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How does the COVID-19 affect earnings management: Empirical evidence from China

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ABSTRACT

Using China's A-share listed companies from 2018 to 2020, this paper examines the impact of COVID-19 on earnings management. The results reveal that: (1) The COVID-19 shock intensifies earnings management, which is reflected in the increasing accrual-based earnings management and real earnings management. Moreover, when enterprises face a higher degree of financial constraints, this shock effect is more evident. (2) Enterprises in industries and regions where COVID-19 is more severe are more affected by the suspension of work and production caused by the epidemic prevention policies, so these enterprises choose accrual-based earnings management through accounting items rather than carrying out earnings management through real activities. (3) Further analysis finds that, enterprises with more investment opportunities have more evident earnings management caused by the COVID-19 shock. However, high-quality auditing has an inhibitory effect on accrual-based earnings management caused by the COVID-19 shock but has no inhibitory effect on real earnings management.

1. Introduction

COVID-19, which broke out in early 2020, continues to be a global pandemic and cause serious impacts on economies around the world. The COVID-19 shock has caused serious economic losses in production, consumption, and imports and exports. The prevention and control measures such as regional lockdown and traffic restrictions hinder the development of many industries. Countries around the world are facing the problems of increasing debt risks and rising inflation. The global economy is facing serious risks and uncertainties. Currently, COVID-19 has spread all over the world, with "outbreaks in multiple countries and regions." As microeconomic entities, enterprises face immense pressure. Therefore, we focus on what impact COVID-19 will have on the production, operation, and financial decision-making behavior of enterprises.

Based on the existing research, the spread of COVID-19 has significant impacts on business operations. Current studies mainly explore the practical dilemma of enterprises from the perspective of market supply and demand. For example, [Hassan et al. \(2020\)](#) found that the COVID-19 shock has caused sudden supply chain disruption and decreasing demand for most enterprises. In terms of survival and development, enterprises are experiencing significant uncertainties. Specifically, from the perspective of supply, the sudden outbreak of public health events makes it difficult to maintain the normal flow of production factors such as labor and raw materials ([Zellweger et al., 2017](#); [Ma et al., 2019](#)). Therefore, the crisis spreads quickly from the upstream to the downstream of the industrial chain. The disruption to the supply chain makes it difficult for enterprises to continue production activities, and many face

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the risk of capital chain rupture (De Vito and Gómez, 2020). From the perspective of demand, COVID-19 has had a significant negative impact on the aggregate demand of residents (Baker et al., 2020). The consumption restriction and unemployment caused by the lockdown have direct impacts on the demand of residents (Baldwin and Di Mauro, 2020). The stagnation of infrastructure construction and manufacturing significantly affect investment demand. Under an outbreak of COVID-19, the lack of demand becomes a serious challenge faced by enterprises (Dai et al., 2021). The decreasing consumption and investment demand severely restrict the profitability of enterprises (Carletti et al., 2020), resulting in a shortage of liquid funds, which leads to difficulties in repaying debts and greater financing demand (Park and Shin, 2021). In conclusion, the existing literature reveals that COVID-19 increases enterprises' financial pressure. On this basis, we investigate enterprises' strategies to deal with this kind of financial pressure and analyze the earnings management behavior caused by COVID-19.

Based on the existing research on earnings management, it is a common method for enterprises to deal with the shock of exogenous events. There are two common types: accrual-based earnings management and real earnings management (Cohen and Zarowin, 2010). In comparison, accrual-based earnings management adjusts accrual items by selecting accounting policies, so it does not affect the total corporate profits; however, it has higher litigation risks (Gunny, 2010; Cohen and Zarowin, 2010). Real earnings management controls earnings by manipulating related businesses in daily operations. This method is more subtle but affects the company's long-term performance and future growth (Graham et al., 2005). Owing to the different characteristics of these two earnings management methods, they can be used simultaneously or alternatively. Therefore, in the outbreak of external public events, enterprise managers compare the costs and benefits of earnings management and make different choices at different times (Zang, 2012). Under China's "zero-COVID" prevention and control policy, enterprises are facing greater production, operation, and financial pressures, which are expected to have a particular impact on earnings management behaviors. It is interesting and meaningful to investigate this impact.

For empirical analysis, we adopt the cross-sectional modified Jones Model to estimate the accrual-based earnings (Dechow et al., 1995). Using the method of Roychowdhury (2006), we build a model to measure real earnings management. We then examine the impact of COVID-19 based on the time of occurrence. The empirical results show that the COVID-19 shock can intensify earnings management, and the enterprises that face high financial constraints have a more obvious shock effect. In contrast to enterprises that are less affected by COVID-19, this paper also finds those enterprises that are more severely affected tend to choose accrual-based earnings management rather than real earnings management. We additionally analyze the impact of heterogeneity in investment opportunities on earnings management behavior caused by COVID-19, as well as the governance effect of external audit.

Our study makes several contributions. First, our study contributes to the rapidly growing literature on COVID-19 and corporate finance. The existing literature on COVID-19 is mostly focused on its impact on macroeconomic development (Eichenbaum et al., 2021; Ashraf and Goodell, 2022; Guerrieri et al., 2022). There is a growing literature on how COVID-19 affect decision-making in finance of individual firms. Our paper using the quasi-natural experiment of COVID-19 reveals the impact of public emergencies on the financial behavior of micro enterprises. Especially for the particularity of China's implementation of the "dynamic zero-COVID" prevention and control policy, the consequences of COVID-19 are also special. This provides unique empirical evidence and inspiration from China in terms of the global COVID-19 impact. Second, the existing literature on earnings management is mostly focused on the effects of firm characteristics (e.g., Liu and Lu, 2007; Zalata et al., 2018; Huang et al., 2019; Elnahass et al., 2022), our study also adds to the existing literature investigating how public emergencies affect earnings management in an environment of a developing market, especially China has a vast territory and a complete industrial chain. The severity of the COVID-19 impact varies across regions and industries so we can use this natural scenario to explore the heterogeneity of earnings management behavior in different regions or industries. Third, from the perspective of audit governance, this study determines the countermeasure for the COVID-19 shock and provides empirical evidence for the participation of external audits in internal corporate governance.

