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COVID-19 impact on firm investment—Evidence from Chinese publicly listed firms

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\section*{ABSTRACT}

The COVID-19 outbreak had a significant impact on business cash flows and investment activities. This paper examined the COVID-19 impact on Chinese business investment in 3326 A-share listed quarterly financial reports, from which it was found that the negative relationship was more pronounced in the large, eastern Chinese state-owned firms. Using a propensity score matching method and difference-in-differences estimation, corporate financial flexibility was also examined, with the results indicating that high cash flexibility provided a buffer that allowed firms to better deal with adverse external shocks as the firms that had high cash flexibility were able to significantly increase their investments after the COVID-19 outbreak. Various robustness tests were conducted, all of which verified the robustness of the results. Overall, the empirical results provided evidence that the COVID-19 pandemic in China had a negative impact on Chinese listed firms, and verified the vital role of flexible financial reserves for firm survival and development during crises.

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1. Introduction

In January 2020, the novel coronavirus (COVID-19) broke out in China and rapidly spread across the country and the world. To contain the pandemic, Chinese government authorities at all levels adopted measures to curtail the spread, such as home isolation, social distancing, travel and transport restrictions, and the temporary suspension of non-essential economic activities, all of which placed significant pressure on economic growth in 2020. These COVID-19 curtailment actions were a huge shock to micro-firm capital chains, making it difficult to sustain general operations. A February 2020 survey reported that 68.39\% of firms that mainly operated offline (and 72.87\% of online firms) expected to be able to maintain their cash flows for no more than three months.\textsuperscript{1}

COVID-19 impacted both internal and external corporate capital chains. Internal capital chain ruptures often expose financial risks associated with receivables and payables turnover periods (Wu & Lu, 2001; Yang, 2013) and accounts receivable recovery rates, which could result in fund defaults, inventory overstocks, and long-term losses (Altman, 1968; Reisz & Perlich, 2007). The COVID-19 curtailment actions that delayed the recommencement of normal operations also
resulted in a lack of corresponding stickiness and elasticity in the industrial and supply chains in which the firms were located, which seriously affected internal daily operations such as purchasing, production, and sales, greatly weakened business incomes, and lengthened the receivables collection cycle, which in turn reduced cash flows and increased the risk of capital chain ruptures. Firms were also faced with the need to maintain their employees’ wages, social security, taxes and rents, which made it very difficult to maintain daily operations.

Externally, the outbreak resulted in a significant shock to the global capital market (Liu, Wang, He, & Wang, 2020; Liu, Manzoor, Wang, Zhang, & Manzoor, 2020), with the stock market value plunging and stock issuances blocked or stopped, making it difficult for firms to sustain their equity capital (Zeng, Fu, & Wei, 2011). At the same time, the financial markets were turbulent, and as financial institutions were under funding constraints, they became less willing to take risks, which blocked corporate financing channels and increased the external financing constraints (Arslan-Ayaydin, Florackis, & Ozkan, 2014; Kaplan & Zingales, 1995).

Although central and local governments adopted various firm rescue measures such as financial subsidies, preferential loans, and preferential taxes and fees to help firms survive, the pandemic curtailment measures inevitably led to the substantial deterioration of firm financing environment and substantial declines in firm financing capacities, which further exacerbated the risk of capital chain disruption. Many firms had insufficient cash inflows to cover their daily expenses, with some going into bankruptcy and liquidation, which then led to a general decline in the scale of firm investment. The National Bureau of Statistics, China, reported that fixed assets investment fell 16.1 % year-on-year in the first quarter, with private fixed assets investment falling by 18.8 % (Fig. 1).

