Results are reported in Table 2.

To mitigate possible concern for the 'endogenous control' problem (see Angrist and Pischke (2009) and Gormley and Matsa (2016)), we report the results both without control variables (columns (1) to (5)) and with control variables (columns (6) to (10)). We find that the coefficient of *Violation* is significantly negative for all models at the 1% level. The results are also economically significant. For example, firms that violate

Table 4 Accounting restatement

	Restatement			
	OLS (1)	*OLS* (2)	*Logit* (3)	*Logit* (4)
Violation t−1	−0.0111**	−0.0099**	−0.2067***	−0.1601***
	(0.005)	(0.005)	(0.051)	(0.054)
Market to book		−0.0002		−0.0018
		(0.000)		(0.002)
Sales growth		0.0105***		0.0945***
		(0.003)		(0.028)
Size		0.0216***		0.2411***
		(0.002)		(0.025)
Finance		0.2267***		3.4104***
		(0.085)		(1.131)
Leverage		0.0000		0.0005
		(0.000)		(0.001)
Market equity		−0.0000		0.0002
		(0.000)		(0.000)
ROA		−0.0000		−0.0003
		(0.000)		(0.000)
Current ratio	0.0596***	0.0965		−0.0005
	(0.004)	(0.062)		(0.000)
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
N	60,103	57,474	60,103	57,474
R-squared	0.027	0.131		

This table reports OLS and logit regression estimates of the effect of debt covenant violations on firms' likelihood of accounting restatement. The dependent variable is *Restatement*, which equals 1 if the financial results of a firm-year are affected by accounting restatement; it equals 0 otherwise. The other variables are defined in Appendix A1. Heteroscedasticity-robust standard errors are reported in parentheses and clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels

debt covenants in the previous year on average show 1.44% lower absolute discretionary accruals (as a percentage of total assets) (i.e. − 0.0144 in column (6)) and 19.29% lower total real earnings management by (i.e. − 0.1929 in column (10)) than firms do not.

Following Kothari et al. (2005), we conduct robustness tests by adjusting accruals-based and real earnings management for each firm's past financial performance. Specifically, in each year we divide firms within a two-digit SIC industry into quartiles measured by ROA one year prior to the year in which earnings management was found. We then calculate performance-adjusted accruals-based earnings management and real earnings management as the absolute values of the firm's discretionary accruals and abnormal real activities minus the average accruals and average abnormal real activities of other industry-peer firms in the benchmark ROA quartile. These performance-adjusted earnings management measures are used as dependent variables to re-sun Eq. (5); Table 3 reports results, which are consistent with the findings of our baseline models.

In our baseline sample, firms may not have loan or borrowing records from banks, which could bias our baseline results. To address this concern, we follow Franz et al. (2014) and restrict the samples with data in both Dealscan and Compustat data set. The results are reported in Appendix Table 10. The results are consistent with those presented in Tables 2 and 3, showing that banking intervention significantly decreases both accruals-based earnings management and real earnings management of the firms.

As earnings management can increase the likelihood of accounting restatement, we would expect that a reduction in earnings management is associated with fewer accounting restatements. We conduct further tests to examine the relationship between DCVs and accounting restatements, and results are shown in Table 4. Using data on accounting restatements from the Audit Analytics database, we create an indicator of *Restatement*, which equals one if Audit Analytics indicates a firm restated its financial results for a fiscal year. The coefficients in columns (1) and (2) suggest that *Violation* is significantly and negatively related to the instances of accounting restatement, which is consistent with our main results. Given that *Restatement* is a dummy variable, we use logit model to further examine the relationship between DCVs and accounting restatements for sake of robustness. The coefficients of logit model are reported in columns (3) and (4) of Table 4. Both the logit model and the OLS model produce consistent results.

4.2 Endogeneity tests

Although we have controlled for firms-specific factors in the regressions and used a one-year lag for the variable of *Violation*, there are potential endogeneity concerns with our baseline results. For example, some may argue that firms that manipulated their earnings approaching the events of debt covenants are likely to avoid violating their debt covenants. Following Gu et al. (2017), we further investigate the dynamics of firms' earnings management behaviour surrounding DCVs by employing the Difference-in-Difference (DiD) approach to address the endogeneity concern.

