Management Earnings Forecast and Technical Innovation: The Mediating Effects of Cost of Debt

Abstract

Purpose - This study examines whether a firm's management earnings forecasts affect its technical innovation activities. Our study also examines whether the cost of debt plays a mediating role between the management earnings forecasts and the innovation nexus.

Design/methodology/approach We obtained data from 1032 Chinese non-financial firms listed on the Shanghai and Shenzhen stock markets from 2005 to 2022 (i.e., 18576 firm-year observations). We used various econometrics techniques, such as Heckman's (1979) two-stage selection method and two-stage least square, to examine the relationship between management earnings forecasts and the firm's technical innovation activities.

Findings - We find a positive relationship between management earnings forecasts and the firms' technical innovation. We also find that the cost of debt mediates the relationship between management earnings forecast and technical innovation. Further analysis indicates that frequent earnings forecasts provide incremental information regarding a firm's future value and cash flows, thus reducing the volatility and uncertainty in cash flow calculations. Our findings are robust to several tests.

Research Implications - Our study has implications for policymakers, practitioners, and high-level management of Chinese firms, enabling them to understand the relationship between management earnings forecasts and firms' innovation activities.

Keywords: Management Earnings Forecasts, Firm's Technical Innovation Activities, Cost of Debt, Mediation Effect, Information Asymmetry implications for policymakers, practitioners, and high-level management of Chinese firms,

1. Introduction

In recent years, intense competition has led to increased innovativeness among firms (Bena & Li, 2014; S.-S. Chen, Huang, Hwang, Wang, & Accounting, 2019). Previous studies highlight that innovation enables a firm to gain a competitive advantage by creating novel products or services desired by customers (Jia, 2019; Ren, Huang, Liu, & Yan, 2023; Van de Ven, 1986). Innovative-friendly firms are mindful of short-term outside pressure (Ederer & Manso, 2011) and try to manage market participants' expectations through management earnings forecasts (Choi, Myers, Zang, & Ziebart, 2011; H. J. Huang, Habib, Sun, Liu, & Guo, 2021).

Management earnings forecasts communicate comprehensive information about the firm's essential features that control the value-generating process, particularly the firm's future cash flows (Dutta & Gigler, 2002). The key motivation for disclosing firms' information is to reduce asymmetric information (Gong, Xia, Xia, & Wang, 2023; Rakow, 2010) and provide transparency in the innovative process (Brown & Martinsson, 2019; Zhong, 2018). Hence, a firm's higher commitment toward frequent forward-looking earnings forecasts reflects the managers' aptitude to close the information gap between managers and outsiders (Abdelazim, Metwally, & Aly, 2023).

Extant literature suggests the need for firms to communicate with market participants and maintain a transparent environment through frequent disclosure of information as it directly impacts the cost of capital and is a key source of input into innovation activities (Alhaddad, Whittington, & Gerged, 2021; Stephen P Baginski & Rakow, 2012; Cao, Myers, Tsang, & Yang, 2017; Rakow, 2010). Previous studies suggest that disclosing firm-specific information will mitigate information asymmetry (R. Salem, Ezeani, & Song, 2023; R. I. A. Salem, Ezeani, Gerged, Usman, & Alqatamin, 2021) and uncertainty among investors (Darrough & Stoughton,

1990). However, the proprietary cost (Jia, 2019), litigation costs (Yamada, 2016), and the possibility of eroding firms' competitive advantage imply that it is not always beneficial for managers to provide frequent earnings forecasts. This study examines whether frequent management earnings forecasts affect the firm's research and development (R&D) expenditure (i.e., technical innovation activities). It also investigates the mediating effects of the cost of debt in the relationship between management earnings forecast and technical innovation. Our study is important due to China's unique institutional environment (Komal, Ezeani, Shahzad, Usman, & Sun, 2021; Komal, Ezeani, et al., 2023) and the mandatory earnings forecast requirements, which deviate from the voluntary approach used in most developed countries.

We are motivated to undertake this study for the following reasons. Firstly, consistent with the signaling and agency theory, studies suggest that management earnings forecasts will mitigate information asymmetry (Dutta & Gigler, 2002; Hsieh, Song, Wang, & Wang, 2019; Preussner & Aschauer, 2022). However, the existing studies have focused on voluntary forecasts (Jog & McConomy, 2003; Waymire, 1986). Previous studies have ignored the impact of management earnings forecasts on firm innovation. Also, no study have considered the mediating effect of the cost of debt on the relationship between management earnings forecasts and firm innovation.

Secondly, studies show that corporate innovation is generally costly (Bouncken & Kraus, 2013; Tian & Wang, 2014). However, it is well documented that management earnings forecasts influence the cost of capital (Stephen P Baginski & Rakow, 2012; Cao et al., 2017; Rakow, 2010; K. T. Wang & Zhu, 2023), thereby reducing the cost of firms exploration. Hsieh et al. (2019) proved that management earnings forecasts could help firms assess favourable bank loan

contract terms. However, no study to date has examined the mediating effect of the cost of debt on the management earnings forecasts and the firm's technical innovation activities nexus.

Finally, China provides a unique context for examining the relationship between management earnings forecasts and firm innovation. The country has the largest economy among the world's emerging markets, and its capital market is rapidly improving. Also, the Chinese government's growing efforts to increase investment probabilities (Ren et al., 2023) have led to firms' innovative efforts. Previous studies overwhelmingly document voluntary disclosure's relevance in reducing information asymmetry (Al-Bassam, Ntim, Opong, & Downs, 2018; Md Zaini, Samkin, Sharma, & Davey, 2018; Ntim, Opong, Danbolt, & Thomas, 2012; R. Salem et al., 2023; R. I. A. Salem et al., 2021; Tan, Komal, Ezeani, Usman, & Salem, 2022). However, China has a mandatory approach to management earnings forecasts (Xiaobei Huang, Li, Tse, & Tucker, 2018; Y. Wang, Chen, & Wang, 2015) and a unique institutional environment with type two agency conflict (Komal, Bilal, et al., 2023; Komal et al., 2021; Tan et al., 2022). The mandatory approach to earnings forecasts and the unique business environment makes it interesting to examine the relationship between management earnings forecasts and corporate innovation in China.

Therefore, using a sample of 1,032 non-financial firms listed on the Shanghai and Shenzhen stock markets from 2005 to 2022, this study examines whether a firm's management earnings forecasts affect its technical innovation activities. Our study also examines whether the cost of debt plays a mediating role between the management earnings forecasts and the innovation nexus. We find a positive relationship between frequent management earnings forecasts and a firm's technical innovation activities, suggesting that frequent earnings forecasts enable firms to invest in potential R&D projects. We show that management earnings forecasts

improve innovation by decreasing information asymmetry. Also, we find that the cost of debt mediates the relationship between management earnings forecasts and technical innovation.

Our study contributes to previous literature in the following ways: firstly, previous studies focused on the impact of voluntary management forecasts on various organisation outcomes (Gramlich & Sørensen, 2004; Jog & McConomy, 2003; Kim, Shroff, Vyas, & Wittenberg-Moerman, 2018), we contribute to this area of study by focusing on management earnings forecasts in China, which is mainly mandatory. Secondly, we contribute to the literature by documenting novel evidence on the mediating role of the cost of debt in the relationship between management earnings forecast and technical innovation. Thirdly, the signaling theory suggests the impact of disclosure in mitigating the information gap between insiders and firm outsiders (Spence, 1978). Consistent with the signaling theory, we demonstrate that the frequency of management earnings forecasts positively impacts corporate innovation.