2. Hypothesis development

2.1. How the COVID-19 shock affects the earnings management behavior

The sudden outbreak of COVID-19 led to drastic changes in the internal and external environment of enterprises (Ding et al., 2021), so they had a strong incentive to carry out earnings management, which is reflected in the following three aspects.

First, COVID-19 has brought enormous financial pressure to enterprises (De Vito and Gómez, 2020). Owing to the unprecedented scope and destructiveness of COVID-19, most enterprises are facing the problems of supply chain disruption and stagnating sales (Hassan et al., 2020). The shortage of working capital has led to deteriorating business conditions. Enterprises urgently need to obtain funds from the capital market to overcome of the financial crisis. However, if enterprises reflect their actual operating conditions through profit statements, it will become more difficult to obtain financing. Therefore, they may use earnings management to whitewash statements and meet their financing demand.

Second, according to the signaling theory (Spence, 1978), because investors are more sensitive to "good news" in a sluggish economy, the enterprises that create the illusion of good development can release positive signals to the market. Such signals help enterprises obtain more funds from external investors, so it becomes possible for them to turn losses into profits and get rid of practical difficulties.

Third, uncertainty has a significant impact on firm financial policies. For example, Bernanke (1983) and Baker et al. (2016) point out that high uncertainty gives firms an incentive to delay or reduce investment when investment projects are costly to undo. COVID-19 rapidly increases the uncertainty faced by enterprises (Ramelli and Wagner, 2020) and makes their actual operating conditions more unpredictable. In addition, China's prevention and control policies of COVID-19 limit external stakeholders' supervision of enterprises to a certain extent, increase the asymmetry of internal and external information, and create natural conditions

for enterprises to speculate (Yuan et al., 2022). Additionally, according to the principal-agent theory (Laverty, 1996), if COVID-19 affects the interests of shareholders, they will put pressure on the management. In the situation of unstable business operation, executives are more inclined to carry out upward earnings management to create the illusion that the company is in good condition and thus maintain their own remunerations and reputations.

In summary, this study proposes the following hypothesis:

H1. Assuming other conditions remain unchanged, the COVID-19 shock intensifies the earnings management behavior of enterprises.

2.2. Differences in financial constraints and the “shock effect” of COVID-19 on enterprise earnings management

The ability to obtain financing plays an essential role in whether enterprises can overcome the crisis (Martin and Sunley, 2015), and financing pressure is one of the main driving factors of earnings management (Cohen and Zarowin, 2010). Related research has proved that obtaining external funds through earnings management enables enterprises to obtain more financial support (Ma et al., 2014).

Under the COVID-19 outbreak, enterprises need a lot of cash to maintain normal turnover. Due to the performance decline caused by COVID-19, enterprises do not have sufficient capital reserves and can only rely on external financing. However, the COVID-19 has sent a negative signal to the financial market: on the one hand, due to the suddenness and uncertainty of the COVID-19, it is difficult to predict the return of stocks, which has caused investor anxiety (Ma et al., 2017; Xu et al., 2019). On the other hand, the COVID-19 has caused the production and operation of enterprises to face difficulties. As the enterprises are forced to suspend production, the operating risks have increased, and future performance expectations will decline. The negative signal of the financial market decreases investor confidence and makes them generally more conservative in investments (Wang and Wang, 2021). This makes it more difficult for enterprises that already face high financial constraints to obtain external funds. Even if these enterprises have good investment opportunities to help them overcome difficult situations, they may miss the opportunities due to insufficient external funds. Therefore, in the context of rising operating costs and financial risks caused by COVID-19, enterprises that face high financial constraints have a stronger incentive to carry out earnings management to obtain external funds. In summary, this study proposes the following hypothesis:

H2. Assuming other conditions remain unchanged, the enterprises that face high financial constraints have a more obvious “shock effect” of COVID-19 on earnings management behavior.

2.3. The severity of the COVID-19 impacts and the choice of earnings management strategies

China has a vast territory and a complete industrial chain. All industries and provinces in China are affected by the COVID-19 outbreak. However, due to the characteristics of COVID-19 outbreaks, the regions of concentrated outbreaks, and the strictness of China’s epidemic prevention and control policies, the severity of the impact varies across industries and regions. This forms an interesting experimental scenario. Because enterprises in different industries and regions resume work and production and realize the return of funds and normal operation of the industrial chain at different times, they may adopt different earnings management strategies.

The Chinese government regards the COVID-19 outbreak as a major public health emergency, carries out the first-level response, and strictly controls industries and regions with high risks of spreading. Affected by epidemic prevention and control policies, many enterprises suspend work and production, which greatly limits their choices for earnings management strategies. Because real earnings management is mainly achieved by selling at a lower price, cutting discretionary expenses, and investing or selling long-term assets (Roychowdhury, 2006), enterprises that are severely affected by COVID-19 are not able to use real earnings management to manipulate profits. Moreover, such enterprises have a reduced ability to bear the cost of adopting earnings management. If they continue to adjust their profits using real earnings management, they will undoubtedly make their financial situation more difficult. Therefore, more enterprises will turn to accrual-based earnings management for earnings manipulation. Although the economic recession caused by COVID-19 affects almost all enterprises, those that are less affected by city lockdown and suspension of work and production have more choices of earnings management methods. Accrual-based earnings management has a higher regulatory risk. Especially in the context of COVID-19, enterprises will pay a higher price if they are caught using accrual-based earnings management. Therefore, enterprises that are less affected by COVID-19 usually adopt real earnings management instead of accrual-based earnings management. In summary, this study proposes the following hypothesis:

H3. Assuming other conditions remain unchanged, compared to enterprises that are less affected by COVID-19, those that are more severely affected are more likely to be affected by the “suspension of work and production” caused by “epidemic prevention and control” policies, so they tend to carry out accrual-based earnings management through accounting items rather than carrying out earnings management through real activities.