It has been found that when firms are facing financing constraints, cash flow risk has a significant positive effect on cash holdings (Kaplan & Zingales, 1995; Opler, Pinkowitz, Stulz, & Williamson, 1997). Cash flow risks generated by adverse external shocks have also been found to have a greater impact on cash flow. Agency and trade-off theories claim that firms would be more likely to hold cash during a pandemic for preventive motivation or to take advantage of favorable investment opportunities (Keynes, 1936). However, firms with less cash flexibility would find it difficult to repay the principal and interest on their loans, would face huge external financing constraints, and would encounter obstacles to refinancing, which would result in less spending on technology, employees, and capital equipment (Campello, Graham, & Harvey, 2010; Campello, Giambona, Graham, & Harvey, 2011). Therefore, firms with low leverage and high cash holdings have a significantly better anti-risk ability when faced with sudden shocks as they can take advantage of cash investment opportunities and maintain or increase firm value (Ge Jianshu, 2008). As the pandemic, caused a sharp fall in capital assets, the value of firms suffering from financial crises and bankruptcy fell. However, while the crisis also provided good opportunities to expand for firms that had cash flexibility, firms that lacked cash flexibility lost investment opportunities (Arslan-Ayaydin et al., 2014; Zingales, 1998).

Most research on corporate cash flexibility and investment behavior has been based on the impact of financial crises and other events. As the COVID-19 outbreak resulted in adverse demand and supply side external shocks, it provides an ideal setting for the use of propensity score matching (PSM) and difference-in-differences (DID) methods to explore the role of cash flexibility in preventing uncertainty risk. Several studies have explored the short-term impact of the COVID-19 on global stock market values and cumulative abnormal returns, finding that the pandemic had made it more difficult for firms to raise funds from the capital market (Costola, Iacopini, & Santagiustina, 2020); however, COVID-19’s impact on corporate cash flow has been largely overlooked.

![Fig. 1. Year-on-year growth rate in fixed assets investments (excluding farmers).](image-url)
Therefore, this study seeks to fill the gap and makes three important contributions. First, it enriches the literature on the firm impact of COVID-19 and provides empirical evidence. The burgeoning literature on the firm impacts of COVID-19 has mainly focused on the short-term stock market responses using event study methods (Narayan, 2020). Therefore, unlike most of the recent literature, this study examined the impact of COVID-19 on firm cash flows, combined the latest quarterly financial reports from Chinese A-share listed firms and compared first quarter, 2020, and fourth quarter, 2019, data to quantitatively analyze the COVID-19 impact on corporate investment expenditure. Based on 3,326 A-share listed firms’ quarterly financial reports, the empirical results show that the outbreak reduced firms’ investment expenditures, and find this negative relationship is more pronounced in the large, eastern Chinese state-owned firms. As the COVID–19 pandemic is expected to have an impact for a longer time, research on its effects on corporate cash flows and the possible financial risks could be of significant value. Therefore, this paper contributes to existing research on the COVID-19 pandemic and enriches research on firm heterogeneity in the context of the pandemic.

Second, this study supplements existing literature on the value of financial flexibility. Prior studies confirmed that financial flexibility could improve core competitiveness, and was conducive to the optimal allocation of financial resources and the effective management of financial risk; however, there has been little research on the advantages of financial flexibility in an external crisis, with research on crisis resistance being mostly related to the impacts of financial turmoil. This paper used a PSM-DID method to study the role of corporate cash flexibility in responding to adverse external shocks from public health issues. Taking corporate cash flexibility as the entry point and proving the importance of cash flexibility in public health crisis periods, this paper supplements research on the buffer role played by corporate financial flexibility during such crises.

Third and last, our results can provide certain guidance for firms and government on how to relieve business operation and investment pressure during the COVID-19 pandemic. As the firm’s daily operations are blocked at the time of the crisis, there is a risk of breaking the cash chain, thus profitable investment opportunities may be missed. Therefore, firms should pay more attention to the management of cash reserves and establish reasonable cash flexibility. As the substantial deterioration of firm financing environment and substantial declines in firm financing capacities would last for a long time during the pandemic, the related authorities should also take corresponding measures to support firms with less cash flexibility but holding important position in supply chains to alleviate the negative impacts caused by external shocks.

The remainder of this paper is structured as follows. Section 2 discusses the related theoretical and empirical literature on business crises, cash flexibility, and corporate investment expenditure, and presents the hypotheses, Section 3 outlines the data and methodology, Section 4 discusses the empirical findings, and Section 5 concludes by discussing the possible implications of the results.