Specifically, we evaluate the earnings management of a sample of treatment firms that violate debt covenants and the earnings management of control firms that do not have any debt covenant violation, before and after the control rights are transferred to banks. The treatment and control groups of firms are identified using propensity score matching. We construct a sample of U.S. listed firms (excluding the financial industry) that violate or do not violate debt covenant during the period 1995–2008 and do not have any missing matching variables and missing earnings management outcome variables in both the year before debt covenant violation (*t-1*) and the year after debt covenant ($t+1$).Following previous literature (e.g. Nini et al. 2012; Gu et al. 2017), we define a new violation of debt covenant as a violation by a firm that has not violated any financial covenant in the previous year. Firms with new violations are included in the treatment group (i.e. violating firm group), while the control group includes those firms that do not violate debt covenants in both the current year (t) and the previous year ($t-1$).

We use a propensity score matching (PSM) algorithm to match up treated firms and control firms following several steps. First, a probit model is employed based on around 17,000 sample new-violation firm-year observations and 45,000 firm-year observations that do not have new violation. We use a nearest-neighbour propensity score matching method, in which the dependent variable is a dummy variable that equals one if the firm is in the violating firm group and zero otherwise. The probit model results are presented in

Table 5 Difference-in-differences (DiD) test results

Panel A: Pre-match propensity score regression and post-match diagnostic regression

	Pre-match (1)	*Post-match* (2)
Market to book	−0.0043***	0.0013
	(0.001)	(0.001)
Sales growth	−0.0526***	−0.0006
	(0.010)	(0.013)
Size	−0.0154***	0.0085
	(0.003)	(0.006)
Finance	0.1373	−0.0577
	(0.099)	(0.121)
Leverage	0.0003**	0.0001
	(0.000)	(0.000)
Market equity	−0.0002***	−0.0001
	(0.000)	(0.000)
ROA	0.0007***	0.0002
	(0.000)	(0.000)
Current ratio	−0.0002***	−0.0001
	(0.000)	(0.000)
Constant	0.7331***	0.2030
	(0.131)	(0.142)
Industry FE	YES	YES
Year FE	YES	YES
N	50,531	27,584
Pseudo R-squared	0.169	0.004

Panel B: Post-match differences

	Treatment (13,792)	Control (13,792)	Differences	T-statistics
Market to Book	2.1766	1.9567	0.2199	1.1113
Sales growth	0.1261	0.1239	0.0021	0.3001
Size	4.5262	4.4528	0.0733	0.5976
Finance	0.0842	0.0848	0.0006	−0.7557
Leverage	0.2563	0.2078	0.0485	0.9821
Market equity	1.2158	1.2503	−0.0345	2.5726
ROA	−0.8020	−1.2176	0.4155	0.7135
Current ratio	1.7359	1.5621	5.259	0.1738

Panel C: DID analysis for earnings management dynamics

	AEM (1)	*ABS_DCFO* (2)	*ABS_DPROD* (3)	*ABS_DEXP* (4)	*REM* (5)
*Violation*Before_1*	−0.0173	−0.0331*	−0.0011	−0.0356	−0.0435
	(0.016)	(0.022)	(0.012)	(0.038)	(0.031)
*Violation*Current*	0.0047	−0.0293**	−0.0359**	−0.0310	−0.0911**
	(0.007)	(0.013)	(0.014)	(0.024)	(0.035)

Table 5 (continued)