The remaining study is arranged as follows. Section 2 includes the Institutional background, Section 3 covers the literature review and hypothesis development, Section 4 describes the data sample, measurement of variables, experimental research design, and empirical analysis, and Section 5 presents the empirical result of this study. Lastly, section 6 reveals the study's conclusions, limitations, and future directions.

2. Institutional background

In most Western countries, firms are expected to voluntarily provide earnings forecasts (Gramlich & Sørensen, 2004; Jog & McConomy, 2003). Studies suggest that a voluntary approach to earnings forecasts may result in bias and not fully reflect management information (McConomy, 1998; McNichols, 1989).

As an emerging economy, China has not adopted the voluntary disclosure of earnings forecasts prevalent in the West. Before 1998, it was not common for Chinese firms to forecast their earnings before the required report date. However, Chinese regulators introduced mandatory earnings forecasts in 2001 to reduce the information gap. According to the China Securities Regulation Commission (CSRC), if a listed firm's financial efficiency and deviation reach a specific threshold, they must publicly disclose their earnings forecasts (Xiaobei Huang et al., 2018). Publicly listed firms in China must issue earnings forecasts for the fiscal year if the manager anticipates their earnings will increase or reduce by at least 50% in the prior year. As all the Chinese firms end their fiscal year on 31st December, the forecasts must be issued by 31st January. An additional layer of mandatory earnings forecast was added in 2004 and required firms to disclose the anticipated profit of the current year following a loss in the previous year.

From 1998 to 2006, management earnings forecast requirements passed through several significant modifications and revisions, which suggest the vital influence in China. Also, the stock exchange supported the mandatory approach to earnings forecasts advocated by the CSRC by providing forms that enhance forecast release standardization. It also mandates an update on the earnings forecast previously issued by firms if there are changes in circumstances. For instance, the stock exchange demands another update if the new estimate shows a significant difference (more than 50%) from the previous year's estimate. Also, firms are likely to be publicly denounced for inaccurate earnings forecasts. In certain circumstances, the firm may be required to restore the trust of investors by offering an apology through the national newspaper.

Previous studies in Chinese context highlight the benefits of the mandatory approach to earnings forecast used in China (Xiaobei Huang et al., 2018; Y. Wang et al., 2015). For instance, Xiaobei Huang et al. (2018) argue that mandatory forecasts' information content is superior to voluntary

earnings forecasts. They also suggest that mandating firms to forecast earnings will increase the chances of future voluntary earnings forecasts since firms are accustomed to providing valuable information. Similarly, Y. Wang et al. (2015) argue that forced earnings forecast increases the likelihood of more timely information that mitigates asymmetric information in the capital market. Dai, Parwada, and Zhang (2015) report that Chinese firms provide miscellaneous information through management earnings forecasts, which help to decrease the information risk between managers and market participants. Thus, market participants consider them an essential document for the securities market in the country.

Prior studies have shown that a rigorous approach to management earnings forecasts encourages managers to meet investor expectations regarding firms' performance, mitigate mispricing, and reduce short-term behaviour (Choi et al., 2011; Kasznik & Lev, 1995). Mandatory earnings forecasts also provide an incremental measure to the investor to assess how the managers enhance the monitoring mechanism (Bens & Monahan, 2004; O. Z. LI & Zhuang, 2012). Hence, examining the association between management earnings forecast and technical innovation in Chinese firms would be interesting.

3. Theoretical framework

Studies suggest that firms managers and outsiders are at risk of information gaps due to the complexity of innovative projects (March, 1991; Tian & Wang, 2014), making it difficult for stakeholders to assess the benefits of innovation (Petkova, 2006; Zhong, 2018). Previous studies suggest corporate transparency mitigates asymmetric information (Brown & Martinsson, 2019; Elghuweel, Ntim, Opong, & Avison, 2017; D. Huang, Liu, Chan, & Chen, 2023). D. Huang et al. (2023) argue that the mandatory and frequent disclosure of value-relevant firm-specific

information is the most effective way to reduce asymmetric information associated with innovation.

Management earnings forecasts enable firms to open up credible communication channels with market participants and maintain a good information environment, enabling firms to mitigate asymmetric information (Preussner & Aschauer, 2022). In line with the signalling theory (Spence, 1973), the credibility of disclosure and its relevance in reducing asymmetric information may be influenced by the frequency of the signal sent (Ajinkya & Gift, 1984; Gonedes, Dopuch, & Penman, 1976; Maslar, Serfling, & Shaikh, 2021). Extant literature suggests numerous benefits of management earnings forecasts. For instance, Stephen P Baginski and Rakow (2012) and Cao et al. (2017) suggest that management earnings forecasts will likely reduce the cost of financing innovation projects, thereby boosting firms' technical innovation activities. Verrecchia (2001) argues that minimising the information gap between firms and investors will increase liquidity and enable firms to reduce the cost of external finance.

The literature highlights the consequences and costs of public disclosure of firm-specific information (Berger & Hann, 2007; Leuz & Verrecchia, 2000; Yamada, 2016). Leuz and Verrecchia (2000) highlight the proprietary cost of disclosing firms-specific information. (Darrough & Stoughton, 1990) emphasize the importance of considering competition costs relating to disclosure. Firms may erode their competitive edge by publicly disclosing the estimation of future income relating to innovation efforts (Berger & Hann, 2007; Leuz & Verrecchia, 2000; Yamada, 2016). Providing valuable firm-specific information may facilitate competitors' exit or entry decisions (Jia, 2019). This view implies that managers of innovative firms should conduct a cost-benefit analysis before disclosing firm-specific information.

From the agency theory perspective, studies suggest that improving firms' information environment through frequent management earnings forecasts helps resolve agency conflicts. In line with the agency theory of free cash flow (Jensen, 1986), the improved information environment resulting from frequent forecasts will enhance board monitoring. Therefore, the possibility of board monitoring may increase self-interested managers' reluctance to provide frequent earnings forecasts.

4. Empirical Literature Review and Hypothesis

4.1 Management Earnings Forecasts and the Firm's Technical Innovation

The relationship between technical innovation and management earnings forecasts is still unclear. On the one hand, previous studies suggest that proprietary and competition costs may deter a firm from disclosing firm-specific information (D. Huang et al., 2023; Jia, 2019; Zhong, 2018). In this case, the public disclosure of the estimation of future income relating to innovation efforts may reduce a firm's competitive advantage by facilitating competitors' exit or entry decisions. Constant provision of management earnings forecasts is likely to increase the risk of imitation and unwarranted competition (D. Huang et al., 2023). Y. Wang et al. (2015) and (Yamada, 2016) suggest that earnings management forecast is associated with litigation risks. In China, the regulator also closely monitors the format and content of the management forecasts (Xiaobei Huang et al., 2018). Therefore, managers of innovative firms may show conservatism towards providing earnings estimates, especially when the content of such disclosure matters to the regulators. Ali, Klasa, and Yeung (2014) document an inverse relationship between proprietary costs and voluntary disclosure.