2. Literature review and hypotheses

2.1. Impact of COVID-19 on corporate investment expenditure

Cash is an asset expression of corporate capital (wealth) and is equivalent to the blood of a firm. The cyclical movement of cash is the basic premise for firm survival, as well as a key method for realizing capital appreciation (Ferreira, Custodio, & Raposo, 2005; Opler et al., 1997). Cash flow has two sources: external funds from customer sales, and internal funds from shareholders and creditors. Adverse external shocks usually affect a firm’s business operations, financing, and investment links and can result in reductions in the external funds obtained from sales and services operating income. Financial crises and other events that affect China’s macroeconomic situation can also result in severe external financing constraints for firms, which makes it more difficult for them to obtain internal funds (Xin, Dasgupta, Wong, & Yao, 2012).

The uncertainty generated by the COVID-19 outbreak has significantly affected firm cash flows, has made it difficult for many to continue business activities, and has limited their short-term collection capacities. The global stock market has been turbulent, with investor confidence initially declining (Huo & Qiu, 2020). Because financing channels became blocked, many firms were faced with liquidity losses when their operating income was difficult to obtain. For example, Vito and Gomez (2020) studied how the COVID-19 health crisis affected the liquidity of listed firms across 26 countries, and found that it could cause about one-tenth of the firms in the sample to become illiquid within six months. In the worst-case scenario, the average firm with partial operating flexibility was found to exhaust their cash holdings in about two years. Goodell (2020) evaluated the possible direct and indirect impacts of COVID-19 on financial markets and financial institutions, and concluded that it had caused unprecedented damage to the global economy and that the negative impacts were continuous and were expected to affect long-term corporate financing costs. The COVID-19 crisis has constrained both internal and external financing, which has in turn changed investment, financing and dividend distribution behavior (Campello et al., 2010, 2011). Investments in long-term (fixed) and short-term assets are important uses of corporate cash, with investment decisions being the main driving force behind firm growth. Therefore, investment is an important basis for future cash flow growth, profitability, reductions in operating risks, and future development prospects (Ferreira et al., 2005; Myers & Majluf, 1984). During the COVID-19 outbreak, investment activities have been blocked because of the tightening of cash flows; therefore, the following hypothesis is proposed:

Hypothesis 1. The COVID-19 outbreak is causing a significant decline in firm investment.
Firms with different characteristics were differently affected by the pandemic, with small and medium-sized private enterprises with a weaker ability to withstand risks being more affected and large state-owned firms having a greater corporate social responsibility and a greater negative corporate investment impact. National public policy officially recognized the environment, employees, and consumers to be significant for business stakeholders (Carroll, 1991), with state-owned firms and large-sized firms having to assume greater social responsibilities for both economic and non-economic goals (Xu & Zou, 2011) during the critical period of the pandemic by reducing business investment projects related to enterprise business operations and development. Geographical distribution studies have examined how regional factors such as open-door policies, special economic zones, financial development, high-quality human capital, and infrastructure development have contributed to economic growth and corporate investment (Ashoka & Fang-Yi, 1997; Li, 2014). As the more developed and open region in China, eastern China has a higher level of openness, financialization, and marketization compared with the central and western regions. Faced with the international economic shutdowns caused by the COVID-19 curtailment measures, it was expected that the firms located in eastern China could be more greatly impacted. To verify the moderating effect of firm heterogeneity on corporate investment expenditure after the COVID-19 outbreak, the following hypothesis is proposed:

**Hypothesis 2.** The negative impacts of the COVID-19 curtailment measures on corporate investment expenditures varies due to differences in ownership structure, firm size and geographical location.

2.2. Cash flexibility and investment expenditure

Financial flexibility reveals a firm's internal financial comprehensive ability, and as a long-term mechanism, provides for the optimal allocation of financial resources and the effective management of financial risks, such as its buffering ability (Buzacott, 1982), adaptability (Bulan & Subramanian, 2008), and coordination.