Panel C: DID analysis for earnings management dynamics

	AEM (1)	*ABS_DCFO* (2)	*ABS_DPROD* (3)	*ABS_DEXP* (4)	*REM* (5)
*Violation*After_1*	−0.0162***	−0.0416***	0.0057	−0.0712***	−0.0599**
	(0.006)	(0.011)	(0.012)	(0.020)	(0.031)
Market to Book	−0.0015***	−0.0014**	−0.0012	−0.0033**	−0.0037**
	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)
Sales growth	0.0667***	0.1128***	0.1350***	0.2576***	0.4437***
	(0.006)	(0.011)	(0.011)	(0.034)	(0.033)
Size	−0.0357***	−0.0613***	−0.0426***	−0.0987***	−0.1657***
	(0.001)	(0.002)	(0.003)	(0.006)	(0.007)
Finance	−0.0405	−0.1858***	−0.1479***	−0.0434	−0.2816**
	(0.026)	(0.047)	(0.053)	(0.099)	(0.139)
Leverage	0.0007	0.0020*	−0.0002	−0.0029	0.0019
	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)
Market equity	0.0004**	0.0011***	0.0006	0.0028***	0.0039***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
ROA	0.0001	0.0001	−0.0015**	−0.0016	−0.0021
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Current ratio	0.0000	0.0001*	0.0001	0.0002	0.0001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.2029***	0.3608***	0.2570***	0.4235***	0.8711***
	(0.022)	(0.037)	(0.035)	(0.088)	(0.125)
Industry FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
N	19,328	19,535	17,421	16,076	15,924
R-squared	0.224	0.241	0.147	0.192	0.310

This table reports diagnostic tests and the DiD results on how violations of debt covenants affect firm accruals-based earnings management and real earnings management. The treatment group includes firms with new violations, defined as violations where the firm has not violated a financial covenant in the previous four quarters, while the control group includes firms that do not violate debt covenant in the current and previous year. We match firms using one-to-one nearest neighbour propensity score matching. The variables are defined in Appendix A1. Heteroscedasticity-robust standard errors are reported in parentheses and clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

column (1) of Table 5 Panel A. The results indicate that the specification captures a significant amount of variation in the choice variable.

Second, we repeat our analysis for the PSM sample in column (2) of Table 5 Panel A. We find that coefficients for all the control variables are insignificant in the PSM sample, and the pseudo-R2 reduces significantly.

Third, we compare the characteristics of treatment and control firms after matching. The univariate comparison between the two groups and their corresponding t-statistics are reported in Panel B of Table 5. No discernible differences of these statistics can be found between treated and control firms after matching. Overall, the diagnostic tests described above indicate that the propensity score matching process has ruled out significantly

observable differences and created the probability that the variations in earnings management are triggered only by bank intervention resulting from the control rights transfer due to DCVs.

In the last step, we employ DiD approach in a regression to address the potential reverse causality concern. We preserve firm-year observations for both treatment and control firms for a five-year window around the year when the firm violate the debt covenant and estimate the following model:

$$\begin{aligned} Earnings\,Management_{i,t} = \beta_0 &+ \beta_1 Violation * Before\_1_{i,t} + \beta_2 Violation * Current_{i,t} \\ &+ \beta_3 Violation * After\_1_{i,t} + \beta_4 MarkettoBook_{i,t} \\ &+ \beta_5 Salesgrowth_{i,t} + \beta_6 Size_{i,t} + \beta_6 Finance_{s,t} \\ &+ \beta_7 Leverage_{i,t} + \beta_8 Marketequity_{i,t} + \beta_9 ROA_{i,t} \\ &+ \beta_{10} CurrentRatio_{i,t} + IndustryFE + YearFE + \varepsilon_{i,t} \end{aligned} \tag{6}$$

where *Violation* is a dummy variable that equals one for treated group (violating firms) and zero for control group (non-violating firms). *Before*_1 is a dummy that equals one if a firm-year observation is from one year before the covenant violation $(t-1)$ and zero otherwise. *After*_1 is a dummy that equals one if a firm-year observation is from one year or two after the covenant violation $(t+1)$ and zero otherwise. The coefficient estimates of interest are $\beta_{1,2,3}$. If the negative relationship between the DCVs and firms' earnings management is driven by reverse causality, then we should see significant and negative coefficients of $\beta 1$.