On the other hand, due to the capital-intensive nature of technical innovation (D. Huang et al., 2023) and the need to fund innovative projects over a longer period, managers are likely to report frequent earnings estimates to reduce the cost of innovation. Also, since firms engaging in technical innovation have a higher knowledge and information gap with their stakeholders (Zhong, 2018), frequent management forecasts may be relevant to keep the investors on board and reduce the information gap. D. Huang et al. (2023) suggest that outsiders are likely to benefit from the credibility of the mandatory management earnings forecast. It is also the case that each milestone in the innovative process represents 'a small win' for the firm. Penman (1980) argues that firms with 'good news' are more likely to disclose private firm-level information. Therefore, we expect that firms with technical innovation will increase their management earnings forecasts and propose the following hypothesis.

H1: Management earnings forecasts have a positive effect on technical innovation activities

4.2 Management Earnings Forecasts, the Firm's Technical Innovation and the Cost of debt

Prior studies have examined the increasing effects of disclosure practices on a firm's cost of capital (Cao et al., 2017; Rakow, 2010). For instance, using overall corporate disclosure measures, Lang and Lundholm (1996) showed that a higher level of disclosure was related to a more significant analyst following enhanced market expectation accuracy and lower information asymmetry. Their results suggested that high-quality disclosure led to a lower cost of capital. Similarly, using a disclosure level self-constructed measure, Botosan (1997) found a negative relationship between disclosure level and the firm's cost of capital. Stephen P. Baginski and Hinson (2016) documented that the increase in management earnings forecast frequency, followed by forecast initiation, was related to a decrease in the firm's cost of equity capital. Since

the management earnings forecasts provide a projection of the firm's future cash flow to repay its debt obligations, they can assist creditors by communicating essential forward-looking details of a firm that help reduce the cost of debt. The lower cost of debt could help firms manage their expected free cash flows and increase investment in potential R&D innovation projects. Thus, we conjecture an inverse relationship between the management earnings forecast and the cost of debt.

In line with the agency theory, frequent management earnings forecasts will improve the corporate governance of innovative firms. Consistent with the agency theory of free cash flow, previous studies find that a good corporate governance environment will increase the monitoring effect of debt (Elghuweel et al., 2017; Ezeani, Kwabi, et al., 2023; Ezeani et al., 2022; Morellec, Nikolov, & Schürhoff, 2012). Also, Since innovative projects are capital-intensive and funded over an extensive period, Hall and Lerner (2010) suggest that using debt for R&D projects may be costly. They suggest lenders may be unwilling to finance firms with quality R&D projects due to the information asymmetry problem. In contrast, Nanda and Nicholas (2014) showed that debt is a vital financing choice for a firm's innovation activities. We suggest that self-interested managers may refrain from frequent management earnings forecasts to evade the monitoring effect of debt and formulate the following hypothesis.

H2: Cost of debt has a mediating impact between management earnings forecasts and firm's technical innovation activities.

Insert Figure 1 here

5. Data and Research Design

5.1 Data

We collected listed firm's management earnings forecasts data from Wind database, while the related financial indicators data and corporate governance indicators data from China Stock Market & Accounting Research Database (CSMAR) database over the period 2005-2022. Our study sample includes different industry sectors based on the China classification of national economy industries-GB/T4754-2002. Our initial sample consists of 1,223 firms (22,008 firm-year observations) obtained from the China Stock Market & Accounting Research Database (CSMAR) and Wind database between 2005-2022. Following the prior research (Zhong 2018; Jiang, Habib, and Gong 2015; Pittman and Fortin 2004; Jia, 2019; Qin and Zhang 2019), we removed 191 firms from regulated industries and those with missing data or incomplete information. We exclude the financial services, real estate, and insurance-related industries. We also excluded 38 firms for which we cannot obtain management earnings forecasts from the Wind/CSMAR database. We remove 39 firms which have insufficient information to construct the cost of debt proxy. We exclude 42 firms with insufficient information to construct innovation activities variables. Finally, we remove 71 firms that lack sufficient data to compute the control variables. Our final sample is 1032 firms (18,576 firm-year observation). Panel A of Table I shows the sample selection process, while Panel B of Table I explains the deletion of insufficient data from the selected sample size.

All the management earnings forecasts data are firm-yearly and all the R&D activities, cost of debt, and other proxies are taken from annual report of the company. For the technical innovation activities data, we removed implementation observations that have been discontinued. Therefore, we eliminated financial firms' observations and observations of firms that have been treated differently and other inaccurate observations (Ezeani, Salem, Usman, & Kwabi, 2023;

Komal et al., 2021). For the earnings forecasts and other variables data; this study filtered the sample using the following conditions to attain the final selection set: (1) Special treated and newly listed firms were removed from the dataset. (2) Missing value observations and abnormal data were dropped from the dataset. (3) Real estate, financial, and insurance firms were removed from the study dataset. (4) To control any impact of outliers, entire perpetual variables were winsorized at 01 percent to 99th percent. 5) Focused on A-share firms because the effect of realized cost of debt of these firms is more significant in the capital market settings, and the A-share financial information environment is different from that of the Band H-share firm[1]. Additionally, we exclude ambiguous observations, financial firms' observations and special treated firms' observations.

Our dependent variable is the firms' technical innovation activities (TIA), demonstrating the firm's innovation intensity. Prior studies used different proxies to estimate the firm's innovation (Griliches, 2007; Hall, Mairesse, & Mohnen, 2010). Knott and Vieregger (2019) assessed three typical innovation proxies in recent times. They contended that the research quotient is the only proxy that fulfils the condition for the R&D productivity construct in Romer's Theory (Romer, 1990). However, the main focus of our study is on the innovation intent; thus, we follow Zhong (2018) and measure innovation as the firms' R&D spending scaled by the entire operating revenue during the year.

In this study, we used management earnings forecasts (MEFs) as the independent variable of primary interest. MEFs are commonly provided through a variety of channels, including media releases, analyst interviews, and telephone conferences (F. Li, 2010) and their information is effectively communicated to end users (Chen, Huang, Hwang, & Wang, 2019).

[1]Chen et al. (2007) document that A-shares are traded in Yuan (Renimbi) and owned by individual and legal persons of the China, whereas B- and H-shares are exchange in foreign money and offered to foreign nations including Hong Kong, Macau, and Taiwan citizens only.

Following Jiang, Habib, and Gong (2015), this study estimated management earnings forecasts as the firm's earnings forecast quantity during a financial year. The MEFs were used to test the study hypotheses that capture the firms' precise information on future incomes relating to accounting basics used to hold the firm's value-generating practices, particularly the firm's free cash flow.

Our study used one mediating variable, namely the Cost of Debt (COD), to investigate the firm's COD effect on the association between management earnings forecasts and TIA (see Figure I). Following previous studies, including Pittman and Fortin (2004), this study estimated COD as the interest cost of a firm divided by total debt (non-current obligations due during one year, short- and long-run debts, bond payables, and accounts payable) of the firm "i" and year "t." Our study expects that the firms' MEFs and COD are negatively associated.

Following previous studies (Jia, 2019; Qin and Zhang, 2019 (Owusu, Kwabi, Ezeani, & Owusu-Mensah, 2022), the present study used control variables that might confound the relationship among MEFs, TIA, and the COD. The control variables included bank loan access (ABL), leverage (LEV), firm size (FS), firm's age (FA), profitability (ROA), state-owned enterprise (SOE), cash flow from operations (CFO), the book value to market (BTM), big four auditors (B4A), growth opportunity (GRO), Tobin's Q (TQ), loss in net income (LOSS), industry and year effects. Also, following previous studies (Kwabi, Owusu, Ezeani, & Boateng, 2024; Obenpong Kwabi, Owusu-Manu, Boateng, Ezeani, & Du, 2022) politically connected firm (PCF).