There are two main types of corporate financial flexibility: cash flexibility and debt flexibility. Cash flexibility is the availability of excess cash holdings and debt flexibility is a firm's residual debt capacity, with the cash holdings in particular being recognized as the main source of corporate financial flexibility (Arslan-Ayaydin et al., 2014; Bonaime, Hankins, & Harford, 2014; Byoun, 2011). Therefore, this paper focuses on the buffering effect of cash flexibility during the outbreak under the assumption that cash-flexible reserves can serve as a buffering mechanism for firms facing uncertainty.

Cash holdings can mitigate the negative impact of policy uncertainty on a firm's economic activities (Duong, Nguyen, Nguyen, & Rhee, 2020). When there is policy uncertainty, firms tend to hold more cash to mitigate the negative impacts on capital investment and innovation. Research has found that in addition to preventive savings, speculation can increase a firm's non-monetary financial asset holdings (Huang, Luo, & Peng, 2019). When financing becomes difficult, internal cash flows then become the main source for corporate funds and can effectively alleviate the lack of investment due to financing difficulties and/or restrictions (Kaplan & Zingales, 1995).

Zeng et al. (2011) examined the exogenous shocks resulting from the 2008 global financial crisis, and concluded that because high-cash-flexible firms adhered to a high cash holding financial policies before the crisis, they had more cash reserves when the crisis came and were therefore better able than the control group to directly use their cash reserves for their investment activities. Qianxi (2016) examined firm excess cash holdings and cash flexibility reserves, and found that the negative impact of financing constraints on investment activities was weakened when firms had large excess cash holdings. Yung, Li, and Jian (2015) analyzed firms in 33 emerging countries and found that corporate cash flexibility enhanced investment abilities, reduced the sensitivity of investments to cash flow, reduced equity payouts, and increased cash holdings, and during the 2008 financial crisis, cash flexibility increased firm value, with flexible firms suffering less from adverse external shocks and having smaller reductions in investment and equity expenditures.

In short, previous studies have found that reasonable cash holdings can assist firms in dealing with crises, with an appropriate level of cash flexibility being found to be an important condition for firm survival and sustainable growth. When a firm has insufficient cash inflows, it can call on its cash reserves to ensure normal daily operations and take advantage of future investment opportunities.

Based on previous studies, the Chinese A listed firm sample was divided into two groups based on their cash flexibility: a research group (high cash flexibility), and a control group (low cash flexibility); for which the following hypothesis is proposed:

**Hypothesis 3.** High-cash-flexibility reduces the adverse effect on corporate investment activities during a crisis.

3. Data and variables

3.1. Data

Based on the availability and comparability of financial data, the first quarter of 2020 and the last quarter of 2019 were selected for the comparative analysis of the Chinese A-share firms listed on the Shanghai and Shenzhen stock markets. The main analysis variable was cash flexibility, with its relevant indicators and data collected from the China stock market &
accounting research (CSMAR) database. Other firm-level data: financial ratios, firm characteristics, and governance structures were then matched and merged from their financial reports in the CSMAR database.

3.2. Variables

3.2.1. Definition of a cash-flexible firm

Financial flexibility has been defined as the ability of firms to acquire and transfer internal and external funds through appropriate financial policy arrangements (DeAngelo & DeAngelo, 2007; Ma, 2010), with cash flexibility being the ability of a firm to transfer its cash reserves. The financing priority theory proposed by Myers and Majluf (1984) states that firms holding large amounts of cash can effectively avoid issuing stocks to raise funds when stock prices are undervalued, can assist firms take advantage of favorable investment opportunities, and assist them in avoiding major financial difficulties. At the same time, existing research also has found that both opportunities and crises coexist. If a firm can access sufficient funds when valuable investment opportunities arise, they can increase their corporate value, which indicates that cash flexibility is vital for firm development (DeAngelo & DeAngelo, 2007; Zeng et al., 2011). Therefore, research has confirmed that financial flexibility through excess cash holdings and low debt ratios is beneficial when external funds are unavailable or the borrowing costs are high (Ma, 2010).

