

Article The Role of Internal Control in Firms' Coping with the Impact of the COVID-19 Pandemic: Evidence from China

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Abstract: Internal control plays a role in risk prevention for firms when dealing with serious emergencies, which ensures the sustainable development of firms during a crisis. Based on the rapid outbreak of COVID-19 in China, this paper empirically tests whether internal control alleviates the negative impact of the pandemic on firm performance. Using a sample of Chinese listed firms from the first quarter of 2019 to the third quarter of 2020 and employing the difference-in-difference (DID) method, we find that the firms with a higher quality of internal control achieve better financial performance during the pandemic period; the more serious the pandemic is, the more obvious effect internal control plays. Furthermore, we consider the industry heterogeneity and firm heterogeneity of the risk resistance effect of internal control. In the manufacturing industry, which is a "disaster zone" of the pandemic, and the non-high-tech industry with a low degree of digitization, internal control can play a more important role in firms' performance. Moreover, for state-owned enterprises, and firms with strong financing constraints, the role of internal control is more prominent. The above results provide empirical evidence for the risk prevention function of internal control and shed new light on the measures for firms to resist emergencies in the future.

Keywords: COVID-19; internal control; risk prevention; financial performance; sustainability

1. Introduction

A sound internal control system is the decisive factor for a firm's sustainability, especially in a crisis. The failure of firms' sustainable development commonly happens when firms fall into a crisis with high risk. At the beginning of 2020, a catastrophic epidemic (COVID-19) has attracted the attention of the public all over the world. The outbreak of COVID-19 has seriously affected people's health, society, and the whole economy. At the micro-level, due to the extremely infectious, high-risk, and wide coverage, firms have been forced to shut down or delayed return to work. As a major public health event, the pandemic not only tests the endurance and sustainability of the economy but also tests the timeliness of firms' crisis response and the effectiveness of the operation and control system.

The existing research has studied the impact of COVID-19 on firm performance [1], and some influencing mechanisms on the COVID-19 impact, such as corporate governance [2], R&D [3], cash holding [4], and operating flexibility [5]. However, whether and how internal control affects firm performance during COVID-19 remains unsettled.

Internal control reflects the ability of a firm's risk management and is an essential part of modern governance mechanisms. Modern internal control theory based on COSO (Committee of Sponsoring Organizations of the Treadway Commission) framework after SOX 404. COSO committee defines internal control as "the procedures implemented by the board of directors, management and other stakeholders of the firm to provide reasonable assurance to achieve the following objectives: the performance and efficiency of operation, the reliability of financial reporting and compliance with applicable laws and regulations." In 2008, five Chinese ministries and commissions issued "*Basic Norms for Enterprise Internal Control*". In the notion, the goal of internal control is to reasonably ensure the legality and



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compliance of enterprise operation and management, the safety of assets, the authenticity and integrity of financial reports and relevant information, improve the operation efficiency and effect, and promote the realization of enterprise development strategy.

Under the multiple pressures of survival and development, internal control is directly related to a firm's operation and risk resistance. In the face of high risk caused by the pandemic, the role of internal control can be reflected in the ability to improve operation efficiency, alleviate the information asymmetry between the management and stakeholders, then reduce crisis loss and resume normal production rapidly. Based on the above facts, this paper discusses the impact of the pandemic on the micro-economy from the perspective of a firm's performance, as well as the role of internal control in a firm's response to the pandemic crisis. We also pay attention to the heterogeneity of firms and industries. To sum up, this paper attempts to answer the following questions: (1) whether the firms' internal control plays an effective role in coping with the impact of the pandemic; (2) whether the role of internal control has industry heterogeneity and firm heterogeneity.

To address those questions, we adopted the "Difference-in-Difference" method to distinguish the firm performance pre- and post-pandemic. The "outbreak-to-recovery" process of China's COVID-19 pandemic is suitable as an exogenous event for exploring the impact of large emergencies on firm performance, and whether internal control plays a role in coping with the crisis. We select the quarterly data of Chinese listed firms from the first quarter of 2019 to the third quarter of 2020 as our sample.

In this study, we found that high-quality internal control plays a role in resisting risk in crisis response, and this role is positively related to the seriousness of the pandemic. In further analysis, we find that the role of internal control has industry heterogeneity and firm heterogeneity. In the manufacturing industry, which is a "disaster zone" of the pandemic, and non-high-tech industries with a low degree of digitization, internal control plays a more important role. For the state-owned enterprises (SOEs) and firms with strong financing constraints, internal control is more important for coping with the impact of the pandemic.

We contribute to the literature in three aspects. First, this paper enriches the empirical evidence about COVID-19 in the field of micro-economy. Among the existing studies that focus on the impact of the pandemic on the economy, scholars mostly observe from the macro-economic level, such as oil prices [6] and exchange rates [7]. In addition, most of the literature about the micro impact of the pandemic is based on case studies, with survey and investigation evidence and lack of empirical evidence; only when studying the capital market reaction of firms, does it involve empirical research [8–11]. Therefore, we provide new evidence of COVID-19 at the firm level.

Second, there is little literature focusing on the relationship between a firm's management ability and crisis response. We attempt to answer how to do a good job of crisis prevention from the firm level. Previous studies mainly focus on the impact of internal control on accounting information quality [12,13], capital cost [14], corporate investment behavior [15], and executive compensation [16]. There is no literature focusing on the relationship between internal control and emergency events. This paper is the first one that analyzes the regulatory role of internal control in the mechanism of pandemic impact on the micro-economy, which enriches the micro evidence on the economic consequences of internal control.

Third, it is difficult to evaluate internal control quality through a firm's public information disclosure. Among most empirical studies which test the economic consequences of internal control, scholars use the data that firms are required to disclose, the internal control weakness after SOX 404, as an indicator to measure internal control quality. However, there are only a few firms with internal control weaknesses, and some firms tend to disclose selectively. This paper uses the unique database of China, which comprehensively constructs the internal control index and reflects internal control quality for all listed firms without selection bias. The paper proceeds as follows. The second part is the introduction of the research background, where we present the general process of COVID-19 in China. In Section 3, we derive the literature review and hypotheses. The fourth part is the research design. We present our sample and variables in Section 4. In Section 5, we show the empirical results and relate them to the hypotheses. In Section 6, we provide the evidence of furthers studies, in which we test the industry and firm heterogeneity of internal control effect. The seventh part is robustness tests. At last, we draw a conclusion and enlightenment.

2. Research Background

The COVID-19 pandemic swept across China in the spring of 2020. As a large public health emergency with the fastest transmission speed, the widest range of infection, and the greatest difficulty in prevention and control in China, it is a comprehensive test of the health, society, and economy of the whole country, and even the world. During the pandemic period, China took decisive action at the beginning of the pandemic to slow down the outbreak and eventually overcome the crisis in the shortest time. For instance, the Chinese government has adopted a series of measures, such as reducing the bank interest rate, providing loans to small and medium-sized enterprises, and delaying payment of electricity charges for them. The provinces are also ready to invest in infrastructure construction. As a result, China's business and economy have recovered. In some provinces, business enthusiasm is approaching the level before the outbreak. In such an economic environment, the impact of the pandemic on Chinese firms is short-term and limited. Compared with other countries in the world, COVID-19 in China is more suitable for research with the consistent meaning of "emergency" and the time cycle of "outbreak-to-recovery" for the pandemic.