3. Research design

3.1. Sample

This study selects Shanghai and Shenzhen A-share listed companies from 2018 to 2020 as the initial research sample. At the same time, the sample companies are screened according to the common research practice: (1) 328 observations of financial and insurance

companies with special industry nature, (2) 409 observations of companies with asset-liability ratios greater than one or less than zero, (3) exclude 2162 subsamples with missing real or accrual-based earnings management data, and (4) 210 subsamples with missing explanatory variables or control variables are excluded. Finally, we obtain 8832 observations. As shown in Table 1, the distribution of the sample across years and industries is reasonable. The data are mainly from the CSMAR database and the Wind financial database. The data of control variables such as “audit firm characteristics” and “auditor’s personal characteristics” are mainly collected and sorted out manually. This study winsorizes 1 % of all continuous variables in each tail to alleviate the interference of extreme values.

3.2. Definitions and explanations of variables

3.2.1. Explained variables

3.2.1.1. *Accrual-based earnings management (DA)*. Following Dechow et al. (1995), this study constructs Model (1) and uses the cross-sectional modified Jones Model to estimate the discretionary accrual-based earnings ($DA_{i,t}$). When $DA_{i,t}$ is negative, it means that the enterprise has carried out negative earnings management. On the contrary, when $DA_{i,t}$ is positive, the enterprise has carried out positive earnings management. In Model (1), $TA_{i,t}$ represents the total accrued profit of the enterprise, which is the difference between operating profit and net operating cash flow, $A_{i,t-1}$ represents the total assets of the enterprise in period t-1, $\Delta SALES_{i,t}$ represents the change in sales revenue of the enterprise, $\Delta AR_{i,t}$ represents the change in accounts receivable of the enterprise, $PPE_{i,t}$ represents the original value of the enterprise’s fixed assets, and $\varepsilon_{i,t}$ can be positive or negative, which is used to measure the degree of accrual-based earnings management of the enterprise.

$$\frac{TA_{i,t}}{A_{i,t-1}} = \delta_1 \frac{1}{A_{i,t-1}} + \delta_2 \frac{\Delta SALES_{i,t} - \Delta AR_{i,t}}{A_{i,t-1}} + \delta_3 \frac{PPE_{i,t}}{A_{i,t-1}} + \varepsilon_{i,t} \tag{1}$$

3.2.1.2. *Real earnings management (REM)*. When calculating the measurement index of real earnings management, this study refers to the research method of Roychowdhury (2006) and builds Model (2) to measure enterprises’ real earnings management ($REM_{i,t}$). $EM_PROD_{i,t}$ represents abnormal production costs, $EM_CFO_{i,t}$ represents abnormal cash flow from operating activities, and $EM_EXP_{i,t}$ represents abnormal discretionary expenses. They are the residual values of Models (3)–(5), respectively, and are used to measure the three real earnings management methods of production manipulation, sales manipulation, and expense manipulation. $PROD_{i,t}$ represents production costs, $SALES_{i,t}$ represents sales revenue, $CFO_{i,t}$ represents cash flow from operating activities, and $DISEXP_{i,t}$ represents discretionary expenses.

$$REM_{i,t} = EM_PROD_{i,t} - EM_CFO_{i,t} - EM_EXP_{i,t} \tag{2}$$

$$\frac{PROD_{i,t}}{A_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{A_{i,t-1}} + \alpha_2 \frac{SALES_{i,t}}{A_{i,t-1}} + \alpha_3 \frac{\Delta SALES_{i,t}}{A_{i,t-1}} + \alpha_4 \frac{\Delta SALES_{i,t-1}}{A_{i,t-1}} + \varepsilon_{i,t} \tag{3}$$

$$\frac{CFO_{i,t}}{A_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{A_{i,t-1}} + \alpha_2 \frac{SALES_{i,t}}{A_{i,t-1}} + \alpha_3 \frac{\Delta SALES_{i,t}}{A_{i,t-1}} + \varepsilon_{i,t} \tag{4}$$

Table 1
Distribution of the sample.

Industry	2018	2019	2020	Total
Farming, Forestry, Animal Husbandry, and Fishing	36	34	37	107
Mining	66	71	66	203
Manufacturing	1794	2041	1957	5792
Electricity, Gas and Water	97	97	97	291
Building and Construction	81	84	81	246
Wholesale and retail	144	151	132	427
Transport, storage and post	80	89	90	259
Information Technology	201	223	208	632
Real Estate	112	108	90	310
Leasing and business services	32	40	36	108
Scientific research and technology services	30	40	35	105
Water conservancy, environment and public facilities	38	50	51	139
Health and social work	0	12	11	23
Culture, sports and entertainment	43	53	46	142
Comprehensive	18	18	12	48
Total	2772	3111	2949	8832

Note: Industry category is based on ‘guidance on the industry category of listed companies’ issued by the China Securities Regulatory Commission (CSRC). Consistent with most related studies about China, for the manufacturing industry (C), we take the 2-digit code of the CSRC industry classification; for other industries, we take the 1-digit code.

$$\frac{DISEXP_{i,t}}{A_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{A_{i,t-1}} + \alpha_2 \frac{\Delta SALES_{i,t-1}}{A_{i,t-1}} + \varepsilon_{i,t} \quad (5)$$

3.2.2. Explanatory variables

3.2.2.1. Impact of COVID-19 (Covid19). The COVID-19 outbreak began in early 2020, and spread widely. Before 2020, enterprises were not affected by the epidemic. Therefore, this study defines the dummy variable of the impact of COVID-19 (Covid19) based on time of occurrence; 2020 is the year after the COVID-19 outbreak, so *Covid19* equals one, 2018 and 2019 are before the outbreak, so *Covid19* equals zero.