Panel C of Table 5 presents the DiD test results. Columns (1)–(5) report the average change in the accruals-based and real earnings management. We find that the coefficient for $Violation * Before_1$ is statistically insignificant for most of the models (except that in column (2)), suggesting that there is no pre-trend in firms' earnings management. On the other hand, the coefficient of *Violation* ∗ *After*_1 is significantly negative across the majority of our models, except for the one with ABS_DPROD as the dependent variable (column (3)). This suggests that, following DCVs when control rights are transferred to banks, both accruals-based earnings management and real earnings management reduce significantly for firms in the treatment group, compared with those control firms.

To summarise, the empirical evidence in this section consistently suggests that bank intervention has a potentially causal and dampening effect on the intensity of accruals-based and real earnings management by firms, supporting our hypothesis H1.

5 Further evidence

Our empirical evidence based on the DiD approach suggests that bank intervention via DCVs reduces firms' earnings management. We argue that following DCVs, control rights are transferred to banks and they tend to play an active governance role in managers' decision making through the enhanced monitoring and increased bargaining power banks have during the renegotiation process of credit agreement. If this holds true, we would expect that financial constraints and bank competition level are likely to influence the impact of bank intervention on firms' earnings management (H2, H3 and H4). In this section, we

Table 6 Financial constraint tests

	Low EFD		High EFD		Full sample		*Low KZ*		*High KZ*		*Full Sample*	
	AEM (1)	*REM* (2)	*AEM* (3)	*REM* (4)	*AEM* (5)	*REM* (6)	*AEM* (7)	*REM* (8)	*AEM* (9)	*REM* (10)	*AEM* (11)	*REM* (12)
Violation t−1	0.0019	0.0028	−0.0255***	−0.2429***	−0.0097*	−0.1307***	0.0058	−0.0039	−0.0231***	−0.2352***	−0.0021	−0.1241***
	(0.004)	(0.012)	(0.004)	(0.019)	(0.005)	(0.021)	(0.005)	(0.016)	(0.005)	(0.019)	(0.005)	(0.022)
Violation t−1 * *High KZ*											−0.0379***	−0.1280***
											(0.006)	(0.027)
Violation t−1 * *High EFD*					−0.0167***	−0.1130***						
					(0.006)	(0.026)						
High KZ											0.0345***	0.1112***
											(0.002)	(0.009)
High EFD					0.0273***	0.1112***						
					(0.002)	(0.009)						
Market to book	0.0003	0.0021	−0.0013***	−0.0030***	−0.0010***	−0.0016***	−0.0002	0.0012	−0.0013***	−0.0043***	−0.0010***	−0.0014***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.001)	(0.000)	(0.000)
Sales growth	0.0579***	0.3696***	0.0882***	0.4554***	0.0841***	0.4530***	0.0665***	0.3901***	0.0846***	0.4662***	0.0853***	0.4576***
	(0.006)	(0.027)	(0.003)	(0.011)	(0.002)	(0.008)	(0.006)	(0.027)	(0.003)	(0.012)	(0.002)	(0.008)
Size	−0.0188***	−0.1190***	−0.0456***	−0.2119***	−0.0396***	−0.1796***	−0.0263***	−0.1401***	−0.0486***	−0.2212***	−0.0396***	−0.1802***
	(0.005)	(0.016)	(0.001)	(0.003)	(0.000)	(0.002)	(0.005)	(0.020)	(0.001)	(0.003)	(0.000)	(0.002)
Finance	−0.0051	0.2482	−0.0247	−0.0792	−0.0444***	−0.1974***	0.0176	−0.3357	−0.0189	−0.1289	−0.0457***	−0.2012***
	(0.056)	(0.222)	(0.024)	(0.105)	(0.016)	(0.067)	(0.062)	(0.252)	(0.025)	(0.105)	(0.016)	(0.067)

Table 6 (continued)