The ABL was calculated as equivalent to "1" when firms access bank loans and "0" for others. The LEV was calculated as the debt of the firms relating to the sum of debt in a year scaled by assets in total (Usman et al., 2023). The FS is determined as the natural logarithm of

316 assets in total (Usman, Ezeani, Salem, & Song, 2022). Extant literature documents that FA is an
317 essential variable influencing innovation activity. The FA was estimated as the years between the
318 firm's annual financial reports and initial public offerings.

319 The ROA is the firm's profitability, estimated as the net earnings scaled by the total firm
320 assets. The SOE was calculated as if a non-financial firm was controlled by the state or
321 government, with one and zero values. The BTM was determined by the equity market worth
322 plus the sum of the asset book worthless, the equity book value, and deferred taxes (adjusted to
323 "0" when lost) scaled by the firm's entire asset book value. The B4A equaled one if an audit
324 report was issued in a year and zero otherwise. The PCF was equivalent to "1" if firms' officials,
325 including the manager, general manager, or real controller, had a political link with government
326 officials linked with political consultative meetings or national people congress duties at a
327 country level or above "0" otherwise. The CFO was measured as cash flow scaled by assets in
328 total in a year. The GRO was sales growth estimated as the disparity with the existing year's
329 sales plus the preceding year's sales divided by the prior sales. The TQ was calculated as the
330 equity market worth plus the firm's obligations book worth divided by the firm's total assets. A
331 firm's earnings are less substantial for the firm's loss, and the financial expectation of achieving
332 or striking the goals is less vital for the said firms. Thus, following a study like Jia (2019), this
333 study included LOSS estimated as one for the firms whose net income was negative and zeroed
334 otherwise to report a substantial loss in the previous period. Finally, this study includes year and
335 sector dummy variables to identify the invariable period, industry heterogeneity, and period
336 trends. The descriptive information of the sample selection procedure is presented in Table I.

337 **Insert Table I here**

5.2 Research Design

We first examined the effects of a firm's management earnings forecasts on technical innovation activities (in model 1). Secondly, we examined whether the cost of debt plays a mediating role in the relationship between management earnings forecasts and innovation (see models 2 and 3). We used fixed effects regression to test the effect of management earnings forecasts on technical innovation activities and the mediating effect of the cost of debt. We also controlled for self-selection and endogeneity problems using Heckman's (1979) two-step selection method and two-stage least square analysis. In the first step, we use a probit regression model containing instrumental variable(s) that predict the independent variable but do not directly expect the dependent variable. We computed the inverse Mills ratio in the first stage and incorporated it in the second step to avoid self-selection bias. Following Caramanis and Lennox (2008), we also used a two-stage least square technique to address the endogeneity problem. In the first stage of regression, we regress the endogenous variable on their lagged values (lagged variable used as instrumental variable). We used these variables to predict the endogenous variable in the next-stage. In the second stage, we incorporate the endogenous variable's predicted value along with the exogenous variable in the regression equation. Then, we used ordinary least squares (OLS) regression to determine the variables that are vital (coefficient) in the equation. The coefficient obtained from the second stage regression have similar results to the regression models of the study. Finally, Following Liu, Cullinan, Zhang, and Wang (2016); Gul, Zhou, and Zhu (2013), we used a robustness test i.e., regression (fixed effect) as a strategic approach in which the dependent variable proxy was replaced with an alternative proxy along with lagged variables. The industry and year fixed effects are controlled for in all the regressions.

5.1.1 Management Earnings Forecasts and Firms' Technical Innovation Activities

H1 states that MEFs have a positive effect on TIA. It postulates that frequent MEFs increase a firm's innovation activities to mitigate information asymmetry's innate issue in firms involved in additional innovation activities. Hence, we estimated the following basic model equation (1):

$$\mathrm{TIA_{it}} = \alpha_0 + \beta_1 \mathrm{MEF_{it}} + \beta_2 \mathrm{ABL_{it}} + \beta_3 \mathrm{LEV_{it}} + \beta_4 \mathrm{FS_{it}} + \beta_5 \mathrm{FA_{it}} + \beta_6 \mathrm{ROA_{i,t}} + \beta_7 \mathrm{SOE_{i,t}} + \beta_8 \mathrm{BTM_{i,t}} + \beta_9 \mathrm{B4A_{i,t}} + \beta_{10} \mathrm{PCF_{i,t}} + \beta_{11} \mathrm{GRO_{i,t}} + \beta_{12} \mathrm{CFO_{i,t}} + \beta_{13} \mathrm{TQ_{i,t}} + \beta_{14} \mathrm{LOSS_{i,t}} + \text{Ind. FE} + \text{Yr. FE} + \varepsilon_{i,t} \quad (1)$$

The TIA was the dependent variable, measuring its innovation intensity, and the subscript denotes the industry and year. The independent variable, MEFs, referred to earnings forecasts' quantity for the firm in a particular year t. The remaining are the control variables described.

5.1.2 Cost of Debt Mediation Effect between Management Earnings Forecasts and Firm's Technical Innovation Activities.

Next, we investigated how the lower (higher) COD alleviated (aggravated) the issue of the cash flow of a firm because of the MEFs; in turn, the MEFs facilitate (impede) the TIA. We used path analysis to examine the presence of an indirect direction and assess the significance of the direct and indirect connection through MEFs to the TIA. The path study presents the conclusive descriptions of correlation structures, as it decomposes or breaks down a correlation between the variable of the source (causal) that is MEFs, and the outcome that is the TIA, into paths such as a simple, direct, indirect, or compound path that contains a mediating variable (COD). The decomposition suggests the occurrence and proportional significance of both direct and indirect pathways between MEFs and the TIA. This study considered that the primary path analysis was repeated, e.g., all paths' flows are in one direction and include observable variables.

The path study's main output was the route coefficient connecting the path coefficient signified the correlation part decomposed to the pathway matching.

This study used the path coefficient ratio to estimate the mediation effect or direct pathway's significance, i.e., the mediation pathway with additional parts to the entire association between the MEFs and TIA. The importance of the direct and indirect paths increases due to the rise of the ratio, and, within the background of this research, the mediation effect between MEFs and the TIA was the path coefficient product between the MEFs and COD and the path coefficient between the COD and the TIA. To examine the COD mediation effect on the relationship between MEFs and TIA, this study used the three steps of performing the mediation effect described by Baron and Kenny (1986) are as follows;

The study's mediator regressed on the independent variable in the first step. Then, the dependent variable regressed on the independent variable. Lastly, the dependent variable was regressed on the mediator and independent variable. These authors explained that the independent variable was expected to exhibit statistical significance in the first two steps. The mediator variable was supposed to show statistical significance in the third step, and the independent variables were unimportant. However, Zhao, Lynch, and Chen (2010) showed that the association linking an independent and dependent variable is insignificant because it can be confusing. An indirect effect establishes the mediation effect because it is the indirect and direct impacts (along with the mediator). Thus, the indirect effect should be significant. We used the following model's equations, i.e., (2) and (3), to check the COD mediation effect.