3.2.2.2. Financial constraints (SA). Compared to the KZ index and the WW index, the SA index does not include endogenous financing variables, so it is more robust. Referring to the existing method (Hadlock and Pierce, 2010), this study uses the SA index to measure enterprises' financial constraints and constructs Model (6). The smaller the SA index, the higher the financial constraints. The larger the SA index, the lower the financial constraints. In Model (6), *Size* is the logarithm of enterprise fixed assets in millions, representing the total size of the company's assets, *Age* represents the year of operation of the enterprise.

$$SA = -0.737Size + 0.043Size^2 - 0.040Age \quad (6)$$

Therefore, the subsamples of listed companies whose SA index is less than or equal to the median in the same year are included in the high financial constraint group. The remaining listed companies are included in the low financial constraint group. This study selects the KZ index for the robustness test to prevent the regression results from being affected by the choice of measurement index.

3.2.2.3. Severity of the COVID-19 impacts (severity). According to China's "Investigation of COVID-19 Impact on Major Industries and Its Policy Support," the "transportation industry," "warehousing industry," and "postal service industry" are significantly affected by the suspension policy. "Accommodation and catering industry" and "tourism industry" are negatively affected by China's COVID-19 policies that impose restrictions on the movement and gatherings of people. In the "mining industry" and "construction industry," there is not sufficient staff to start work. "Wholesale and retail industry" and "real estate industry" are also significantly affected by restrictions on the movement of people. Referring to Shi and Li (2022), when an enterprise belongs to the above industries, it is more severely affected by the epidemic and *Severity* equals one, otherwise, zero.

3.2.3. Control variables

Based on the method in Chi et al. (2017), this study selects control variables from six aspects: company basic situation, financial characteristic, governance structure, company registration place, audit firm and signing auditor. The control variables mainly include company size (*Size*), leverage (*Lev*), operating cash flow (*CF*), return on equity (*Roe*), the ownership percentage of the largest shareholder (*Top1*), the percentage of independent board directors (*Indp*), the marketization index of Wang et al. (2021) (*Market*), the size of the audit firm (*Big*), whether the company re-appoints an audit firm (*Firmchg*), the auditor's age (*Old*), whether the auditor's college major is accounting (*Major*), and the number of years an auditor has served as signing partners (*Signy*). We also control for annual fixed effects (*Year*) and industry fixed effects (*Industry*), the Appendix provides definitions of all these variables.

Table 2
Variable definition and description.

Variable type	Symbol	Description
Explained Variable	DA	Discretionary accruals estimated by the Modified Jones Model (Dechow et al., 1995)
	REM	The sum of the standardized three real earnings management proxies (Roychowdhury, 2006).
Explanatory Variable	Covid19	Equals 1 if the year after the COVID-19 outbreak, and 0 otherwise. 2020 is the year after the COVID-19 outbreak, 2018 and 2019 are before the outbreak.
	SA	SA Index.
	Severity	Equals 1 if the company belongs to the industries severely affected by the epidemic, and 0 otherwise. The details are documented in Section 3.2.2.
Control Variable	Size	The natural logarithm of total assets at the fiscal year-end.
	Lev	Total liabilities divided by total assets.
	CF	Net cash flow from operating activities per share.
	Roe	Net income divided by total assets.
	Top1	The ownership percentage of the largest shareholder.
	Indp	The number of independent directors divided by the total number of board directors.
	Market	The marketization index score of Wang et al. (2021) of the provinces in which the firm is located.
	Firmchg	Equals 1 if the company is audited by the international Big 4 auditor or the domestic top ten auditors, and 0 otherwise.
	Old	Equals 1 if the company re-appoints an audit firm, and 0 otherwise.
	Major	The natural logarithm of the average age of the two signing partners.
	Signy	Equals 1 if an auditor's college major is accounting or finance, and 0 otherwise.

3.3. Research model

This study constructs Model (7) to test the impact of the COVID-19 shock on earnings management behavior (Hypothesis H1) and uses the grouping method to test H2 and H3.

$$DA_{i,t}(REM_{i,t}) = \lambda_0 + \lambda_1 Covid19_{i,t} + \sum Controls_{i,t} + \sum Year_{i,t} + \sum Industry_{i,t} + \varepsilon_{i,t} \quad (7)$$

DA and REM represent accrual-based earnings management and real earnings management, respectively. Covid19 is the epidemic dummy variable. Controls is the combination of the abovementioned control variables (Table 2).

4. Empirical results

4.1. Descriptive statistics

The descriptive statistics of the variables used in this study are reported in Table 3. (1) The mean, median, and standard deviation of discretionary accrual-based earnings management are 0.0018, 0.0059, and 0.0743, respectively. The results are basically consistent with the existing research results, and the distribution is relatively uniform. The mean, median, and standard deviation of real earnings management are -0.0025, 0.0122, and 0.1712, respectively. Its distribution is reasonable. (2) The mean and standard deviation of the COVID-19 dummy variable are 0.3338 and 0.4716, respectively. (3) The dummy variable of the severity of the COVID-19 impact has a mean of 0.1796, and the SA index has a mean of -3.8881. In addition, the descriptive statistics of the control variable are basically consistent with the existing research results.

4.2. Multiple regression analysis

The multiple regression results of COVID-19 and enterprise earnings management behavior are presented in Table 4. Columns (1) and (4) report that when accrual-based earnings management (DA) and real earnings management (REM) are used as explained variables, the regression coefficients of the COVID-19 shock (Covid19) are both significantly positive at the 1 % level. Columns (2) and (3) indicate that after the accrual-based earnings management is divided into positive and negative groups, the two regression coefficients are significantly positive at the 10 % and 1 % levels. The above conclusions demonstrate that the COVID-19 shock intensifies earnings management behavior, and managers use both accrual-based and real earnings management to carry out upward earnings manipulation. In conclusion, H1 is verified.