	Low EFD		High EFD		Full sample		*Low KZ*		*High KZ*		*Full Sample*	
	AEM (1)	*REM* (2)	*AEM* (3)	*REM* (4)	*AEM* (5)	*REM* (6)	*AEM* (7)	*REM* (8)	*AEM* (9)	*REM* (10)	*AEM* (11)	*REM* (12)
Leverage	0.0406***	0.2074***	0.0001*	0.0023***	0.0002***	0.0026***	0.0159***	0.1625***	0.0001	0.0020***	0.0002**	0.0025***
	(0.011)	(0.059)	(0.000)	(0.000)	(0.000)	(0.000)	(0.005)	(0.055)	(0.000)	(0.000)	(0.000)	(0.000)
Market equity	−0.0000	0.0000	0.0000**	0.0000***	0.0000***	0.0000***	0.0011	0.0225***	0.0000**	0.0000***	0.0000***	0.0000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.006)	(0.000)	(0.000)	(0.000)	(0.000)
ROA	−0.0046*	−0.0254	−0.0001***	−0.0002***	−0.0001***	−0.0002***	−0.0054***	−0.0182	−0.0001***	−0.0002***	−0.0001***	−0.0002***
	(0.002)	(0.019)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.011)	(0.000)	(0.000)	(0.000)	(0.000)
Current ratio	0.0002***	−0.0002	0.0001***	0.0000	0.0001***	0.0000**	0.0000	−0.0001*	0.0001***	0.0000	0.0001***	0.0000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.1610***	0.9755***	0.2114***	0.9667***	0.2008***	0.8755***	0.1957***	1.0805***	0.2492***	1.1555***	0.1974***	0.8797***
	(0.022)	(0.074)	(0.036)	(0.160)	(0.023)	(0.103)	(0.022)	(0.098)	(0.036)	(0.158)	(0.023)	(0.103)
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	24,595	20,466	24,595	20,466	56,689	46,080	26,619	21,506	26,619	21,506	56,689	46,080
R-squared	0.172	0.166	0.227	0.308	0.213	0.288	0.185	0.217	0.244	0.322	0.214	0.288

This table reports OLS regression estimates of the effect of bank intervention on earnings management conditional on financial constraints. We consider firms with a higher-than-median KZ index in year *t* as financially constrained and firms with EFD values above the median in year *t* and a two-digit SIC industry as financially constrained. The dependent variables in columns (1)–(12) are proxies for accruals-based and real earnings management. The variables are defined in Appendix A1. Heteroscedasticity-robust standard errors are reported in parentheses and clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively

provide further empirical evidence on the mechanism through which bank intervention affects firms' earnings management.

5.1 Impact of financial constraint

To investigate how the effect of bank intervention on firms' earnings management varies across firms with different levels of financial constraint, we consider two financial constraint proxies, following Duchin et al. (2010): the Kaplan–Zingales (KZ) index and the index of dependence on external finance (EFD). Firms are classified as financially constrained or non-constrained by dividing the sample at the medians of the two proxies in each year and each industry grouped by two-digit SIC code. Firms with higher-than-median KZ and EFD indices are considered financially constrained, while firms with lower-than-median indices are grouped as financially non-constrained. We then introduce the interaction terms of *Violation t − 1* High KZ* and *Violation t − 1* High EFD,* respectively, into the baseline model and rerun the regressions. The results are reported in Table 6. We would expect financially constrained firms to show a more significant reduction in the intensity of earnings management than financially non-constrained ones after DCVs. If the impact of bank intervention on intensity of earnings management is channelled through active and enhanced bank monitoring due to control rights transfer, financially constrained firms would be less involved in earnings management as they tend to be more afraid of being caught and losing bank loans because of manipulating earnings.

We find that financially constrained firms reduced the intensity of their earnings management significantly after violating their debt covenants, while financially non-constrained firms did not. We also observe that the interaction effects of banking intervention and financial constraint are statistically significant and negative for all models. These results further support our previous empirical findings and suggest that the channel through which bank intervention affects the intensity of firms' earnings management is enhanced bank monitoring.

5.2 Bank competition effect

In this subsection, we conduct further analyses to examine the mechanism through which bank intervention influences firms' earnings management. We argue that in states with high level of bank competition, firms could relatively easily find alternative financing sources, i.e., be less financially constrained, compared to those operating in states where competition is low. Therefore, bank intervention may have less of an impact on earnings management for firms located in high competition states where banks have less bargaining power. Huang et al. (2023) find that credit market competition could discourage firms' earnings management behaviours due to released financial constraint by providing them better access to external bank financing.