$$COD_{it} = \alpha_0 + \beta_1 MEF_{it} + \beta_2 ABL_{it} + \beta_3 LEV_{it} + \beta_4 FS_{it} + \beta_5 FA_{it} + \beta_6 ROA_{i,t} + \beta_7 SOE_{i,t} + \beta_8 BTM_{i,t} + \beta_9 B4A_{i,t} + \beta_{10} PCF_{i,t} + \beta_{11} GRO_{i,t} + \beta_{12} CFO_{i,t} + \beta_{13} TQ_{i,t} + \beta_{14} LOSS_{i,t} + Ind.\ FE + Yr.\ FE + \varepsilon_{i,t} \quad (2)$$

$$TIA_{it} = \alpha_0 + \beta_1 MEF_{it} + \beta_2 COD_{it} + \beta_3 ABL_{it} + \beta_4 LEV_{it} + \beta_5 FS_{it} + \beta_6 FA_{it} + \beta_7 ROA_{i,t} + \beta_8 SOE_{i,t} + \beta_9 BTM_{i,t} + \beta_{10} B4A_{i,t} + \beta_{11} PCF_{i,t} + \beta_{12} GRO_{i,t} + \beta_{13} CFO_{i,t} + \beta_{14} TQ_{i,t} + \beta_{15} LOSS_{i,t} + Ind.\ FE\ +\ Yr.\ FE + \varepsilon_{i,t} \quad (3)$$

The TIA was the dependent variable, measuring the firm's innovation intensity. The MEFs were the independent variable measured as earnings forecast quantity in an "i" firm for a "t" year. A firm's COD measure was used to mediate between the study's dependent and independent variables. All the variables are labeled.

Considering the possible endogenous association of MEFs with the TIA, we used the Two-Steps Selection Method (TSSM) and Two-Stage Least Square (TSLS) to manage self-selection and endogeneity. TSSM is used to avoid possible self-selection bias arising from endogenous earnings forecasts. In the first step of TSSM, a Probit Regression Model (PRM) was used to foresee that firms involved in innovation intent would issue more MEFs to obtain more external debt financing. When employing the continuous variable, a dummy dependent variable was required to run in the PRM. Thus, we included a dummy variable during the first step of the PRM. Also, the 1st step model of TSSM must consist of the instrumental variable(s) that predict the independent variable (MEFs) but do not directly expect the dependent variable (TIA); therefore, this study included instrumental variables in the PRM[2]. Finally, the inverse Mills ratio (IMR) was produced following the PRM[3]. The IMR was incorporated into the next step to avoid self-selection bias from the empirical analysis. This study used the TSLS method to control endogeneity and recognise the instrumental variables that realise the elimination constraint related to the MEFs but not correlated with TIA. Hence, we used a lagged instrument approach

[2]Following O. Z. LI and Zhuang (2012), this study includes industry guidance as an instrumental variable obtained as the proportion of the issuing MEF of a firm in the same sector.
[3]The IMR is calculated by ϕ (z)/ Φ (z), whereas z present the proper index feature of PRM; ϕ present the function of density; and Φ is the regular normal distribution total density.

in the TSLS method[4]. Finally, to verify the study's robustness, our results employed the alternative proxy of innovation[5].

6. Empirical Findings and Discussion

6.1 Descriptive Summary

Table II represents the descriptive statistics of the management earnings forecasts' effects on innovation activities and the mediating effect of the cost of debt in the relationship between management earnings forecast and technical innovation. Similar to the findings of Zeng and Lin (2011), we find that on average, each firm spends about 4% of the R&D expenditure per year on its technical innovation activities. The mean (median) value of the MEF frequency was 0.68 (0.000), whereas the Chinese firms had an average COD of 7%. The control variables, for example ROA, CFO, and LEV mean (median) values were 4% (0.04), 6% (0.06), and 43% (0.43), respectively. However, the dataset also showed that 67% of the Chinese firms were SOEs, suggesting that SOEs were the principal shareholders and played an essential role in domestic firms (Khan, Kayani, Saleem, & Aysan, 2024; Zeng & Lin, 2011).

Insert Table II here

Pearson's correlation matrix results are shown in Table III among all study variables. The primary variable of interest, MEF, was positive and significantly correlated to TIA. The

[4] Due to a few causes, the second stage estimate provided important findings (Caramanis & Lennox, 2008). Primarily, the lagged values of TIA in the first stage was strongly related to the MEFs (p-value <0.001), suggesting that lagged MEFs could act as a robust instrument. Similarly, the next stage estimates were consistent when the instrumental variables were uncorrelated to residual error.

[5] The patent (INNO) was used as the dependent variable to further verify the study robustness. This study followed recent studies Qin and Zhang (2019), the present study selected patent data rather than the citations of patents as the firm's innovation proxy. For various reasons, the patent citation data is unavailable in China. Hence, this study calculated innovation output measures, i.e., total patent, as the sum of the inventory, utility, and design patent. These three measures were used to compute the total patent as the natural logarithm and the inventory patents, plus the natural logarithm and utility patents, plus the natural logarithm and design patents. The intellectual property market the patents actively traded by firms to guarantee safe lending.

correlation between MEF and TIA was 0.246, suggesting that MEF positively affected its technical innovation activities. The relationship between the MEFs and COD was also significant and negatively correlated. The correlation between MEFs and COD was -0.1053, indicating that MEFs were useful in decreasing the firm's COD. Furthermore, in this study, many variables were significantly correlated in the expected direction; therefore, all variables captured a distributed underlying construct. Most pair-wise variables connected considerably at the one percent mark in the predicted order.

Insert Table III here

6.2 Management earnings forecasts, technical innovation activities: mediated by the firm's cost of debt

Table IV presents the baseline regression results of the H1 and H2 tests. In Model (1), the finding shows that the coefficient of MEFs has a positive relationship with TIA. This relationship is significant in both models 1 and 3 suggesting that frequent MEFs positively affect the firm's TIA. Thus, this finding supports our first hypothesis, H1. Consistent with the signaling theory and previous literature, MEFs provide valuable information about a firm's necessary records that capture the value-generating process, particularly future cash flow (Bhattacharya, Ecker, Olsson, & Schipper, 2012). Besides, these frequent MEFs are also associated with improved reporting quality and transparency and a better internal control system (Feng, Li, & McVay, 2009) that provides decision-makers a better precision about possible returns from uncertain endeavors (Bushman & Smith, 2001), which helps decision-makers to understand the future innovation prospects with fewer errors to achieve higher technical innovation success. Our results are economically significant as a unit increase in MEFs corresponds to a 1.28 increase in TIA.

In Table IV, the findings of Model (2) and (3) shows that the coefficient between (MEFs and COD) and (TIA and COD) were negatively significant (ß = -0.00183 significant at 01 percent) and (ß = -0.0619 significant at 01 percent) suggesting that creditors offer lower interest rate loans to frequent and precise MEFs due to fewer information asymmetry problems. This study estimated that the overall correlation between MEFs and TIA was 0.0011 ($p<0.10$). The direct and mediated pathways decomposed this association into the section featuring the direct relationship between MEFs and TIA and the COD mediated as an indirect relationship. For both parts, the path coefficient (i.e., MEF path to COD and COD path to TIA) was statistically significant at 1%, suggesting a robust mediation effect of COD on the MEFs and TIA nexus.