From the perspective of the development process, the COVID-19 pandemic in China can be divided into three stages. The First Stage: outbreak of the pandemic (from 11 January to 5 February 2020). On 11 January, Wuhan, the capital of Hubei province, issued an official report about the new coronavirus. From 23–25 January, nearly all provinces across the country launched the "First Level Response to the Large Public Health Emergencies" and initiated the "Stop Work Order" according to the pandemic situation. Enterprises and factories must lay off, and citizens should stay at home to avoid the spread of the virus. At the beginning of February, the pandemic finally came to a turning point.

The Second Stage: the pandemic slowed down (from 5 February to early March 2020). With the effective control of the pandemic situation, provinces began to carry out returning to work and production and ensure that society is back on the right track. Around February 21st, provinces successively launched policies for firms to return to work. Enterprises encourage employees to go to work, but in the meantime, they should take corresponding safeguard measures, and strictly implement the requirements for epidemic prevention. In early March, 91.7% of Chinese central SOEs returned to work, while over 30% of small and medium-sized enterprises resumed work.

The Third Stage: recovery and overseas outbreak (from early March to 8 April 2020). During this period, the outbreak spread to the world, causing a global panic. In China, Wuhan was reopened on April 8th, declaring the end of the domestic pandemic. According to the actual situation of the above three stages, we suggest that the pandemic directly affects the firm's performance in the first quarter of 2020. In the post-pandemic period, the firms have gradually resumed production and operation under strong prevention and control measures. By June, the requirements for pandemic prevention in various provinces were gradually relaxed, so the domestic economy in the second quarter of 2020 is still affected. By the third quarter of 2020, the economy has recovered to the pre-pandemic level.

3. Literature Review and Research Hypothesis

3.1. Literature Review

3.1.1. Emergency Events and Economic Consequences

For emergency events, scholars have studied and analyzed its concept, elements, types, and effects from a theoretical perspective. At present, there is no consensus on the definition of emergency in academia. Previous literature about emergencies mainly focuses on natural disasters. The threat of natural disasters (e.g., typhoons, earthquakes, etc.) to the economy and society may be transient and local, but the harm caused by large-scale public health emergencies is more likely to be persistent and extensive [17]. Moreover, the life threat caused by the strong infectivity can easily cause social panic and reduce the enthusiasm of all social subjects to participate in activities, which is obviously different from the social impact of natural disasters. In addition, although a few studies have examined the economic consequences of large-scale public health events, such as the analysis of the impact of the SARS in 2003 and COVID-19 on economic development [6,7,18,19], their research only stays at the level of macro-economy and industrial development, unable to go deep into the firm-level to explore the micro impact mechanism of public health events.

The COVID-19 outbreak has had an important impact on the economy and society. The pandemic has caused a serious imbalance between supply and demand. For firms at the micro-level, sales channels are blocked, raw material supply is tight, and the cost pressure increases. Specifically, traffic control has seriously affected the flow of goods and personnel. The infection of COVID-19 has led to difficulties in reemployment, which leads to staff psychological panic. At the same time, normal business negotiation and communication activities are significantly reduced. External service department business is limited, and strict preventive measures seriously affect the firm's operational efficiency. It is difficult to judge firms' future sustainable development. In a word, shrinking demand, operating difficulties, and tight funds have become serious problems faced by firms, which are bound to cause huge losses to the performance of firms. Overall, COVID-19 has a negative impact on the firms' performance in the short term, which can be seen in Figure 1.



Figure 1. The impact of COVID-19 on firm performance. The measurement for the y-axis is the average financial performance of Chinese listed firms (the *year-on-year growth rate of net profit*, see Section 4.2.1). Data source: CSMAR database.

However, relatively few studies have observed the micro-economic consequences of COVID-19. Shen et al. [1] showed that COVID-19 has a negative impact on firm performance, especially when a firm's investment scale or sales revenue is smaller. Other relevant studies focus on some influencing mechanisms on COVID-19 impacts, such as corporate governance [2], R&D [3], cash holding [4], and operating flexibility [5]. Overall, few studies used empirical methods to examine the association between a firm's specific behavior and the pandemic impact.

3.1.2. The Role of Internal Control

After the Sarbanes-Oxley Act in the United States, many countries have implemented a series of internal control policies and regulations to restore investors' confidence, improve financial reporting quality and strengthen corporate governance. The Committee of Sponsoring Organization (COSO) provides an IC framework that is used worldwide after SOX 404. China has also promulgated the so-called "Basic Norms for Enterprise Internal Control", which requires listed companies to conduct self-evaluation on the effectiveness of their internal control, disclose the annual self-evaluation report, and employ intermediary agencies (securities and audit) to qualify the effectiveness of internal control.

According to the definition of COSO, the goal of internal control is to prevent and reduce corporate governance risk, management risk, and operational risk, which is consistent with the firm's goals. The initial goal of an enterprise is survival (that is, sustainability), then followed by development and profitability. Sustainability is the most basic demand of an enterprise, development is an important guarantee for its sustainability, and profitability is the ultimate goal. In the case that the firm's goal is determined to achieve sustainable development, the setting of the internal control goal is to ensure the realization of the firm's goal. Therefore, a sound internal control system is conducive to alleviating the sustainable operation problems of firms in high uncertainty environment [20]. Internal control can effectively prevent and reduce firm risks through sound management systems such as risk assessment and response procedures, control activities such as authorization approval and fund management, and timely and accurate information communication [12].

The literature on internal control approached the question of its role and consequences. Internal control (IC) also affects the decisions of financial statement users, both internal and external stakeholders. For managers, effective IC may lead to higher inventory and fixed assets turnover ratios, and estimate more accurate future cash flows [21,22]. IC also improves the quality of accounting information [23] and reduces the risk to firms [24]. For other stakeholders, IC has brought positive effects on debt cost, equity cost, audit quality [25–27], etc. Overall, the high quality of IC guarantees the interest of stakeholders and generates better performance. Although researchers have examined various benefits of high IC quality, such as improving firm operating efficiency and firm performance, there is limited evidence on its risk prevention function. This paper attempts to discuss the risk prevention function of internal control by analyzing the COVID-19 crisis.

3.2. Research Hypotheses

Under the impact of the COVID-19 pandemic, massive firms have been struggling, and their operating conditions have continued to deteriorate. Specifically, there are several problems for firms caused by the pandemic, including the shutdown of production, recruitment difficulties, the breakdown of supply and customer chain, and financing and cost pressure. Faced with the sudden increase of business risk, internal control plays a good role in resisting risk for firms to deal with large emergencies. If the firm has a perfect internal control system in advance, it will help the firm to deal with this emergency, ensure that the production and operation are interfered with by the pandemic to a low degree, avoid the firm from falling into the predicament of bankruptcy, and even get some special development opportunities by taking advantage of the situation from other competitors falling into crisis.

Internal control ensures firm performance will be less affected by the pandemic by two aspects. On the one hand, effective IC promotes accounting information transparency. According to principal-agent theory, effective IC alleviates the information asymmetry between the management and stakeholders (such as shareholders and creditors), so that stakeholders are willing to offer the contracts with lower financing cost, and ease firms' financing constraints, which help firms overcome the crisis. Due to the lower cost, the firms with high IC quality will suffer relatively less crisis loss. Compared with the firms with low IC quality, the firms with high IC quality will have better performance when encountering great risks simultaneously.