Columns (1) and (2) of Table 5 indicate that when accrual-based earnings management (DA) is used as the explained variable and financial constraints (SA) is used for grouping, the regression coefficient of the COVID-19 shock (Covid19) is significantly positive at the 5 % level in the high financial constraint group, but not significant in the low financial constraint group. Columns (3) and (4) show that when real earnings management (REM) is used as the explained variable, the regression coefficient of the COVID-19 shock (Covid19) is significantly positive at the 1 % level in the high financial constraint group, but not significant in the low financial constraint group. Suppose H2 holds. The above conclusions demonstrate that COVID-19 does not intensify the earnings management behavior of all enterprises, and evident motivations exist for adopting this earnings management strategy.

The heterogeneous effect of the severity of the COVID-19 impact on earnings management behavior is reported in Table 6. Columns (3) and (4) reveal that when real earnings management (REM) is used as the explained variable and the severity of the COVID-19 impact (Severity) is used for grouping, the regression coefficient of the COVID-19 shock (Covid19) is not significant in the group that is severely affected by the epidemic. However, the regression coefficient of the COVID-19 shock (Covid19) is significantly positive

Table 3
Descriptive statistics.

Variable	N	mean	sd	p25	p50	p75	min	max
DA	8832	0.0018	0.0743	-0.0314	0.0059	0.0428	-0.2659	0.2060
REM	8832	-0.0025	0.1712	-0.0819	0.0122	0.0957	-0.6216	0.4240
Covid19	8832	0.3338	0.4716	0	0	1	0	1
SA	8832	-3.8881	0.2339	-4.0401	-3.8862	-3.7360	-4.4711	-3.1935
Severity	8832	0.1796	0.3839	0	0	0	0	1
Size	8832	22.4293	1.3093	21.4871	22.2535	23.1670	20.0989	26.4077
Lev	8832	0.4325	0.1950	0.2812	0.4265	0.5753	0.0695	0.8886
CF	8832	0.6077	0.9097	0.1040	0.4019	0.8653	-1.3725	4.7757
Roe	8832	0.0303	0.2155	0.0245	0.0642	0.1102	-1.4007	0.3030
Top1	8832	0.3310	0.1439	0.2185	0.3073	0.4245	0.0857	0.7199
Indp	8832	0.3786	0.0543	0.3333	0.3636	0.4286	0.3333	0.5714
Market	8832	8.2341	1.2983	8.1100	8.2800	9.5100	4.9000	9.7300
Big	8832	0.7381	0.4497	0	1	1	0	1
Firmchg	8832	0.1202	0.3253	0	0	0	0	1
Old	8832	3.7292	0.1178	3.6376	3.7257	3.8177	3.4812	3.9982
Major	8832	0.7394	0.4390	0	1	1	0	1
Signy	8832	1.9250	0.5379	1.6094	2.0149	2.3016	0	2.8904

Table 4
Regression results of COVID-19 and earnings management.

Variable	Accrual-based earnings management (DA)			Real earnings management (REM)
	Full sample	Distinguish direction		Full sample
		Positive group	Negative group	
	(1)	(2)	(3)	(4)
Covid19	0.0041*** (2.7148)	0.0025* (1.7247)	0.0059*** (3.1373)	0.0130*** (3.2313)
Size	0.0099*** (15.0199)	0.0024*** (3.8150)	0.0075*** (8.8940)	0.0207*** (12.8230)
Lev	-0.0262*** (- 5.9370)	-0.0164*** (- 3.9605)	0.0068 (1.1177)	0.1531*** (14.3710)
CF	-0.0392*** (- 36.5950)	-0.0403*** (- 27.0287)	-0.0145*** (- 13.6482)	-0.0838*** (- 34.2016)
Roe	0.2005*** (33.7699)	0.3428*** (26.1804)	0.0983*** (19.9305)	-0.0492*** (- 5.5081)
Top1	0.0188*** (4.3036)	-0.0050 (- 1.2702)	0.0261*** (4.7418)	-0.0163 (- 1.3741)
Indp	-0.0026 (- 0.2324)	0.0206* (1.9391)	-0.0013 (- 0.0999)	0.0000 (0.0005)
Market	0.0001 (0.2588)	-0.0007 (- 1.4667)	0.0001 (0.1964)	-0.0001 (- 0.0902)
Big	-0.0003 (- 0.2167)	-0.0009 (- 0.7134)	0.0001 (0.0480)	-0.0001 (- 0.0251)
Firmchg	-0.0044** (- 2.2891)	0.0007 (0.3913)	-0.0058** (- 2.3469)	0.0071 (1.4462)
Old	-0.0094* (- 1.6630)	-0.0018 (- 0.3516)	-0.0120 (- 1.5786)	0.0069 (0.4717)
Major	0.0015 (1.1317)	0.0022* (1.7429)	-0.0031* (- 1.7985)	0.0016 (0.4478)
Signy	-0.0003 (- 0.2001)	-0.0016 (- 1.4173)	0.0025 (1.3454)	0.0042 (1.1923)
Constant	-0.1594*** (- 6.3226)	0.0008 (0.0321)	-0.1673*** (- 5.1041)	0.0103*** (2.5781)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Observations	8832	4791	4041	8832
R-squared	0.4494	0.3573	0.4015	0.2268

Robust t-statistics in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

at the 1 % level for the industries that are less affected by the epidemic. Columns (1) and (2) indicate that when accrual-based earnings management (DA) is used as the explained variable, the regression coefficient of the COVID-19 shock (Covid19) is significantly positive at the 5 % and 10 % levels in the group that is severely affected by COVID-19 and in the group that is less affected by COVID-19, respectively. When the regression coefficients are all significant, this study tests the coefficient difference between two groups to compare whether the coefficients are significantly different. The p-value value is significant at the 10% level, indicating that enterprises that are severely affected by COVID-19 carry out more accrual-based earnings management than enterprises that are less affected by the epidemic. In conclusion, H3 is verified.