Besides, the impact of the path coefficient between COD and TIA was negatively significant, suggesting that creditors include MEFs to lower information asymmetry and would likely charge a lower interest rate when the firms provide frequent MEFs (Hsieh et al., 2019). Sequentially, the firm's COD alleviates free cash flow problems, which are used to spur the firm's innovation activities. Overall, these findings support the H2 predictions.

Furthermore, the control variables result revealed that the firm's ABL, LEV, FA, PCF, GRO, CFO, TQ, and B4A were positively related to TIA. While the FS, ROA, SOE, BTM, and LOSS were negatively associated with TIA. We also found that higher innovation activities are related to a firm's LEV, which was identical to a previous study, suggesting that the credit market was reluctant to encourage innovation activities because innovative firms have an unstable and inadequate amount of inside-generated cash flows to facilitate debt (Hsu, Tian, & Xu, 2014). Furthermore, a big-size firm's growth potential shows more significant innovation activities (Tian & Wang, 2014).

Insert Table IV here

6.3 Two-Steps Selection Method (TSSM)

A key issue related to the findings from this research was the possibility of self-selection bias. Thus, we conducted TSSM to process this possible self-selection bias concern. In Table V, the 1st step employed a PRM to predict MEF decision but did not relate to TIA. We used a continuous independent variable, i.e., MEF frequency, to calculate the significance of MEFs on a firm's innovation intensity; therefore, it followed Xuerong Huang and Sun (2017) to construct a dummy variable (MEFD) to run the PRM. Our study also followed O. Z. LI and Zhuang (2012) and included instrumental variable industry guidance (ING). It was estimated as the proportion of earnings forecasts released by firms in the identical industry and selected control variables. This study produced the IMR following the self-selection PRM, adding IMR to avoid possible endogeneity in selecting MEFs. The findings of the TSSM suggested that IMR had a significant coefficient in all models, i.e., models (1, 2, and 3), which captured TIA in model 1, the dependent variable, and model 3 and the mediator variable as the dependent variable in model 2. The coefficient of ING was favorable and significant in the 1st step (i.e., presented in Table V). MEFs coefficient was positive and significantly related to the TIA. In contrast, the MEFs were negative and significantly associated with the mediator variable COD, suggesting that this study's conclusion still holds after correction for self-selection bias. Therefore, the results did not have selection bias by the MEFs decision.

Insert Table V here

6.4 Endogeneity

To address endogeneity, we used the TSLS technique to control endogeneity. We performed a TSLS instrument variable method following (Caramanis & Lennox, 2008). Our study conducted a 1st stage model that determined the observed level of TIA with the MEFs lags as an instrumental variable and all formerly employed controls as exogenous variables. The expected value through the 1st stage then replaced the MEFs in the model of the 2nd stage. The findings for the 2nd stage generated the same results, indicating that the MEFs facilitated the TIA (See Table VI).

Insert Table VI here

6.5 Robustness Test

During our research, we extensively analyzed the study data using various sophisticated statistical techniques. In particular, our analytical framework incorporated a baseline regression (fixed effect) analysis used to control for unobserved heterogeneity and time-invariant factors. We also used Heckman's (1979) two-stage selection model to analyze any potential bias in sample selection thoroughly. Additionally, endogeneity issues were addressed using the two-stage least square approach, assuring the accuracy and consistency of our findings.

For robustness, this study used an alternative method for estimating the quality of innovation is to study the association between effort and efficiency. We used a strategic approach by replacing the technical innovation activities with proxy innovation patent proxy and lagged variables. Using this technique, our research can evaluate the generality and consistency of our findings beyond the particular measurement used in the initial models. We increase the study's robustness by ensuring that our conclusions are independent of any metric by examining

how sensitive our conclusions are to changes in the selected dependent variable. This analytical method provides a more thorough grasp of the phenomenon being studied, strengthening the validity of our research and adding to the general dependability of the study's findings. In general, using these many statistical methods demonstrates the care with which our study design was executed since they all work together to produce a solid and well-supported analysis. Our detailed methodology strengthens the validity and reliability of the results, supporting the strength of the study's empirical findings. In this context, our study included a total patent as a substitute for invention. This research followed previous studies by Qin and Zhang (2019) and took a firm's entire patent (INNO) as the dependent variable for robustness tests. This study estimated INNO as the natural logarithm and total patents (including inventory, utility, and design). The finding shows that the coefficient of MEFs was also a positively significant relationship with INNO. This relationship is significant in both models 1 and 3 with innovation activities measured i.e., TIA (ß = 0.0385 significant at 01 percent and (ß = 0.0378 significant at 01 percent). Additionally, the findings of Model (2) and (3) shows that the coefficient between (MEFs and COD) and (INNO and COD) were negatively significant (ß = -0.00180 significant at 01 percent) and (ß = -0.0677 significant at 10 percent), suggesting that creditors offer lower interest rate loans to frequent and precise MEFs due to fewer information asymmetry problems. This study estimated that the overall correlation between MEFs and TIA was 0.00378 ($p<0.01$). Overall, the robust test resembled the results of the baseline analysis (see Table VII).

Insert Table VII

7. Conclusion

We examine the relationship between management earnings forecasts and corporate innovation. Our study also examines whether the cost of debt plays a mediating role between the management earnings forecasts and the innovation nexus. Our independent variable is corporate innovation, measured as the firms' R&D spending scaled by the entire operating revenue during the year. The key independent variable used in this study is the management earnings forecast, estimated as the firm's earnings forecast quantity during a financial year. We also examined the mediating effect of the cost of debt (COD), defined as the interest cost of a firm divided by its total debt.

Using data from 1032 non-financial firms listed on the Shanghai and Shenzhen stock markets from 2005 to 2022, we document a positive relationship between management earnings forecasts and the firms' technical innovation. Our findings also show that the cost of debt mediates the relationship between management earnings forecast and technical innovation. Further analysis indicates that frequent earnings forecasts provide incremental information regarding a firm's future value and cash flows, thus reducing the volatility and uncertainty in cash flow calculations.

Our study has implications for Chinese regulators, enabling them to promote frequent management earnings forecasts through targeted incentives. The findings of this study are also relevant to Chinese firms, allowing them to understand the relationship between management earnings forecasts and firms' innovation activities. Our study will also help academics appreciate the merits of mandatory disclosure in a weak institutional environment.

Our study has some limitations. One key limitation of this study is that the data used is limited to Chinese firms. China has a unique disclosure environment, so our findings may not be

generalizable to different capital market settings. Future research would benefit from including samples from both developed and emerging economies. This approach will help researchers to compare the relationship between mandatory and voluntary MEFs disclosure on firm innovation.