On the other hand, high IC quality guarantees a firm's operation efficiency [28] and the ability of rapid recovery. When the business situation changes, it can timely adjust and improve the business strategy. For example, for the temporary traffic control and restrictions on imports caused by the pandemic, the firms with higher quality IC will often make a series of strategic adjustments (such as seeking local partners) to meet the market demand, so as to have better performance. From the perspective of demand and supply, IC can standardize and strengthen the supply chain management procedures, avoid conflicts of interest among firms. Suppliers and demanders gradually share common interests and increase the degree of mutual trust between the two sides. When the firms resume production after the outbreak of COVID-19, the supply and demand chains recover rapidly. From the perspective of labor, a high-quality IC environment means that according to the changing internal and external conditions, firms promote contractual arrangements, ensure the reasonable distribution and balance between internal stakeholders, and effectively improve corporate governance. Therefore, the firm and its employees still keep close contact during the crisis [29]. They can resume normal production in a short time. Overall, the COVID-19 can be expected to have a negative impact on a firm's performance, but the negative impact of firms with higher quality internal control will be smaller.

Hypothesis 1 (H1). *Internal control plays a positive role in coping with the impact of the COVID-19 pandemic.*

The impact of the COVID-19 pandemic on firms is extensive but diverse in different provinces, so the relationship between internal control quality and a firm's performance may also be affected by the seriousness of the COVID-19 pandemic. The more serious the pandemic situation the firm faces, the worse the business situation is. Therefore, the effect of internal control is more prominent in the regions with a serious pandemic. Previous studies have shown that emergencies pose a threat to the development of firms, the economy, and society, such as the impact of natural disasters on corporate donations [30] and cash holdings [31]; also, the financial crisis leads to the decline of effective demand and the slowness of a firm's inter capital flow. Additionally, the more serious the financial crisis is, the greater the impact on the firm is [32,33]. Therefore, in the regions where the COVID-19 pandemic is more serious, the impact of internal control on firms' performance will be more significant. Based on the above discussion, we put forward the following hypothesis:

Hypothesis 2 (H2). *The more serious the pandemic situation is, the more positive the internal control can play on COVID-19 impact.*

4. Research Design

4.1. Sample Selection and Data Source

This paper focuses on the quarterly financial indicators of Chinese listed firms from the first quarter of 2019 to the third quarter of 2020. The data of relevant financial indicators and control variables are collected from the China Stock Market and Accounting Research Database (CSMAR), then we manually calculated them into the quarterly financial indicators (see Appendix A). Moreover, we collect the pandemic data manually, including the daily cumulative and new cases in each province, from the beginning of the pandemic to 30 June 2020. The data of internal control quality is collected from the DIB database. In addition to the above data, other data of control variables required in this paper are from the CSMAR database. After the completion of data collection, the data are processed as follows: (1) eliminating missing values; (2) continuous variables are winsorized in 1% and 99% level, in order to remove the impact of extreme values on the regression results.

4.2. Measurement of Variables

4.2.1. Measurement of Firm Performance

Referring to relevant research, firm performance can be mainly measured by financial performance and market performance. Compared with most literature that uses market performance to measure the impact of specific events, financial performance is more reliable to reflect the real operating situation of the firm. Scholars mainly observe the financial performance from the growth rate index [34] and ratio index [35]. To fully observe the impact of the pandemic, it is an effective method to measure the year-on-year growth rate based on the data before the pandemic (base period), so the year-on-year growth rate index is selected to measure the change of firm performance caused by the pandemic. Compared with financial performance, market performance has higher requirements on the effectiveness of the market [36]. As investors show great panic in the face of crisis, irrational behavior increases, which will bring more noise to the capital market. When the market has more noise, the firm performance reflected by market performance may deviate from the reality, so this paper intends to measure the firm performance from the financial performance. Among the measurement of financial growth rate, the net profit is regarded as the core surplus, which truly reflects the firm's earning situation, and to eliminate the seasonal trend, the year-on-year growth rate of net profit is used as the indicator to measure the performance of the firms. In the robustness test, the year-on-year ROA growth rate is substituted for the explanatory variable. Furthermore, we use quarterly financial indicators rather than annual financial indicators. Since the pandemic situation changed rapidly in a short time, quarterly data is more precise and reliable for the measurement of financial performance.

4.2.2. Measurement of Internal Control Quality

Referring to literature in Chinese settings [37–39], the measurement of internal control quality always adopts the Internal Control Index developed by Shenzhen DIB Risk Management Technology Company. DIB Internal Control Database is the first professional and authoritative internal control information database in China, which basically reflects the internal control level of all Chinese listed firms objectively and authoritatively. DIB Database designed the internal control index to measure the efficiency and effect of the implementation of firm internal control norms. It is designed with the five goals of internal control, so the index is more scientific and reasonable, for its clearer hierarchy. The five internal control goals consist of the legality and compliance of firm operation and management (Compliance), the security of assets (Security), the authenticity and integrity of financial reports and relevant information (Reporting), the operation efficiency and effect (Operating), and realization of firm development strategy (Strategy). Each goal has a separate index, which then sums up the scores of the five goals to obtain the total internal control index (ICQ). In this paper, we mainly take the internal control index to measure the ex-ante internal control quality. The higher the DIB internal control index, the more effective the internal control.

4.2.3. Measurement of the Seriousness of COVID-19

Considering the impact of COVID-19 is different across regions, the cumulative confirmed cases (Cases_num) are used in this study as a measure of the regional pandemic situation [40]. The number of confirmed infective cases reflects the seriousness of the pandemic situation. Since the pandemic in China is concentrated in the first quarter of 2020, and the growth rate of confirmed cases in various provinces has slowed down since

the second quarter of 2020, we adopt the cumulative number of confirmed cases reported by provinces, autonomous regions, and municipalities on March 31st, 2020. To make the data of different provinces more comparable, this paper also uses the rank of cumulative confirmed cases of different regions (Cases_rank) as a variable to measure the seriousness of COVID-19 in different regions.

4.2.4. Measurement of Control Variables

In addition, according to previous studies, the regression models also control the following variables: SIZE is the level of total assets at the beginning of the period, which is expressed by the natural logarithm of total assets; OWC is the amount of working capital; LEV is the ratio of asset-liability at the beginning of the period, which is expressed by the total liabilities divided by the total assets; LIQUID is the current ratio of the firm; ROA is the return on total assets at the beginning of the period, which is expressed by net profit divided by total assets; TOBINQ is the market value of the firm divided by the total assets; TOP1 is the equity ratio of the largest shareholder; SOE is the dummy variable of the property nature of the firm, which is one when the firm is a state-owned enterprise, zero otherwise. The main variable definitions are shown in Appendix A.

4.3. Model Setting

We use Equation (1) to do regression analysis of the sample data and verify Hypothesis 1. We regard the occurrence of COVID-19 as an exogenous event to exclude the influence of internal control on a firm's performance before the pandemic and examine the role of internal control in a firm ability to cope with COVID-19. Combined with the development of the pandemic situation, we select Chinese A-share listed firms from the first quarter of 2019 to the third quarter of 2020 as the sample. Referring to the "difference-in-difference" (DID) method, the period before the pandemic is taken as a benchmark, which is convenient to correctly observe the effect of internal control on firms' performance after COVID-19. The model is as follows:

$GPROFIT_{t} = \alpha_{0} + \alpha_{1}Pandemic_{t} + \alpha_{2}ICQ_{t-1} + \alpha_{3}ICQ_{t-1} \times Pandemic + \beta X_{t-1} + Industry + Quarter + \varepsilon$ (1)

GPROFIT is the dependent variable of the model, which includes the growth rate of net profit (YOY) in each quarter respectively; Pandemic is an indicator and is equal to one if quarter t is one of the quarters of 2020 and zero otherwise; ICQ_{t-1} is the firm's internal control quality at the beginning of the quarter t; X_{t-1} includes the control variables at the beginning of the quarter t; ε is residual error. If α_3 is positive, the impact of internal control is positive during the pandemic and can help firms improve performance during the crisis.