4.3. Robustness tests

4.3.1. Alternative measures of key variables

4.3.1.1. Alternative measure of accrual-based earnings management. To ensure the reliability of the research conclusions, this study replaces the measurement index of accrual-based earnings management. Referring to Jones (1991), we use the basic Jones Model to calculate the discretionary accrual-based earnings (DA₁) and perform the regression again.

The regression results after using the alternative measure of accrual-based earnings management are reported in Table 7. The results reveal that there is a significant positive relationship between the impact of COVID-19 and the earnings management behavior of enterprises. The conclusions obtained after distinguishing the direction are still consistent and robust.

4.3.1.2. Alternative measure of financial constraints. This study uses the KZ index as an alternative index to measure the financial constraints of enterprises. The larger the KZ index, the higher the financial constraints faced by enterprises, and vice versa. The enterprises with the KZ index less than or equal to the sample median belong to the low financial constraint group, and the remaining enterprises belong to the high financial constraint group. The results in Table 8 indicate that whether accrual-based earnings

Table 5
Heterogeneity analysis results for distinguishing financing constraints.

Variable	Accrual-based earnings management (DA)		Real earnings management (REM)	
	High financing constraints group (1)	Low financing constraints group (2)	High financing constraints group (3)	Low financing constraints group (4)
Covid19	0.0043** (2.0360)	0.0034 (1.5906)	0.0177*** (3.3307)	0.0076 (1.2562)
Size	0.0117*** (10.3250)	0.0093*** (10.9786)	0.0182*** (6.9424)	0.0205*** (9.6900)
Lev	-0.0241*** (- 3.9220)	-0.0276*** (- 4.2365)	0.1636*** (11.5254)	0.1459*** (9.0754)
CF	-0.0412*** (- 25.5229)	-0.0389*** (- 27.1419)	-0.0923*** (- 25.2036)	-0.0758*** (- 23.3618)
Roe	0.1903*** (23.8621)	0.2202*** (24.8590)	-0.0331*** (- 3.0867)	-0.0662*** (- 4.4724)
Top1	0.3408*** (5.5858)	0.0046 (0.7219)	-0.0189 (- 1.1700)	-0.0062 (- 0.3595)
Indp	0.0045 (0.2920)	-0.0122 (- 0.7918)	0.0488 (1.2236)	-0.0557 (- 1.3401)
Market	-0.0008 (- 1.1605)	0.0005 (0.7918)	0.0014 (0.8224)	-0.0010 (- 0.5020)
Big	-0.0003 (- 0.1281)	0.0005 (0.2493)	0.0001 (0.0226)	-0.0003 (- 0.0524)
Firmchg	-0.0016 (- 0.6100)	-0.0062** (- 2.1654)	0.0105 (1.6247)	0.0039 (0.5119)
Old	-0.0084 (- 1.0486)	-0.0122 (- 1.5132)	0.0174 (0.8673)	-0.0109 (- 0.5063)
Major	0.0028 (1.4826)	-0.0001 (- 0.0323)	0.0028 (0.5917)	0.0001 (0.0230)
Signy	0.0014 (0.7804)	-0.0013 (- 0.7027)	0.0075 (1.5434)	0.0015 (0.2923)
Constant	-0.2076*** (- 5.5660)	-0.1254*** (- 3.5038)	-0.5407*** (- 5.7517)	-0.4102*** (- 4.3627)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Observations	4416	4416	4416	4416
R-squared	0.4565	0.4643	0.2588	0.2049

Robust t-statistics in parentheses.

*** p < 0.01, ** p < 0.05, * p < 0.1.

management (DA) or real earnings management (REM) is used as the explained variable, the regression coefficient of the COVID-19 shock (Covid19) is significantly positive at the 5 % level only in the high financial constraint group.

4.3.1.3. Alternative measure of the severity of the COVID-19 impact. The spread and occurrence of COVID-19 in different provinces in China are different, so the severity of the impact varies across regions. Referring to [Ding et al. \(2021\)](#), this study regards provinces with more than 1000 confirmed COVID-19 cases before December 31, 2020 as regions that are significantly affected by the epidemic, and vice versa. The results in [Table 9](#) demonstrate that the conclusions remain unchanged after using the alternative measure of the severity of the COVID-19 impact.

4.3.2. Consider the impact of external audits on test results

Although COVID-19 did not break out in 2019, the 2019 annual reports of listed companies may be affected by the audit busy season from January to April 2020. Therefore, this study excludes the sample in 2019 and conducts a robustness test. The conclusion is consistent with the main test. In addition, this study performs the same robustness test for [H2](#) and [H3](#), and the results are still robust. Due to limitations of space, the results are not presented in the table ([Table 10](#)).

4.3.3. Control regional fixed effects

Local governments may have some policies to take care of the company in the context of the COVID-19 and vary from region to region, so this study controls regional fixed effects in robustness test. The conclusion is also consistent with the main hypothesis. In addition, this study conducts the same robustness test for [H2](#) and [H3](#), and the results are still robust. Due to limitations of space, the results are not presented in the [Table 11](#).

Table 6
Heterogeneity analysis results for distinguishing severity of COVID-19 impacts.