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Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Table I Descriptive information of sample selection procedure

Panel A

Selection of Firms	Nos. of Firms	%
Agriculture	18	1.744
Telecommunication	10	0.969
Conglomerate	30	2.907
Information Technology	166	16.085
Manufacturing	582	56.395
Metals & Minerals	67	6.492
Business Service Sector	52	5.039
Transportation	20	1.938
Power Utilities	39	3.779
Whole Sales	48	4.651
Total Firms	1,032	100

Panel B

Description	No of Firm Years	No of Firms
Availability of total firm-year observations on the CSMAR and Wind database from 2005 to 2022	22,008	1,223
Less:		
Observations with missing earning management forecasts	680	38
Observations with insufficient data to construct cost of debt proxy	710	39
Observations with insufficient data to construct innovation activities proxy	759	42
Observations with insufficient data construct control variables	1,283	71
Final sample	18,576	1,032

Source(s): Created by Author(s)

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811 **Table II Descriptive Summary**

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Variables	Observation	Mean	Median	Min.	Max.	S.D
Dependent Variable						
TIA	18,576	0.04	0.00	0.00	0.05	0.08
Independent Variable						
MEFs	18,576	0.68	1.00	0.00	1.00	0.85
Mediator						
COD	18,576	0.07	0.05	0.03	0.08	0.07
Control Variables						
ABL	18,576	0.47	0.00	0.00	1.00	0.50
LEV	18,576	0.43	0.43	0.27	0.59	0.20
FS	18,576	21.89	21.78	21.03	22.63	1.23
FA	18,576	10.91	11.00	6.00	14.00	6.24
ROA	18,576	0.04	0.04	0.01	0.07	0.05
SOE	18,576	0.67	1.00	0.00	1.00	0.47
BTM	18,576	0.54	0.51	0.32	0.74	0.27
B4A	18,576	0.04	0.00	0.00	1.00	0.18
PCF	18,576	0.60	1.00	0.00	1.00	0.49
GRO	18,576	0.14	0.07	0.00	0.26	0.28
CFO	18,576	0.06	0.05	0.01	0.09	0.11
TQ	18,576	1.84	1.42	0.73	2.56	1.51
LOSS	18,576	0.12	0.00	0.00	1.00	0.32
ING	18,576	0.06	0.00	-0.16	0.08	0.45

Notes: General information: TIA, the firms' R&D spending scaled by the entire operating revenue during the year; MEF, the firm's earnings forecast quantity during a financial year; COD, the interest cost of a firm divided by debt in total (non-current obligations due during one year, short- and long-run debts, bond payables, and accounts payable) of the firm "i" and year "t."; ABL, equivalent to "1" when firms access bank loans and "0" for others; LEV, the debt of the firms relating to the sum of debt in a year divided by assets in total; FS, the natural log of total assets; FA, the total years between the firm's financial reports per year and initial public offerings; ROA, the firm's profitability, and it was estimated as the net earnings scaled by the total firm assets; SOE, if a non-financial firm was controlled through the state or government, and the value is one and zero; BTM, the market worth of equity add the sum of asset book worthless, the equity book value, and deferred taxes (adjusted to "0" when lost) scaled by the firm's entire asset book value; B4A, equaled one if an audit report was issued in a year and zero otherwise; PCF, equivalent to "1" if firms' officials, including the manager, general manager, or real controller, had a political link with Government officials linked with political consultative meetings or national congress duties at a country level or above and "0" for others; GRO, sales growth estimated as the disparity with the existing year sale plus preceding year sales divided by the prior sales; CFO, CF divided by assets in total in a year; TQ, the equity market worth plus the firm's obligations book worth divided by the firm's total assets; LOSS, one for the firms whose net income was negative and zeroed otherwise; ING, the proportion of earnings forecasts released by firms in the identical industry.

Source(s): Created by Author(s)

Table III Correlation Matrix

Variable	TIA	MEFs	COD	ABL	LEV	FS	FA	ROA	SOE	BTM	B4A	PCF	GRO	CFO	TQ	LOSS
TIA	1															
MEFs	0.2462*	1														
COD	-0.0455*	-0.1182*	1													
ABL	0.1821*	0.2503*	-0.2271*	1												
LEV	-0.1097*	0.0313*	-0.5019*	0.2192*	1											
FS	0.0753*	0.0988*	-0.2251*	0.3008*	0.3912*	1										
FA	0.1106*	0.1122*	-0.2828*	0.3501*	0.3215*	0.4711*	1									
ROA	0.0688*	-0.0622*	0.2740*	-0.1142*	-0.2851*	-0.0163*	-0.1314*	1								
SOE	-0.0790*	-0.1764*	-0.0431*	-0.0331*	0.1014*	0.1906*	0.1322*	-0.1121*	1							
BTM	-0.2230*	-0.1297*	-0.1142*	0.0730*	0.2445*	0.3384*	0.1364*	-0.2685*	0.2098*	1						
B4A	0.0309*	-0.0234*	0.005	0.0314*	0.0694*	0.2262*	0.1020*	0.0380*	0.0187*	0.0963*	1					
PCF	0.2094*	0.3100*	-0.0927*	0.2341*	0.0734*	0.1148*	0.2158*	0.0741*	-0.2963*	-0.1418*	0.0304*	1				
GRO	0.0800*	0.1117*	-0.0922*	0.1265*	0.0744*	0.1616*	0.0795*	0.1673*	-0.0549*	-0.0728*	-0.003	0.0996*	1			
CFO	-0.0431*	-0.1443*	0.2273*	-0.1801*	-0.1603*	-0.1358*	-0.2050*	0.2028*	0.1146*	0.0375*	0.0147*	-0.1706*	-0.0063	1		
TQ	0.2709*	0.1210*	0.1608*	-0.0344*	-0.3654*	-0.3949*	-0.1086*	0.2692*	-0.2315*	-0.7551*	-0.0729*	0.1720*	0.0419*	0.0037	1	
LOSS	-0.0574*	0.0370*	-0.0789*	0.014	0.1438*	-0.0768*	0.0226*	-0.6723*	0.0839*	0.0917*	-0.0210*	-0.0812*	-0.1713*	-0.0452*	-0.0868*	1

Source(s): Created by Author(s)

Table IV Testing mediation effect of cost of debt on the relationship between management earnings forecasts and the firm's technical innovation activities

VARIABLES	Exp. Sign	Model 1	Model2	Model 3
		DV	Mediator	DV
		TIA	COD	TIA
MEFs	+/-	0.00122**	-0.00183***	0.00110*
		(0.000609)	(0.000580)	(0.000608)
COD	-	-	-	-0.0619***
		-	-	(0.00792)
ABL	+/-	0.00267**	-0.00301***	0.00248**
		(0.00108)	(0.00102)	(0.00107)
LEV	+/-	0.0195***	-0.141***	0.0108***
		(0.00353)	(0.00336)	(0.00370)
FS	+/-	-0.00139	-0.00362***	-0.00162*
		(0.000866)	(0.000825)	(0.000865)
FA	+/-	-0.0655***	0.00616**	-0.0651***
		(0.00260)	(0.00248)	(0.00260)
ROA	+/-	-0.0133	0.144***	-0.00434
		(0.0125)	(0.0119)	(0.0125)
SOE	+/-	-0.00151	0.000961	-0.00145
		(0.00128)	(0.00122)	(0.00128)
BTM	+/-	0.00190	-0.0101***	0.00127
		(0.00348)	(0.00332)	(0.00348)
B4A	+	0.0124***	0.00258	0.0125***
		(0.00382)	(0.00364)	(0.00382)
PCF	+/-	0.000783	-0.000801	0.000733
		(0.00145)	(0.00138)	(0.00145)
GRO	+/-	0.00423***	-0.0111***	0.00355**
		(0.00152)	(0.00144)	(0.00152)
CFO	+	0.00594	0.0364***	0.00820*
		(0.00438)	(0.00417)	(0.00438)
TQ	+/-	0.00613***	-0.00350***	0.00592***
		(0.000590)	(0.000562)	(0.000590)
LOSS	+/-	-0.00345*	0.0153***	-0.00250