To examine Hypothesis 2, we replace Pandemic with the seriousness of pandemic, which is defined as the natural logarithm of locally confirmed cases and the regions' ranking of confirmed cases. Before the pandemic, the variables will be zero, which reflects the difference between pre- and post-pandemic. This paper controls the fixed effect of industry and time (quarter) level and excludes the seasonal trend to a certain extent. The model is as follow:

 $\begin{aligned} \text{GPROFIT}_{t} = & \alpha_{0} + \alpha_{1}\text{Cases_num} \left(\text{Cases_rank}\right) + \alpha_{2}\text{ICQ}_{t-1} + \alpha_{3}\text{ICQ}_{t-1} \times \text{Cases_num} \left(\text{Cases_rank}\right) + \beta X_{t-1} \\ & +\text{Industry} + \text{Quarter} + \epsilon \end{aligned} \tag{2}$

GPROFIT is the dependent variable of the model, includes the growth rate of net profit (YOY) in each quarter respectively; Cases_num (Cases_rank) means the natural logarithm of the cumulative number of confirmed cases (or the rank of confirmed cases) reported by each province after the COVID-19 outbreak, and in the before period, Cases_num (Cases_rank) is zero for all provinces and all firms; ICQ_{t-1} is the firm's internal control quality at the beginning of the quarter t; X_{t-1} includes the control variables at the beginning of the quarter t; ϵ is residual error. If α_3 is positive, the impact of internal control becomes more prominent in the areas with a more serious pandemic.

5. Empirical Results and Analysis

5.1. Descriptive Statistic

Table 1 shows the results of descriptive statistics. For the whole sample, the average value of GPROFIT is negative, which means the performance growth of Chinese listed firms from 2019 to 2020 is negative; from the perspective of the sub sample, the performance of firms is greatly negatively affected in the first quarter of 2020, and the impact becomes weakened in the second and third quarters. The *year-on-year* growth rate of net profit in the first three quarters of 2020 fluctuates greatly, which indicates that the impact of the pandemic on the firms' performance has certain heterogeneity. The results of Figure 2 also show that the impact of the pandemic on firm performance is extremely obvious. The descriptive statistics of other control variables are consistent with the results of most literature.

Table 1. Descript	tive Statistic.

Variable	Ν	Mean	Std. Dev.	Min	Median	Max
GPROFIT	18,614	-0.152	2.733	-16.126	-0.012	12.663
GPROFIT_20Q1	2067	-0.484	2.791	-16.126	-0.270	12.663
GPROFIT_20Q2	2067	-0.229	2.717	-16.126	-0.099	12.663
GPROFIT_20Q3	2067	-0.098	2.669	-16.126	-0.004	12.663
ICQ	18,614	6.304	1.388	0	6.621	8.025
Cases_num	18,614	2.148	3.081	0	0	7.315
ZSCORE	18,614	5.090	5.780	0.386	3.172	36.220
SIZE	18,614	22.362	1.362	19.707	22.169	27.227
OWC	18,614	0.234	0.231	-0.460	0.232	0.795
LEV	18,614	0.417	0.199	0.057	0.407	0.973
LIQUID	18,614	2.412	2.294	0.291	1.677	15.896
ROA	18,614	0.105	0.186	-0.789	0.092	0.692
TOBINQ	18,614	1.907	1.262	0.823	1.513	8.525
TOP1	18,614	0.342	0.142	0.085	0.322	0.732
SOE	18,614	0.331	0.470	0	0	1

Note: The sample consists of Chinese listed firms from 2019 Q1 to 2020 Q3. Each continuous variable is winsorized at the 1% and 99% level. Variable definitions are provided in Appendix A.



Figure 2. The trend of COVID-19 in China. Data source: hand-collected from a daily report issued by the National Health Commission of the People's Republic of China.

5.2. Regression Results

5.2.1. The Impact of ICQ for Firm Performance

To test H1, we use Equation (1) to do the regression of the sample, and the results are shown in Table 2. The results of column (1) show that the overall impact of COVID-19 on corporate financial performance is significantly negative. The impact of COVID-19 on microeconomics is systematic, global, and sustainable. Column (2) is the regression result without considering the control variables, and column (3) is the regression result with the control variables and controlling the industry-quarter fixed effect. From the results of columns (2) and (3), we suggest that the coefficient of interaction ICQ \times Pandemic is significantly positive. Internal control has a buffer effect on the impact of the pandemic, which verifies H1. Column (4) measures the dynamic trend of the impact caused by the pandemic. The coefficients in the first and second quarters of 2020 are significantly positive, and the coefficients in the third quarter are not significant, which indicates that the buffer effect occurs only in the first and second quarters. It is because that the impact of the pandemic on firms lasts until the first half of the year. The coefficient in the second quarter of 2020 is the largest and most prominent, which indicates that the role of internal control has a lag and accumulated impact. In the third quarter, China's economy basically returned to normal operation, so the risk-resistance role of internal control is not obvious.

Dependent Variable	GPROFIT			
	(1)	(2)	(3)	(4)
Pandemic	-0.384 ***	-0.447 ***	-0.510 ***	-0.409 ***
	(-4.971)	(-4.348)	(-5.124)	(-3.360)
ICQ		0.165 ***	0.070 **	0.070 **
		(5.987)	(2.516)	(2.515)
$ICQ \times Pandemic$		0.353 ***	0.195 **	
		(3.810)	(2.238)	
$ICQ \times (Iime = 20QI)$				0.249 **
				(1.997)
$ICQ \times (Iime = 20Q2)$				0.315 ***
$ICO \times (Time = 2002)$				(2.392)
$ICQ \times (IIIIe = 20Q3)$				(0.158)
SIZE	0.007		_0.015	-0.015
	(0.294)		(-0.620)	(-0.618)
OWC	0.048		-0.067	-0.067
0110	(0.207)		(-0.297)	(-0.295)
LEV	0.603 **		0.655 ***	0.655 ***
	(2.478)		(2.692)	(2.692)
LIQUID	-0.002		0.005	0.005
	(-0.146)		(0.342)	(0.338)
ROA	4.838 ***		4.757 ***	4.758 ***
	(19.784)		(19.231)	(19.224)
TOBINQ	-0.064 ***		-0.068 ***	-0.068 ***
	(-2.826)		(-2.958)	(-2.957)
TOP1	-0.109		-0.175	-0.175
	(-0.597)		(-0.954)	(-0.954)
SOE	0.044		0.057	0.057
	(0.724)	4.405.444	(0.952)	(0.951)
Constant	-0.918	-1.197 ***	-0.839	-0.840
T 1 .	(-1.569)	(-3.356)	(-1.448)	(-1.449)
Ouenter	Yes	Yes	Yes	res
Quarter	18 614	18 614	19 614	18 614
1N P ²	0 104	0.022	0 106	0 106
R^2	0.104	0.022	0.100	0.100
auj. N	0.102	0.019	0.105	0.103

Table 2. The impact of ICQ for Firms' Performance Change.