Variable	Accrual-based earnings management (DA)		Real earnings management (REM)	
	Severely affected group (1)	Less affected group (2)	Severely affected group (3)	Less affected group (4)
Covid19	0.0087** (2.4940)	0.0029* (1.7306)	-0.0139 (- 1.3245)	0.0198*** (4.6025)
Size	0.0075*** (5.5011)	0.0107*** (14.2879)	0.0259*** (7.2064)	0.0190*** (10.5185)
Lev	-0.0329*** (- 3.2125)	-0.0250*** (- 5.1801)	0.1254*** (4.6090)	0.1595*** (13.8289)
CF	-0.0320*** (- 18.0083)	-0.0418*** (- 32.4083)	-0.0627*** (- 15.2069)	-0.0919*** (- 30.8221)
Roe	0.1735*** (12.9818)	0.2069*** (31.2129)	-0.0392 (- 1.4848)	-0.0488*** (- 5.1745)
Top1	0.2174** (2.2096)	0.1923*** (3.9146)	-0.0397 (- 1.3739)	-0.0091 (- 0.6862)
Indp	-0.0207 (- 0.8623)	-0.0000 (- 0.0030)	0.1399** (1.9755)	-0.0343 (- 1.0908)
Market	0.0004 (0.3928)	0.0001 (0.2363)	0.0038 (1.3063)	-0.0009 (- 0.6570)
Big	0.0007 (0.1831)	-0.0001 (- 0.0410)	-0.0129 (- 1.2307)	0.0004 (0.1041)
Firmchg	-0.0070 (- 1.5768)	-0.0039* (- 1.8008)	0.0238** (2.0963)	0.0049 (0.8878)
Old	-0.0102 (- 0.6805)	-0.0097 (- 1.5888)	-0.0552 (- 1.2976)	0.0167 (1.0749)
Major	-0.0024 (- 0.7534)	0.0026* (1.7668)	0.0018 (0.1963)	0.0018 (0.4599)
Signy	-0.0044 (- 1.4324)	0.0007 (0.4648)	0.0004 (0.0471)	0.0057 (1.4586)
Constant	-0.0878 (- 1.4144)	-0.1778*** (- 6.4239)	-0.4527*** (- 2.6566)	-0.5011*** (- 7.0294)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Observations	1586	7246	1586	7246
R-squared	0.4528	0.4527	0.2112	0.2373

Robust t-statistics in parentheses.

*** p < 0.01, ** p < 0.05, * p < 0.1.

Table 7
Robustness test results after transforming accrual-based earnings management metrics.

Variable	Accrual-based earnings management (DA_1)		
	Full sample (1)	Distinguish direction	
		Positive group (2)	Negative group (3)
Covid19	0.0036** (2.2650)	0.0035** (2.0426)	0.0067*** (3.2801)
Constant	-0.1671*** (- 6.3473)	0.0342 (1.3064)	-0.2010*** (- 5.9265)
Controls	Yes	Yes	Yes
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Observations	8712	4534	4178
R-squared	0.4519	0.3474	0.4007

Robust t-statistics in parentheses.

*** p < 0.01, ** p < 0.05, * p < 0.1.

5. Additional analysis

5.1. The impact of heterogeneity in investment opportunities on earnings management behavior caused by COVID-19

Due to the widespread impact of COVID-19, investment opportunities in the capital market decrease. Therefore, enterprises with more investment opportunities are more likely to conduct more earnings management under the COVID-19 shock to send a signal to

Table 8
Robustness test results after transforming financing constraint metrics.

Variable	Accrual-based earnings management (DA)		Real earnings management (REM)	
	High financing constraints group (1)	Low financing constraints group (2)	High financing constraints group (3)	Low financing constraints group (4)
Covid19	0.0048** (2.0517)	0.0022 (1.2193)	0.0100** (2.0904)	0.0038 (0.6371)
Constant	-0.1205*** (- 3.1545)	-0.2128*** (- 6.8331)	-0.4120*** (- 5.1440)	-0.4784*** (- 4.7909)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Observations	4416	4416	4416	4416
R-squared	0.4953	0.4340	0.1674	0.2162

Robust t-statistics in parentheses.

*** p < 0.01, ** p < 0.05, * p < 0.1.

Table 9
Robustness test results after transforming severity of COVID-19 impacts metrics.

Variable	Accrual-based earnings management (DA)		Real earnings management (REM)	
	Severely affected group (1)	Less affected group (2)	Severely affected group (2)	Less affected group (4)
Covid19	0.0051* (1.9527)	0.0037** (2.0205)	0.0078 (1.0491)	0.0155*** (3.2914)
Constant	-0.2163*** (- 4.4183)	-0.1517*** (- 5.0070)	-0.6137*** (- 4.6615)	-0.4803*** (- 6.0736)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Observations	2843	5989	2843	5989
R-squared	0.4683	0.4470	0.2497	0.2259

Robust t-statistics in parentheses.

*** p < 0.01, ** p < 0.05, * p < 0.1.

Table 10
Robustness test results after excluding subsamples affected by the audit.

Variable	Accrual-based earnings management (DA)			Real earnings management (REM)
	Full sample (1)	Distinguish direction		Full sample (4)
		Positive group (2)	Negative group (3)	
Covid19	0.0042*** (2.7197)	0.0027* (1.8454)	0.0062*** (3.2905)	0.0136*** (3.3835)
Constant	-0.1708*** (- 5.3526)	0.0170 (0.5445)	-0.1908*** (- 4.8347)	-0.5698*** (- 6.9250)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Observations	5720	3029	2691	5720
R-squared	0.4235	0.3669	0.3937	0.2327

Robust t-statistics in parentheses.

*** p < 0.01, ** p < 0.05, * p < 0.1.

external investors that the enterprise is operating well, attract investors' funds, and create conditions for foreign investments. Referring to [Panousi and Papanikolaou \(2012\)](#), this study uses Tobin's Q value (TQ) as an alternative measure of investment opportunities. The enterprises with TQ higher than the sample median belong to the high investment opportunity group. The remaining enterprises belong to the low investment opportunity group. The results in [Table 12](#) indicate that only in the high investment opportunity group, regardless of whether the explained variable is accrual-based earnings management (DA) or real earnings management (REM), the regression coefficient of the COVID-19 shock (Covid19) is significantly positive at the 5 % level. In the low

Table 11
Robustness test results after controlling regional fixed effects.