	(0.00178)	(0.00169)	(0.00178)
Cons.	1.094***	0.113***	1.101***
	(0.0458)	(0.0437)	(0.0458)
Industry F-E	Yes	Yes	Yes
Year F-E	Yes	Yes	Yes
Observations	18,576	18,576	18,576
R-squared	0.359	0.220	0.361

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Source(s): Created by Authors

Table V Findings of Heckman's (1979) Selection Procedure

VARIABLES	**1stStep**	**2nd Step**	**2nd Step**	**2nd Step**
		Model 1	**Model 2**	**Model 3**
	DV	**DV**	**Mediator**	**DV**
	MEFD	**TIA**	**COD**	**TIA**
MEFs	-	0.00130**	-0.00200***	0.00119**
	-	(0.000607)	(0.000577)	(0.000606)
COD	-	-	-	-0.0555***
	-	-	-	(0.00770)
ABL	-0.319***	0.0205***	-0.00529***	0.0202***
	(0.0327)	(0.00181)	(0.00173)	(0.00181)
LEV	2.110***	-0.102***	-0.133***	-0.110***
	(0.0797)	(0.00989)	(0.00944)	(0.00993)
FS	-0.287***	0.0138***	-0.00264*	0.0137***
	(0.0158)	(0.00148)	(0.00141)	(0.00148)
FA	-0.0489***	0.000515	-0.000828**	0.000467
	(0.00303)	(0.000337)	(0.000325)	(0.000336)
ROA	1.889***	-0.107***	0.177***	-0.0973***
	(0.395)	(0.0147)	(0.0140)	(0.0147)
SOE	-0.325***	0.0161***	-0.00126	0.0160***
	(0.0312)	(0.00194)	(0.00185)	(0.00194)
BTM	0.393***	-0.0162***	-0.00846**	-0.0167***
	(0.0869)	(0.00365)	(0.00349)	(0.00365)
B4A	0.582***	-0.0172***	0.00967**	-0.0166***
	(0.0751)	(0.00435)	(0.00416)	(0.00434)
PCF	0.0520	-0.00236	7.16e-05	-0.00236
	(0.0324)	(0.00145)	(0.00138)	(0.00145)
GRO	0.152***	-0.00330**	-0.0113***	-0.00393**

	(0.0544)	(0.00166)	(0.00158)	(0.00166)
CFO	-0.694***	0.0449***	0.0381***	0.0471***
	(0.134)	(0.00539)	(0.00514)	(0.00539)
TQ	0.0746***	0.00334***	-0.00256***	0.00319***
	(0.0155)	(0.000654)	(0.000624)	(0.000653)
LOSS	0.182***	-0.0121***	0.0184***	-0.0111***
	(0.0586)	(0.00192)	(0.00183)	(0.00192)
Instrumental Variable				
ING	-0.256***	-	-	-
	(0.0387)	-	-	-
IMR		-0.0658***	0.0098*	-0.0654***
		(0.00557)	(0.00532)	(0.00556)
Cons.	4.267***	-0.117***	0.185***	-0.107***
	(0.335)	(0.0225)	(0.0215)	(0.0225)
Industry F-E	Yes	Yes	Yes	Yes
Year F-E	Yes	Yes	Yes	Yes
Pseudo R^2	0.1731	-	-	-
R-Square	-	0.2978	0.3211	0.2981

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source(s): Created by Authors

837 **Table VI Findings of Two-Stage Least Square (TSLS)**

VARIABLES	**Model 1**	**Model 2**	**Model 3**
	DV	**Mediator**	**DV**
	TIA	**COD**	**TIA**
MEFs	0.0341***	-0.0151*	0.0346***
	-0.00645	-0.00883	-0.00646
COD	-	-	-0.114***
	-	-	-0.0107
ABL	0.0290***	-0.00542**	0.0282***
	-0.0022	-0.00232	-0.00217
LEV	-0.0575***	-0.141***	-0.0744***
	-0.00362	-0.00318	-0.00419
FS	0.0135***	0.00242***	0.0136***
	-0.000822	-0.000858	-0.000824
FA	0.000282**	-0.00104***	0.000164
	-0.000114	-0.000117	-0.000115
ROA	-0.165***	0.268***	-0.132***
	-0.0196	-0.0215	-0.019
SOE	-0.00598***	-0.00531***	-0.00619***
	-0.00175	-0.00175	-0.00176
BTM	-0.0383***	0.00222	-0.0381***
	-0.00397	-0.00386	-0.00396
B4A	0.0016	0.00558**	0.00293
	-0.00336	-0.00272	-0.00334
PCF	0.0303***	0.00439	0.0304***
	-0.00274	-0.00295	-0.00274

GRO	0.0124***	-0.0126***	0.0108***
	-0.00244	-0.00235	-0.00241
CFO	0.00762	0.0640***	0.0144**
	-0.00597	-0.00628	-0.00591
TQ	0.0119***	-0.00075	0.0117***
	-0.00064	-0.000512	-0.000638
LOSS	-0.00599**	0.0278***	-0.00274
	-0.00248	-0.00194	-0.00252
Cons.	-0.237***	0.0890***	-0.223***
	-0.0149	-0.0127	-0.0147
Sargan Statistic	0.001	0.005	0.001
Cragg-Donald Wald F statistic	245.616	60.033	244.613
LM statistic	242.604	59.87	241.639
Observations	18,576	18,576	18,576
R-squared	0.055	0.306	0.052

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source(s): Created by Authors

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840 **Table VII Findings of the Robustness Test**

VARIABLES	Model 1 DV INNO	Model 2 Mediator COD	Model 3 DV INNO
MEFs	0.0385***	-0.00180***	0.0378***
	(0.00307)	(0.000581)	(0.00310)
COD	-	-	-0.0677*
	-	-	(0.0404)
ABL	0.0168***	-0.00286***	0.0162***
	(0.00542)	(0.00102)	(0.00551)
LEV	0.103***	-0.141***	0.0958***
	(0.0178)	(0.00336)	(0.0191)
FSLN	0.0803	-0.101***	0.0738
	(0.0929)	(0.0176)	(0.0988)
FALN	-0.0893***	0.00374	-0.121***
	(0.0241)	(0.00455)	(0.0289)
ROA	-0.297***	0.144***	-0.267***
	(0.0628)	(0.0119)	(0.0658)
SOE	-0.0620***	0.00112	-0.0580***
	(0.00646)	(0.00122)	(0.00674)
BTM	-0.134***	-0.00953***	-0.145***
	(0.0175)	(0.00331)	(0.0184)
B4A	0.0409**	0.00273	0.0501**

	(0.0193)	(0.00364)	(0.0204)
PCF	0.0684***	-0.000716	0.0662***
	(0.00732)	(0.00138)	(0.00748)
GRO	-0.00519	-0.0107***	-0.00747
	(0.00765)	(0.00145)	(0.00779)
CFO	-0.0390*	0.0354***	-0.0337
	(0.0221)	(0.00418)	(0.0237)
TQ	-0.0112***	-0.00359***	-0.01000***
	(0.00298)	(0.000562)	(0.00306)
LOSS	-0.0275***	0.0152***	-0.0275***
	(0.00896)	(0.00169)	(0.00923)
Constant	-0.134	0.445***	-0.0813
	(0.287)	(0.0542)	(0.299)
Industry F-E	Yes	Yes	Yes
Year F-E	Yes	Yes	Yes
Observations	18,576	18,576	18,576
R-squared	0.917	0.221	0.915

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source(s): Created by Authors

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