Note: *t*-Statistics are based on firm-cluster errors and are reported in parentheses. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively.

Then we further illustrate the risk prevention function of internal control. We divide the sample into a high-financial-risk group and low-financial-risk group and compare the difference in the role of internal control in the two groups. According to the meaning of COSO, the primary task of internal control is to ensure the sustainable operation of firms, and its role is mainly reflected in risk prevention. Therefore, internal control will play a more obvious role in firms with high financial risk. Specifically, we use Edward Altman's method to calculate Z-score (see Equation (3)), which is used to evaluate the financial crisis risk of the firm. Then we divided the sample into two groups according to the median of Z-score in each industry and quarter. The financial risk increases with the declining value of the Z-score.

$$ZSCORE = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.99X_5$$
(3)

 X_1 is working capital divided by total assets; X_2 is retained earnings divided by total assets; X_3 is earnings before interest and tax divided by total assets; X_4 is the market value of equity divided by total liabilities; X_5 is sales divided by total assets.

In Table 3, the result of column (1) is significantly positive at the level of 5%, while the coefficient of column (2) is not significant. Compared to the low-financial-risk group, internal control plays a more positive role in the high-financial-risk group. Similarly, in column (3), the interactive coefficient of the first quarter and the second quarter of 2020 is significantly positive, while column (4) does not have a result, which confirms the risk resistance function of internal control.

Dependent Variable GPROFIT **High-Risk** Low-Risk High-Risk Low-Risk (1) (2) (3) (4) -0.702 *** -0.327 *** -0.557 *** -0.284 * Pandemic (-2.849)(-4.774)(-2.946)(-1.928)ICQ 0.056 * 0.052* 0.056 * 0.052 * (1.738) (1.840)(1.737)(1.838)ICQ × Pandemic 0.304 *** 0.109 (2.604)(1.183) $ICQ \times (Time = 20Q1)$ 0.383 * 0.115 (1.885)(0.784) $ICQ \times (Time = 20Q2)$ 0.471 ** 0.178 (2.433)(1.177) $ICQ \times (Time = 20Q3)$ 0.034 0.056 (0.293)(0.214)SIZE 0.007 -0.0000.007 -0.000(0.215)(-0.015)(0.216)(-0.017)OWC -0.2500.182 0.179 -0.249(0.474)(-1.181)(0.465)(-1.179)LEV 0.727 ** 0.734 ** 0.724 ** 0.734 ** (2.335)(2.333)(2.059)(2.049)LIQUID 0.019 0.019 -0.019 -0.018(-0.207)(1.408)(-0.193)(1.406)3.479 *** ROA 6.364 *** 6.363 *** 3.480 *** (12.710)(16.571)(16.557)(12.697) -0.052 *** -0.051 *** TOBINQ 0.061 0.062 (0.661)(-2.622)(0.651)(-2.615)TOP1 -0.230-0.125-0.230-0.124(-1.399)(-1.398)(-0.565)(-0.569)SOE 0.094 0.095 0.011 0.010 (1.450)(1.454)(0.144)(0.137)Constant -1.881 * -0.463 -1.881 *' -0.463(-2.348)(-0.599)(-2.347)(-0.598)Industry Yes Yes Yes Yes Quarter Yes Yes Yes Yes Ν 9234 9380 9234 9380 R² 0.084 0.1400.084 0.140 adj. R² 0.134 0.078 0.134 0.077

Table 3. Mechanism: Risk Prevention Function of Internal Control.

Note: This table further examines the risk resistance role of internal control quality (ICQ). We divide the sample firms into two groups: high-financial-risk group (High-risk) and low-financial-risk group (Low-risk). *t*-Statistics are based on firm-cluster errors and are reported in parentheses. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively.

5.2.2. Considering the Seriousness of COVID-19

COVID-19 is an exogenous large-scale emergency, and the regions are affected in different ways by the pandemic. To verify hypothesis 2, we use Equation (2) to regress the sample. The value of Cases_num and Cases_rank are zero before the outbreak. From Table 4, the coefficient of interaction terms ICQ \times Cases_num in column (1) and ICQ \times Cases_rank in column (2) are significantly positive at 5%, which indicates that the more severe the pandemic situation is, the more internal control of firms can play the role of resisting risk and buffering performance fluctuation.

Dependent Variable	GPROFIT			
-	(1)	(2)	(3)	(4)
Cases_num	-0.001		-0.001	
	(-0.002)		(-0.031)	
Cases_rank		0.001		0.001
		(0.046)		(0.041)
ICQ	0.071 ***	0.072 ***	0.069 ***	0.071 ***
	(3.168)	(3.257)	(3.055)	(3.146)
$ICQ \times Cases_num$	0.027 **		0.026 **	
	(2.393)		(2.277)	
$ICQ \times Cases_rank$		0.006 **		0.005 *
		(2.003)		(1.856)
SIZE	-0.015	-0.014	-0.015	-0.015
	(-0.748)	(-0.707)	(-0.779)	(-0.737)
OWC	-0.068	-0.067	-0.065	-0.064
	(-0.394)	(-0.392)	(-0.366)	(-0.364)
LEV	0.656 ***	0.658 ***	0.665 ***	0.667 ***
	(3.234)	(3.243)	(3.227)	(3.236)
LIQUID	0.005	0.005	0.004	0.004
	(0.442)	(0.445)	(0.366)	(0.369)
ROA	4.757 ***	4.758 ***	4.765 ***	4.766 ***
	(20.612)	(20.618)	(20.357)	(20.363)
TOBINQ	-0.067 ***	-0.067 ***	-0.069 ***	-0.068 ***
	(-3.515)	(-3.482)	(-3.446)	(-3.410)
TOP1	-0.174	-0.173	-0.197	-0.196
	(-1.235)	(-1.226)	(-1.379)	(-1.371)
SOE	0.058	0.059	0.054	0.055
	(1.151)	(1.177)	(1.045)	(1.071)
Constant	-0.856 *	-0.886 *	-0.809	-0.841 *
	(-1.700)	(-1.762)	(-1.590)	(-1.654)
Industry	Yes	Yes	Yes	Yes
Quarter	Yes	Yes	Yes	Yes
Province	Yes	Yes	Yes	Yes
Ν	18,614	18,614	18,199	18,199
\mathbb{R}^2	0.106	0.106	0.107	0.107
adj. R ²	0.103	0.103	0.103	0.103

Table 4. Considering the Seriousness of COVID-19.

Note: *t*-Statistics are based on firm-cluster errors and are reported in parentheses. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively.

Considering that Hubei is the center of the pandemic, the situation became abnormal from December 2019 to March 2020. The firms in Hubei have suffered severe damage and internal control may not help. At the same time, the government supports Hubei through a series of means to ensure the tenacious recovery of Hubei's economy. Due to the great difference between Hubei and other provinces in the seriousness of pandemic and prevention and safeguard measures, we remove the listed firms located in Hubei Province from the sample, and the results of column (3) and column (4) are still consistent.