We introduce an interaction term of *Violation t − 1*Competition* into the baseline model to assess whether the level of competition affects the impact of bank intervention on earnings management. Rice and Strahan (2010) construct a banking restriction index (*RS Index*) to capture the extent to which each state has set barriers to restrict out-of-state bank entry. Their index ranges from zero (most open) to four (most restrictive). To better reflect the level of bank competition, we define the variable of *Competition* as four minus

Table 7 Bank competition effect

	AEM (1)	*REM* (5)
*Violation t−1*competition*	0.0024*	0.0070**
	(0.001)	(0.004)
Violation t−1	−0.0248***	−0.2133***
	(0.007)	(0.031)
Competition	−0.0041***	−0.0031
	(0.001)	(0.007)
Market to book	−0.0010***	−0.0016
	(0.000)	(0.001)
Sales growth	0.0841***	0.4534***
	(0.004)	(0.021)
Size	−0.0401***	−0.1822***
	(0.001)	(0.006)
Finance	−0.0130	−0.1800
	(0.025)	(0.121)
Leverage	0.0002	0.0026**
	(0.000)	(0.001)
Market equity	0.0000	0.0000
	(0.000)	(0.000)
ROA	−0.0001***	−0.0003*
	(0.000)	(0.000)
Current ratio	0.0001**	0.0000
	(0.000)	(0.000)
Constant	0.2224***	0.9578***
	(0.031)	(0.113)
Industry FE	YES	YES
Year FE	YES	YES
N	56,689	46,080
R-squared	0.211	0.286

This table reports OLS regression estimates of the effect of bank intervention on earnings management conditional on bank competition. We follow Rice and Strahan (2010) to construct a *competition* index to capture the extent to which each state has set barriers to restrict out-of-state bank entry. A higher value for Bank Competition Index indicates lower entry barriers and thus a higher level of bank competition. The variables are defined in Appendix A1. Heteroscedasticity-robust standard errors are reported in parentheses and clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively

RS Index, where a higher value for *Competition Index* indicates lower entry barriers and thus a higher level of bank competition.

The results are presented in Table 7. We observe that the *Violation* term is significantly negative, which is consistent with our baseline results. The coefficient of *Violation t − 1* Competition* is significantly positive, confirming our prediction that bank intervention has less of an impact on earnings management for firms located in states with high bank competition, as they could relatively easily find alternative financing resources compared with firms operating in states where bank competition is low.

Table 8 Bank lending relationship

	AEM (1)	*REM* (2)	*AEM* (3)	*REM* (4)
Bank number violation t−1*	0.0001*	0.0004**	0.0001**	0.0004**
	(0.000)	(0.000)	(0.000)	(0.000)
Bank number	−0.0003***	−0.0008***	−0.0001***	−0.0009***
	(0.000)	(0.000)	(0.000)	(0.000)
Violation t−1	−0.0153***	−0.0370***	−0.0085***	−0.0570***
	(0.002)	(0.009)	(0.002)	(0.008)
Market to book			−0.0000	0.0039***
			(0.000)	(0.000)
Sales growth			0.0624***	0.3433***
			(0.001)	(0.006)
Size			−0.0175***	−0.0784***
			(0.000)	(0.002)
Finance			−0.0165*	−0.2071***
			(0.009)	(0.043)
Leverage			0.0022***	0.0243***
			(0.000)	(0.003)
Market equity			−0.0000	−0.0000
			(0.000)	(0.000)
ROA			0.0002***	0.0022***
			(0.000)	(0.000)
Current ratio			0.0004***	0.0013***
			(0.000)	(0.000)
Constant	0.0300***	2.8673***	3.7231***	0.0669***
	(0.004)	(0.340)	(0.979)	(0.004)
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
N	37,901	32,277	37,632	31,475
R-squared	0.048	0.112	0.157	0.242

This table reports OLS regression estimates of the effect of bank intervention on earnings management conditional on bank-borrower connection. We measure bank-borrower connection using the number of lenders (banks) with which firms have a loan relationship in a given year. A higher value for *Bank Number* indicates firms with more available debt resources. The variables are defined in Appendix A1. Heteroscedasticity-robust standard errors are reported in parentheses and clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively

5.3 Bank-borrower connection

If the effect of bank intervention on firms' earnings management is a result of control rights transfer, we could expect that such a relationship can be affected by the lender-borrower connection. Firms with more lenders could relatively easily find alternative financing resources and thus be less likely to be controlled by particular lenders if they

violate the covenant with them. Thus, we expect that firms that have a loan relationship with more banks will reduce earnings management after DCVs. We introduce a variable that measures the number of banks with which a firm has a loan relationship and create an interaction term of *Bank number* Violation t-1,* which is added into the baseline model. We combine the initial sample with the DealScan data to identify how many banks have provided loans to firms in a given year.

The results are presented in Table 8. The *Violation* term is significantly negative, which is consistent with our baseline results and confirms our H4. The coefficient of *Bank number* Violation t − 1* is significantly positive, confirming our prediction that bank intervention has less of an impact on earnings management for firms with a loan relationship with more banks, as they could relatively easily find alternative financing resources.

6 Conclusion

In theory, corporate governance is expected to discipline managers' behaviour and reduce the conflict of interest between them and shareholders, but the extent to which it works remains a concern to both academic researchers and regulators (Hazarika et al. 2012). Although extensive studies have been conducted to investigate the effectiveness of corporate governance on preventing earnings management, they focus mainly on the role of the board and/or auditors. This paper examines the effect of bank intervention on firms' earnings management. Employing firms' DCVs as the proxy of bank intervention, since control rights are transferred after DCVs, we find a significant decrease in the intensity of both accruals-based and real earnings management after firms violate their debt covenants. We then use a DiD approach to establish causality and confirm the negative causal effect of bank intervention on firms' earnings management. We provide further evidence on the mechanism through which bank intervention affects earnings management by introducing several interaction terms. By interacting DCVs with financial constraint measures, bank competition variables and the lender-borrower relationship, we show that the negative impact of bank intervention on firms' earnings management tends to be enhanced for financially constrained firms and mitigated for firms in states where bank competition is higher, or for firms with more bank lending relationships. These findings suggest that the transfer of control rights after violations of debt covenants allows banks to play an active role in disciplining managers' behaviour and reducing firms' earnings management through enhanced monitoring.

Our findings have important implications for regulators and policy makers. The role of creditors in corporate governance has long been neglected in the traditional corporate governance literature. By providing further empirical evidence to the growing literature on the role of creditors (e.g., Nini et al. 2012; Christensen et al. 2019), we show that, as delegated monitors, bank intervention can effectively govern borrowing firms' behaviour and policy on financial reporting. To improve financial reporting quality and facilitate an efficient market for information, it is important for policy makers to pay attention to the role that creditors, especially banks, could play as part of corporate governance mechanisms.

Appendix

See Tables 9 and 10.