In short, firms with high cash flexibility can make more use of cash reserves to provide funds for their investment activities during crises. Existing research on cash flexibility has mainly focused on quantitative dimensions and the cash resources firms may need to acquire or use in the future (Zeng & Wei, 2013). Therefore, a cash-flexible firm in this paper is based on the definition of Zeng et al. (2011), that is, firms with cash flexibility in the highest 30% of all firms are classified as financially flexible. To examine the continuity in a firm’s financial management policies, those with high cash flexibility in the last three years before the outbreak of COVID-19 (2017–2019) were defined as being cash flexible. The specific cash flexibility calculation index was the firm cash holding ratio, which was calculated as:

\[
\text{Cash Holding Ratio} = \frac{\text{monetary capital at the end of the period} + \text{short–term investment at the end of the period}}{\text{total assets at the end of the period}}
\]

Then, compared with the average industry level, cash flexibility was calculated as:

\[
\text{Cash Flexibility} = \frac{\text{firm cash holding rate} - \text{industry average cash holding rate}}{\text{industry average cash holding rate}}
\]

If a firm’s cash flexibility in the three years before the outbreak fell into the highest 30% of the sample firms, it was classified as a high-cash-flexibility firm, with all other firms in the sample put into the control group and classified as low-cash-flexibility firms. Based on these criteria, 456 of the 3,326 firms in the sample were classified as high-cash-flexibility firms.

3.2.2. Dependent variable

High-cash-flexibility firms can more effectively use cash reserves to provide funds for their investment activities during a crisis. The dependent variable used in this paper is firm investment expenditure, which was calculated as follows:

\[
\text{Investment Expenditure} = \frac{\text{current capital expenditure of the firm}}{\text{total assets of the previous period}}
\]

Of which,

\[
\text{Capital Expenditure} = \text{cash paid for the acquisition and construction of fixed, intangible and other long} \\
- \text{term assets} - \text{net cash recovered from the disposal of fixed, intangible and other long} \\
- \text{term assets}
\]

To increase data comparability, the dependent variable was processed and divided by the sample mean.

3.2.3. Control variables

In reference to previous studies on cash flexibility and investment expenditure (Zeng & Wei, 2013; Zeng et al., 2011), the control variables used in this paper were the firm level financial and corporate governance data. Table 1 gives the definitions and data sources for the variables, and Table 2 gives the descriptive statistics.

4. Empirical results

4.1. Baseline estimate

Model (1) was designed to test the impact of the COVID-19 outbreak on firm investment expenditure, where Invest<sub>t</sub> was the investment expenditure of listed firm i in t period and Post was a dummy variable that took a value of 1 when t was the first quarter, and 0 otherwise. The firm-level control variables included TobinQ, Size, Cflow, Roa, Roe, Debt, Rein, Inde and Dual.
Table 1

Variable descriptions.

| Variables | Measures | Sources |
|-----------|----------|---------|
| Invest    | Investment expenditure in the current quarter / total assets of the previous period | Author |
| TobinQ    | Market value / net assets | CSMAR |
| Size      | Logarithm of book assets | CSMAR |
| Cflow     | Net cash flow from operating activities divided by sample mean | CSMAR |
| Roe       | Ratio of total net profit to average assets | CSMAR |
| Debt      | Asset liability ratio. Ratio of total liabilities divided by total assets | CSMAR |
| Rein      | Cash reinvestment ratio= (net cash flow from operating activities + cash dividend + interest expense) / (original value of fixed assets - foreign investment - other assets - working capital). This indicator shows how much cash a firm has available for asset renewal and firm development. | CSMAR |
| Inde      | Proportion of independent directors. Ratio of independent directors to number of directors | CSMAR |
| Dual      | 1 - if the chair and general manager are the same person; otherwise 0 | CSMAR |
| SOE       | The nature of the ownership structure: 1 - if the largest shareholder is state-owned; otherwise 0 | CSMAR |

Table 2

Sample descriptive statistics.