5.3. Additional Analysis

5.3.1. The Types of Internal Control

According to the definition of COSO, the goal of internal control is to prevent and reduce corporate governance risk, management risk, and operational risk, which is consistent with the enterprise goals. The realization degree of internal control goals determines the realization degree of the firm's goals. In the case that the firm's goals are determined to achieve sustainable development and maximize enterprise value, the internal control goals are embodied in the realization of strategy, asset safety, financial reporting, operating efficiency and effect, and the legality and compliance of operation and management. Failure to achieve any expected goal means that there are weaknesses in the firm's internal control system and implementation, thus increasing the firm risk. For this purpose, we measure the effectiveness of internal control from the perspective of internal control goals. Among them, the goal of operating efficiency and effect is the most important and core factor in the internal control system, which determines the efficiency of firm operation. Therefore, we believe that the degree of achievement of the business operating goal is directly related to the performance fluctuation of firms affected by the pandemic. Furthermore, the high quality of the reporting indicates that the firm has a good information transmission channel, which alleviates the information asymmetry. It will not only guarantee effective communication but also increase the confidence of the external information users (e.g., investors, suppliers, banks, etc.) and release positive signals.

Table 5 shows the regression results of different types of internal control goals. Strategy, Operating, Reporting, Compliance, and Security are the variables of five internal control goals respectively, which are sub-index from the DIB internal control index database. In Column (2), the coefficient of Operating \times Pandemic is significantly positive at the level of 5%, while in Column (3), the coefficient of Reporting \times Pandemic is significantly positive at the level of 10%. The coefficient of explanatory variables in other columns has no significant results, which indicates that the realization of the goal of firms' operating, and reporting effect is the key factor for firms to resist the impact of the pandemic. Internal control improves operating efficiency and the information transmission channel to achieve its goal.

5.3.2. Industry Heterogeneity

The impact of the COVID-19 on the economy is distinct in various industries. Sine the supply chain is easy to fall into the crisis of temporary interruption, the manufacturing industry is the "disaster zone", which is greatly affected by the pandemic. Manufacturing enterprises with perfect internal control systems have strong risk prevention and selfrecovery ability. Therefore, in the manufacturing industry, the so-called "disaster zone" of the pandemic, internal control can provide insurance for firms to deal with the crisis. In the meantime, some high-tech firms with high digital characteristics show great advantages in the pandemic. These firms can timely adjust their strategies in the short term, and quickly realize the transformation from offline mode to online mode, so as to avoid the great impact of the pandemic. Therefore, for high-tech firms that are less affected by the pandemic, internal control plays a weaker role.

The results of Table 6 show that for manufacturing firms, the coefficient of ICQ \times Pandemic is significantly positive; and for non-high-tech firms, the coefficient of ICQ \times Pandemic is significantly positive. The results indicate that the internal control of traditional manufacturing firms is very important for firms to cope with the crisis; for high-tech enterprises, the risk resistance role of internal control is not significant. Otherwise, we can consider that the evaluation system of internal control may need to be adjusted according to the digital characteristic, and the boundary of internal control may be broadened.

Dependent Variable			GPROFIT		
-	(1)	(2)	(3)	(4)	(5)
Pandemic	-0.251 **	-0.329 ***	-1.065 **	-0.261 ***	-0.312 ***
_	(-2.574)	(-3.250)	(-2.248)	(-3.236)	(-3.234)
Strategy	0.091 ***				
Strategy × Pandemic	-0.013				
e dategy // Fallaende	(-0.133)				
Operating	. ,	0.120 ***			
		(4.284)			
Operating × Pandemic		(2.008)			
Reporting		(2.098)	0.065 ***		
			(3.114)		
Reporting \times Pandemic			0.092 *		
			(1.699)	0.000 ***	
Compliance				(4.587)	
Compliance \times Pandemic				0.151	
1				(1.091)	
Security					0.161 ***
Convertex y Dan domin					(4.985)
Security × Fandenic					(0.998)
Controls	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes
Quarter	Yes	Yes	Yes	Yes	Yes
Ν	18,614	18,614	18,614	18,614	18,614
\mathbb{R}^2	0.025	0.024	0.024	0.024	0.025
adj. R ²	0.021	0.021	0.021	0.021	0.022

Table 5. Types of ICQ.

Note: The independent variables are the interaction items of various internal control quality subdivided index (Strategy goal, Operating goal, Reporting goal, Compliance goal, and Security goal) and Pandemic. *t*-Statistics are based on firm-cluster errors and are reported in parentheses. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively.

5.3.3. Firm Heterogeneity

There is also a firm heterogeneity in the role of internal control in coping with the COVID-19 pandemic. There are great differences in financial performance between different firms during the epidemic period. Some firms are still able to adjust their business strategies during the crisis, and even seize the opportunities and acquire growth. Other firms are too busy to cope with the huge risks.

First, from the perspective of the nature of property rights, under the special institutional background of China, state-owned enterprises (SOEs) need to undertake political tasks relative to private enterprises. During the pandemic period, SOEs were the first force to resume production and switch production to provide daily supplies and meet the needs of the citizens. Moreover, the theory of owner absence points out that the SOEs are more likely to have the problem of insider control because the government is the actual controller [41,42]. Therefore, the internal control of SOEs should play a greater role in firm performance during the pandemic, because the internal control system helps firms improve their governance level.

Second, from the perspective of control activities, the most serious impact of the pandemic on firms is the break of the firm capital chain, which leads to the failure of firms to maintain normal operation or even bankruptcy. Therefore, during the pandemic period, the primary control activity of firms is capital management. Internal control responds to the cash flow impact caused by the pandemic through capital management activities. For firms with high financing constraints, they are more likely to face the problem of insufficient capital. Therefore, we believe that the stronger the financing constraints are, the more effective role the internal control can play. In this paper, the SA index is used to measure financing constraints, which is the common measurement among academia. The higher the SA index is, the stronger the financing a firm faces.

Dependent Variable	GPROFIT				
	MANU	NON-MANU	TECH	NON-TECH	
	(1)	(2)	(3)	(4)	
Pandemic	-0.454 ***	-0.667 ***	-0.524 ***	-0.494 ***	
	(-4.224)	(-3.499)	(-3.006)	(-4.460)	
ICQ	0.071 ***	0.063	0.039	0.076 ***	
	(2.634)	(1.607)	(0.914)	(2.979)	
$ICQ \times Pandemic$	0.193 **	0.186	-0.032	0.262 ***	
	(2.251)	(1.222)	(-0.224)	(3.006)	
SIZE	-0.048 **	0.069 *	0.009	-0.038 *	
	(-2.117)	(1.807)	(0.225)	(-1.664)	
OWC	-0.233	0.254	-0.414	-0.011	
	(-1.126)	(0.830)	(-1.373)	(-0.051)	
LEV	0.709 ***	0.462	-0.170	0.968 ***	
	(2.798)	(1.361)	(-0.442)	(4.042)	
LIQUID	0.013	-0.013	-0.027 *	0.026	
	(1.020)	(-0.536)	(-1.662)	(1.583)	
ROA	5.165 ***	3.926***	3.914 ***	5.195 ***	
	(19.226)	(8.859)	(10.074)	(18.192)	
TOBINQ	-0.120 ***	0.035	0.012	-0.121 ***	
	(-5.572)	(0.931)	(0.425)	(-4.653)	
TOP1	-0.194	-0.083	-0.171	-0.170	
	(-1.158)	(-0.313)	(-0.630)	(-1.031)	
SOE	0.058	0.085	0.052	0.063	
	(0.947)	(0.914)	(0.622)	(1.024)	
Constant	0.477	-2.719 ***	-0.464	-0.521	
	(0.929)	(-3.055)	(-0.564)	(-0.936)	
Industry	Yes	Yes	Yes	Yes	
Quarter	Yes	Yes	Yes	Yes	
Ν	13,542	5072	4785	13,829	

Table 6. Industry Heterogeneity.