Table 9 Definition of variables

Variable	Definition
AEM	Accruals-based earnings management, which equals the absolute value of discretionary accruals
DCFO	The level of abnormal cash from the operation scaled by lagged total assets
ABS_DCFO	The absolute value of *DCFO*
DPROD	The level of abnormal production cost scaled by lagged total assets, where production costs are defined as the sum of the cost of goods sold and change in inventories
ABS_DPROD	The absolute value of *DPROD*
DEXP	The level of abnormal discretionary expenses scaled by lagged total assets, where discretionary expenses are the sum of advertising expense, R&D expense and SG&A expense
ABS_DEXP	The absolute value of *DEXP*
REM	Total real earnings management, which equals the sum of *ABS_DCFO, ABS_DPROD* and *ABS_DEXP*
Violation	Dummy variable which equals 1 if a firm violates debt covenant in year *t*
EFD	External finance dependence for each two-digit SIC. Each firm's EFD in year *t* within a specific two-digit SIC industry is calculated as [capital expenditures (*capx*) − funds from operations (*fopt*)]/ *capx*. If *fopt* is not available, funds from operations is estimated as [income before extraordinary items (*ibc*) + depreciation and amortisation (*dpc*) + deferred taxes (*txdc*) + (equity in net loss)/earnings (*esubc*) + sale of property, plant and equipment and investments gain/loss (*sppiv*) + funds from operations, other (*fopo*)]. The industry-level, two-digit SIC is annually taken as the median firm EFD for each two-digit SIC
KZ index	Kaplan–Zingales index, which is a relative measurement of reliance on external financing. A higher KZ index scores indicates that a firm is more likely to experience difficulties when financial conditions tighten due to difficulty of financing their ongoing operations. KZ index is calculated as − 1.001909 [(*ib* + *dp*)/lagged *ppent*] + 0.2826389 [(*at* + *prcc_f* × *csho* − *ceq* − *txdb*)/*at*] + 3.139193 [(*dltt* + *dlc*)/(*dltt* + *dlc* + *seq*)] − 39.3678 [(*dvc* + *dvp*)/lagged *ppent*] − 1.314759 [*che*/lagged *ppent*], where all variables in italics are Compustat data items. Firms above median are coded as constrained
Competition	Equal to 4 − *RS index*
RS Index	Rice-Strahan index of interstate banking deregulation, which is developed by Rice and Strahan (2010). Based on regulation changes in a state, the index has a range from 0 (deregulated) to 4 (highly regulated)
Size	Natural logarithm of the book value of total assets, measured at the end of fiscal year *t*
Market to Book	Market capitalisation divided by book value of common equity
Sales Growth	The change in sales divided by lagged total assets
Leverage	Long-term debt divided by lagged total assets
Market equity	Market value of equity divided by total assets
Current Ratio	Current liability divided by current asset
ROA	Return on asset, which equals net income divided by total asset
Finance	The percentage of finance companies in a state, measured as the number of finance companies divided by the total number of companies in the state, as recorded by Compustat
Bank number	The number of banks that have a lending relationship with the firm in the given year

Table 10 Results based on sample with borrowing recording

	AEM (1)	*ABS_DCFO* (2)	*ABS_DPROD* (3)	*ABS_DEXP* (4)	*REM* (5)
Violation t−1	−0.0076***	−0.0517***	−0.0119**	−0.0382***	−0.1216***
	(0.003)	(0.004)	(0.005)	(0.007)	(0.011)
Market to Book	−0.0001	0.0018***	0.0018***	−0.0004	0.0035***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Sales growth	0.0614***	0.0832***	0.1310***	0.1388***	0.3316***
	(0.004)	(0.007)	(0.009)	(0.024)	(0.025)
Size	−0.0182***	−0.0318***	−0.0255***	−0.0339***	−0.0761***
	(0.001)	(0.002)	(0.002)	(0.004)	(0.006)
Finance	−0.0152	−0.1024***	−0.0523	−0.0056	−0.1687*
	(0.016)	(0.026)	(0.033)	(0.062)	(0.087)
Leverage	0.0039	0.0117**	−0.0028	0.0652**	0.0564*
	(0.003)	(0.005)	(0.004)	(0.027)	(0.031)
Market equity	−0.0000	0.0000	−0.0000	−0.0000	−0.0000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ROA	0.0003	0.0010**	−0.0003	0.0057**	0.0050*
	(0.000)	(0.000)	(0.000)	(0.003)	(0.003)
Current Ratio	0.0005*	0.0005	0.0002	0.0010	0.0015
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Constant	0.1308***	0.2163***	0.1818***	0.1742***	0.5149***
	(0.013)	(0.019)	(0.024)	(0.030)	(0.055)
Industry FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
N	40,726	41,040	36,961	34,215	33,893
R-squared	0.162	0.174	0.156	0.148	0.243

This table reports Ordinary Least-Squares (OLS) regression estimates for the regressions on subsample in which firms have borrowing record from the bank. The dependent variables are proxies for accruals-based and real earnings management. The variables are defined in Appendix A1. Heteroscedasticity-robust standard errors are reported in parentheses and clustered at the firm level. *, ** and *** denote significance at the 10%, 5%, and 1% levels, respectively

Declarations

Conflict of interest None.

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