Variable	Accrual-based earnings management (DA)			Real earnings management (REM)
	Full sample	Distinguish direction		Full sample
		Positive group	Negative group	
	(1)	(2)	(3)	(4)
Covid19	0.0041*** (2.7214)	0.0026* (1.8278)	0.0060*** (3.1721)	0.0131*** (3.2657)
Constant	-0.1285*** (- 2.7694)	-0.0735** (- 2.0648)	-0.1016 (- 1.3261)	-0.4266*** (- 2.8907)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Region	Yes	Yes	Yes	Yes
Observations	8832	4791	4041	8832
R-squared	0.4536	0.3684	0.4068	0.2357

Robust t-statistics in parentheses.

*** p < 0.01, ** p < 0.05, * p < 0.1.

Table 12
Heterogeneity analysis results for distinguishing investment opportunities.

Variable	Accrual-based earnings management (DA)		Real earnings management (REM)	
	High investment opportunity group	Low investment opportunity group	High investment opportunity group	Low investment opportunity group
	(1)	(2)	(3)	(4)
Covid19	0.0059** (2.4521)	0.0026 (1.4016)	0.0205*** (3.1985)	0.0068 (1.4678)
Constant	-0.2180*** (- 5.0801)	-0.1431*** (- 4.6333)	-0.1771 (- 1.5665)	-0.4720*** (- 5.9334)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Observations	4416	4416	4416	4416
R-squared	0.4489	0.4657	0.2365	0.2431

Robust t-statistics in parentheses.

*** p < 0.01, ** p < 0.05, * p < 0.1.

Table 13
Analysis of the governance effect of auditing on earnings management behavior caused by the COVID-19.

Variable	Accrual-based earnings management (DA)		Real earnings management (REM)	
	Big audit firm	Small audit firm	Big audit firm	Small audit firm
	(1)	(2)	(3)	(4)
Covid19	0.0015 (0.8918)	0.0114*** (3.3570)	0.0145*** (3.1189)	0.0131* (1.6613)
Constant	-0.1370*** (- 4.8480)	-0.2318*** (- 4.0562)	-0.4303*** (- 5.3497)	-0.5574*** (- 4.3725)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Observations	6661	2171	6661	2171
R-squared	0.4552	0.4494	0.2366	0.2237

Robust t-statistics in parentheses.

*** p < 0.01, ** p < 0.05, * p < 0.1.

investment opportunity group, the regression coefficient of *Covid19* is not significant. This indicates that enterprises with more investment opportunities have a higher degree of earnings management caused by COVID-19.

5.2. The governance effect of external audits on earnings management behavior caused by COVID-19

Referring to He et al. (2017), the international “Big 4 audit firm” and China’s “domestic top ten audit firm” is defined as the “big audit firms” and the remaining as the “small audit firms.” Similar to the method used to define the international “Big 4 audit firm”, the top ten firms in China are defined as the “domestic top ten audit firm” in terms of client size. The results in Table 13 reveal that when accrual-based earnings management (DA) is used as the explained variable, the regression coefficient of *Covid19* is significant only in the “small audit firm” group, but not significant in the “large audit firm” group. This indicates that audits have an inhibitory effect on the accrual-based earnings management caused by COVID-19. When real earnings management (REM) is used as the explained variable, the regression coefficient of *Covid19* is significantly positive in both the “big audit firm” group and “small audit firm” group. We test the coefficient difference between the two groups, and the p-value is 0.9089, which indicates that audits do not have an inhibitory effect on the real earnings management behavior caused by COVID-19.

6. Conclusions

As a major public health emergency with an overall long-term impact, COVID-19 has an inestimable impact on Chinese enterprises, so enterprises take corresponding measures to reduce their own losses. The results of this study show that: (1) The COVID-19 shock intensifies earnings management behavior, which is reflected in the increasing accrual-based earnings management and real earnings management. (2) The enterprises that face high financial constraints have a more obvious “shock effect” of COVID-19 on earnings management behavior. (3) From the perspective of the impact of COVID-19 on different industries and regions, if enterprises are more severely affected by the “suspension of work and production” caused by “epidemic prevention and control” policies, they tend to carry out accrual-based earnings management through accounting items rather than carrying out earnings management through real activities. (4) The extended analysis finds that enterprises with more investment opportunities have more evident earnings management behaviors caused by the COVID-19 shock. (5) From the perspective of audit governance, high-quality auditing has an inhibitory effect on accrual-based earnings management caused by the COVID-19 shock but has no inhibitory effect on real earnings management.

In conclusion, this study reveals earnings management strategies under the outbreaks of major public health emergencies. At the same time, this study conducts the heterogeneity analysis from the perspectives of financial constraints, the severity of COVID-19 impacts on enterprises, and investment opportunities. This study also analyzes the governance effect of external audits and enriches the existing research on the relationship between major public health emergencies and corporate earnings management behavior.

This study has certain implications. First, in major external events, investors and creditors should fully analyze enterprises’ operating conditions and feedback from the external market and make investment decisions based on careful consideration of enterprises’ true conditions. Second, the external regulatory authorities should not relax regulation during special periods because market instability can cause greater economic fluctuations. The audit department should focus on real earnings management activities which are more difficult to identify under COVID-19 to ensure the authenticity and legitimacy of enterprises’ financial situation. Third, the government should pay attention to the survival pressure of enterprises under the epidemic impact and take corresponding measures to alleviate enterprises’ financing pressure. When building policies on subsidies, the government should respect and protect the interests of all parties and focus on providing subsidies to enterprises to provide sufficient guarantees for economic recovery and development.

Declaration of Competing Interest

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

Data Availability

The data that has been used is confidential.

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