 \mathbb{R}^2

adj. R²

Note: We divide the sample into four sub-samples, includes manufacturing industry firms (MANU) and nonmanufacturing industry firms (NON-MANU), high-tech industry firms (TECH) and non-high-tech industry firms (NON-TECH). The industry fixed effects are controlled in SIC letter code level (except Category C for SIC 2-digit code level), while the cross-sectional analysis is based on SIC 2-digit code. *t*-Statistics are based on firm-cluster errors and are reported in parentheses. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively.

0.092

0.086

0.098

0.094

0.112

0.108

0.117

0.114

Table 7 shows the regression results of firm heterogeneity. Column (1) and column (2) show the difference between state-owned enterprises and non-state-owned enterprises; columns (3) and (4) show the difference in results caused by various financing constraints. In column (1), the interaction coefficient of ICQ \times pandemic is significantly positive at 1%, while the coefficient of column (2) is not significant, which indicates that compared with non-SOEs, the internal control of SOEs can play a more important role; the results of column (3) and column (4) show that the role of internal control is more prominent in the firms with strong financing constraints. The above group tests of sub-samples all passed the coefficient difference test.

Dependent Variable	GPROFIT				
	SOEs	Non-SOEs	High FC	Low FC	
	(1)	(2)	(3)	(4)	
Pandemic	-1.020 ***	-0.258 **	-0.827 ***	-0.198	
	(-5.694)	(-2.157)	(-5.674)	(-1.487)	
ICQ	0.105 **	0.052	0.084 **	0.051	
	(2.474)	(1.396)	(2.394)	(1.086)	
$ICQ \times Pandemic$	0.492 ***	0.031	0.420 ***	-0.048	
	(2.995)	(0.307)	(3.237)	(-0.424)	
SIZE	-0.069	0.005	-0.021	-0.000	
	(-1.637)	(0.163)	(-0.477)	(-0.014)	
OWC	0.320	-0.334	-0.200	-0.018	
	(0.841)	(-1.219)	(-0.620)	(-0.057)	
LEV	1.196 ***	0.421	0.670 **	0.728 *	
	(2.979)	(1.385)	(2.008)	(1.952)	
LIQUID	0.036	0.005	0.047 *	-0.015	
	(0.947)	(0.328)	(1.798)	(-0.909)	
ROA	5.100 ***	4.685 ***	4.850 ***	4.733 ***	
	(9.006)	(16.731)	(13.343)	(14.570)	
TOBINQ	-0.076	-0.072 ***	-0.128 ***	-0.028	
	(-1.369)	(-2.858)	(-3.685)	(-0.963)	
TOP1	-0.049	-0.278	0.187	-0.476 *	
	(-0.142)	(-1.309)	(0.676)	(-1.893)	
SOE	· · · ·		0.092	-0.047	
			(1.110)	(-0.468)	
Constant	-0.277	-0.895	-0.760	-1.086	
	(-0.299)	(-1.097)	(-0.767)	(-1.317)	
Industry	Yes	Yes	Yes	Yes	

Table 7. Firm Heterogeneity.

Note: We divide the sample into four sub-samples based on some firm characteristics (SOEs, financing constraints). t-Statistics are based on firm-cluster errors and are reported in parentheses. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. SUR is used for the Coef-diff tests.

5.78 (0.0163)

Yes

12,458

0.115

0.111

Yes

9234

0.105

0.099

Yes

9380

0.120

0.114

7.39 (0.0066)

Yes

6156

0.107

0.099

5.4. Robustness Analysis

Quarter

Ν

 \mathbb{R}^2

adj. R²

Coef diff

Table 8 shows the results of some robustness tests, including the following tests. Firstly, this paper uses the method of alternative variables. We select ROA as the proxy of firm performance and calculate the year-on-year growth rate of ROA (GROA) as a substitute for the initial explanatory variable (GPROFIT). After restarting the regression of Equation (1) by using the alternative proxies, the results are consistent.

Secondly, in order to more clearly observe the impact of internal control on firm performance in each quarter after the outbreak of the pandemic, Equation (4) is used to regress the changes of firm performance in each quarter. For excluding the impact of ICQ itself on firm performance, GPROFIT in the same quarter of last year is controlled in the model to observe the changes of firm performance caused by the pandemic. The results of columns (3)–(5) also confirm that internal control has a positive effect on the financial performance of firms in the first and second quarters of 2020.

 $GPROFIT (_Q1,_Q2,_Q3) = \alpha_0 + \alpha_1 ICQ_{t-1} + \alpha_2 GPROFIT_{t-4} + \beta X_{t-1} + Industry + \varepsilon$ (4)

Dependent Variable	GROA		GPROFIT		
	(1)	(2)	20Q1	20Q2	20Q3
	(1)		(3)	(4)	(5)
Pandemic	-0.525 ***	-0.429 ***			
	(-5.312)	(-3.520)			
ICQ	0.031	0.031	0.273 ***	0.267 ***	-0.004
ICO × Pandomic	(1.198) 0.188 **	(1.197)	(3.103)	(3.089)	(-0.052)
	(2.165)				
$ICQ \times (Time = 20Q1)$	(0.209 *			
		(1.692)			
$ICQ \times (Time = 20Q2)$		0.331 ***			
		(2.741)			
$ICQ \times (IIme = 20Q3)$		(0.022)			
GPROFIT		(0.174)	0.008	0.055 *	0.021
ornorn _{t-4}			(0.358)	(1.858)	(0.918)
SIZE	-0.017	-0.017	-0.121 *	-0.047	0.023
	(-0.782)	(-0.780)	(-1.906)	(-0.749)	(0.414)
OWC	-0.026	-0.025	1.000*	0.706	0.495
	(-0.120)	(-0.118)	(1.779)	(1.371)	(0.939)
LEV	0.531 **	0.531 **	1.562 ***	0.342	0.044
	(2.098)	(2.096)	(2.637)	(0.630)	(0.063)
LIQUID	0.009	0.008	-0.002	-0.050	-0.018
ROA	(0.500) 4 605 ***	(0.555) 4 605 ***	(-0.037) 4 959 ***	(-1.444) 4 353 ***	(-0.547) 4 509 ***
Rom	(17.821)	(17.812)	(7.007)	(6.670)	(5.353)
TOBINO	-0.081 ***	-0.082 ***	0.036	-0.023	-0.103 *
~ ~ ~	(-3.392)	(-3.392)	(0.651)	(-0.522)	(-1.943)
TOP1	-0.122	-0.122	0.032	-0.232	-0.188
	(-0.754)	(-0.755)	(0.072)	(-0.578)	(-0.481)
SOE	0.113*	0.113*	0.100	0.119	-0.270^{*}
_	(1.939)	(1.938)	(0.629)	(0.787)	(-1.775)
Constant	-0.669	-0.670	-3.072 **	-2.719	-1.368
T 1 4	(-1.236)	(-1.237)	(-2.105)	(-1.636)	(-0.964)
Industry	Yes	Yes	Yes	Yes	Yes
Quarter	185 1861/	185 1861/	1NO 2026	1NO 2042	1NO 2055
R ²	0 107	0 107	2020	20 4 2 0 132	2000
adi R ²	0.102	0.102	0.100	0.132	0.076
uuj. 10	0.077	0.077	0.107	0.107	0.070

Table 8. Robustness Tests.

Note: In Columns (1) and (2), we substitute the proxy of dependent variable. In Column (3)–(5), we adopt model (4) to test H1, where the dependent variables are GPROFIT_Q1, GPROFIT_Q2, GPROFIT_Q3, and the independent variable is the internal control index (ICQ). *t*-Statistics are based on firm-cluster errors and are reported in parentheses. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively.

GPROFIT is the dependent variable of the models, includes the growth rate of net profit (YOY) in 2020 Q1, Q2, and Q3 respectively; ICQ_{t-1} is the firm's internal control quality at the beginning of 2020; X_{t-1} includes the control variables at the beginning of 2020; ϵ is residual error.

Thirdly, we expand the sample interval and select the data from the first quarter of 2013 to the third quarter of 2020. In the alternate sample, we consider the quarters before the first quarter of 2020 as the pre-pandemic period. The results are robust to this alternative sample.

Table 9 shows the results of the Parallel Trend Test and Placebo Test. Since some omitted factors may lead to low or high internal control of some firms, and in order to consider the dynamic time trend of performance decline and recovery caused by the pandemic, it is necessary to test the Parallel Trend Hypothesis, which is the identification

condition of the model. We generate dummy variables for each quarter in the model. After interacting with them with ICQ, we can estimate the situation before and after the pandemic and the duration of the impacts. The results of column (1) in Table 9 show that the interaction coefficient changes from negative to positive in 2020 Q1 and is significantly positive in the first and second quarters of 2020.

Table 9. Parallel Trend Test and Placebo Test.

Dependent Variable		GPROFIT	
	Parallel Trend Test	Placeb	oo Test
	(1)	(2)	(3)
Pandemic	-0.426 ***	-0.386 ***	-0.408 ***
	(-3.133)	(-4.921)	(-4.205)
ICQ	0.084 ***	0.045 *	0.045 *
	(2.643)	(1.784)	(1.785)
$ICQ \times Pandemic$		-0.082	
		(-1.312)	
$ICQ \times (Time = 19Q1)$	-0.051		-0.030
	(-0.473)		(-0.296)
$ICQ \times (Time = 19Q2)$	-0.161		-0.131
	(-1.608)		(-1.410)
$ICQ \times (Time = 19Q3)$	-0.167 *		-0.129
	(-1.766)		(-1.436)
$ICQ \times (Time = 19Q4)$	-0.022		-0.038
	(-0.204)		(-0.376)
$ICQ \times (Time = 20Q1)$	0.229 *		
	(1.844)		
$ICQ \times (Time = 20Q2)$	0.295 **		
	(2.431)		
$ICQ \times (Time = 20Q3)$	-0.000		
	(-0.000)		
Controls	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Quarter	Yes	Yes	Yes
Ν	18,614	21,932	21,932
R ²	0.107	0.168	0.168
adj. R ²	0.104	0.166	0.166

Note: In Column (1), we set the interaction items of ICQ and dummy indicators of each quarter as independent variables to test dynamic trend of ICQ. In columns (2) and (3), we change the sample interval from 2018 Q1 to 2019 Q4, and set 2019 Q1 as the time of shock. *t*-Statistics are based on firm-cluster errors and are reported in parentheses. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively.

The risk prevention function of internal control on the impact of the pandemic may be compounded with the fact that firms with high internal control quality usually have higher financial reserves and operating capacity. To exclude this alternative explanation, we conducted the following placebo test. We change the sample interval from the first quarter of 2018 to the fourth quarter of 2019 and set the placebo time point of the pandemic as the first quarter of 2019. In other words, 2018 Q1–Q4 are the placebo pre-pandemic quarters, while 2019 Q1–Q4 are the placebo post-pandemic quarters. Results as shown in columns (2) and (3) of Table 9, the relationship between internal control and a firm's performance change is not found in those quarters, and alternative explanations are excluded. Therefore, the conclusion of this paper can reasonably explain the causal effect of internal control.

6. Conclusions

COVID-19, a global sudden pandemic, not only brought a serious threat to health but also had a huge impact on the whole economy. This paper focuses on the pandemic response of firms from the micro economy level and discusses the role of internal control in coping with the pandemic. Based on the financial data of Chinese listed firms from the first quarter of 2019 to the third quarter of 2020, this paper examines the impact of internal control on the change of firm performance during the long period of "outbreakto-recovery". The empirical results show that the high quality of internal control plays a role in resisting firm risk and crisis response, and the effect is positively correlated with the seriousness of the pandemic. In further analysis, we find that the role of internal control has industry heterogeneity and firm heterogeneity. In the manufacturing industry, which is a "disaster zone" of the pandemic, and in the non-high-tech industries with a low degree of digitization, internal control can play a more important role. For state-owned enterprises and firms with strong financing constraints, internal control is the key factor for firms to cope with the impact of the pandemic. The above conclusions reveal the risk prevention role of internal control in large-scale emergencies and provide theoretical evidence for improving the firm's crisis response mechanisms in the future.

This study contributes to the literature by adding to evidence on the impact of internal control on risk prevention pre- and post-crisis. This finding is distinct from previous studies about the microeconomics consequences of COVID-19. Our analysis is the first one to empirically examine how COVID-19 influences the existing relationship between internal control and firm performance. The results also contribute to the literature about internal control in developing countries.

Our findings have implications for investors, managers as well as for policymakers. The study indicates that internal control has positive effects on firm performance during crisis times. Therefore, managers should invest in internal control activities in advance to reduce the negative impact of a crisis on performance. Regulators should help enterprises to establish and improve internal controls systems to avoid heavy loss during the crisis period. Specifically, we find that for SOEs and the firms with high financing constraints and in non-high-tech industries, internal control is highly needed. Regulators need to design more strict laws and policies to urge firms to take action, especially in SOEs. Additionally, governments can offer more financial support and promote developing technology, which plays a complementary role with an internal control to benefit firms' sustainable development.

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Appendix A

Variable	Definition	Data Source		
Dependent and Independent Variables				
The change of firm performance	e variables			
GPROFIT	The year-on-year growth rate of net profit in each quarter.	CSMAR		
GROA	The year-on-year growth rate of ROA in each quarter.	CSMAR		
Pandemic	An indicator that is equal to one if quarter t is one of the quarters of 2020 and zero otherwise			
The seriousness of COVID-19 v	ariables			
	The natural logarithm of the			
Cases_num	number of regional cumulative COVID-19 cases by 31 March 2020.	Hand-collected		
	The descending rank of the			
Cases_rank	regions according to the number of regional cumulative cases by 31 March	Hand-collected		
	2020.			
Internal control quality variable	The index of internal control			
ICQ	quality, detailed information of the data is shown above.	DIB Database		
Other Variables				
ZSCORE	Edward Altman's Z-score index, the calculation model (3) is shown above.	CSMAR		
SIZE	The natural logarithm of the total asset.	CSMAR		
OWC	Working capital, current assets scaled by current liabilities.	CSMAR		
LEV	Liabilities scaled by total assets.	CSMAR		
LIQUID	Current liabilities scaled by current assets.	CSMAR		
ROA	The total return on assets.	CSMAR		
TOBINQ	The market value of equity scaled by total assets.	CSMAR		
TOP1	The equity ratio of the largest shareholders.	CSMAR		
SOE	The dummy variable set equal to one if the ultimate controller of a firm is government or a government unit, and zero otherwise.	CSMAR		
FC	Financing constraints, measured by SA index.SA = $-0.737 \times \text{Size} + 0.043 \times \text{Size}^2$ $-0.04 \times \text{Age}$	CSMAR		

Table A1. Variable Definitions and Data Source.

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