| Variable | N    | Mean  | Std Dev | Min  | Max  |
|----------|------|-------|---------|------|------|
| Invest   | 6,652| 1.115 | 10.71   | -11.16 | 704.3 |
| TobinQ   | 6,638| 1.945 | 1.896   | 0.621 | 41.97 |
| Size     | 6,638| 22.92 | 1.338   | 20.55 | 31.08 |
| Cflow    | 6,652| 20.53 | 1822    | -47998 | 119164 |
| Roe      | 6,652| 0.00497 | 0.410   | -30.85 | 4.707 |
| Debt     | 6,597| 0.462 | 0.793   | -31.27 | 41.33 |
| Rein     | 6,520| 0.0441 | 0.978   | 0.00680 | 31.83 |
| Inde     | 6,508| 0.379 | 0.0569  | 0.250 | 0.800 |
| Dual     | 6,508| 0.303 | 0.460   | 0    | 1    |

To account for the potential time-specific shocks and any unobservable industry shocks, time and industry fixed effects were also included, with $\epsilon_{it}$ being the random error term.

$$Invest_{it} = \gamma_0 + \gamma_1 Post_{it} + \sum \gamma_j Control_{it} + \epsilon_{it}$$  \hspace{1cm} (1)

Table 3 shows the baseline estimation results for the impact of COVID-19 on corporate investment expenditure. The $Post_t$ coefficient was found to be significantly negative at the 1% level, indicating that the investment expenditure in the Chinese A-listed firms was significantly reduced after the outbreak, which was consistent with Hypothesis 1. This result shows the negative impact of crisis on the internal and external financing, investment and dividend distribution behavior of firms (Campello et al., 2010, 2011), and from the perspective of domestic investment status, this is also in line with the current situation where both the growth rate of manufacturing investment and the growth rate of private investment have fallen sharply during the COVID-19 in China. To limit the virus spread, population movements were strictly curbed, which affected the real estate, infrastructure, and manufacturing sectors. Investment is the key to stable national growth, especially when the economy is under downward pressure, but the investment expansion was hindered by the outbreak containment measures.

4.2. Moderating effects of firm-level characteristics

Firm-level characteristics affect investment behavior. This section examines the moderating effect of firm heterogeneity on corporate investment after the COVID-19 outbreak.

Model (2) explored the impact of the COVID-19 outbreak on firm investment under different firm characteristics: ownership structures (SOE/Non-SOE), firm size (Large/SMEs), and geographical location (Eastern/Western).

$$Invest_{it} = \gamma_0 + \gamma_1 Post_{it} \times firm_{it} + \sum \gamma_j Control_{it} + \epsilon_{it}$$  \hspace{1cm} (2)

where $Post$ was a dummy variable that took a value of 1 when $t$ was the first quarter, and 0 otherwise, $firm_{it}$ was the firm characteristics, industry fixed effects were included, and the control variables were the same as in Model (1).
4.2.1. Moderating effect of ownership structure on investment expenditure after the outbreak

Column (1) in Table 4 shows the regression results for the moderating effect of ownership structure on investment expenditure after the outbreak, from which it can be seen that the coefficient for the crossover term SOE*Post in column (1) was significantly negative, indicating that COVID-19 had a strong impact on the SOE investment behaviors.

During the fight against COVID-19, the SOEs actively fulfilled their corporate social responsibility, which included the construction of the Huoshenshan hospital and other emergency projects, and the guaranteeing of the supply of emergency materials and services, such as coal, electricity, oil and gas, communication, and transportation. Therefore, the Chinese SOEs play a significant role in ensuring the supply of urban necessities and protecting people’s livelihoods. Due to their low production conversion efficiency and poor market sensitivity, compared to private firms, SOEs reduced their investment spending during the COVID-19 outbreak (Wang Yong & Haidong, 2013). Further, as they had to fulfill their social responsibilities and because of government intervention, the competitive effect of their cash holdings was weakened, further reducing SOE investments (Yu Minggui, 2008).

4.2.2. Moderating effect of firm size on investment expenditure after the COVID-19 outbreak

Firm size also affects firm investment behavior. To provide in-depth insights into these effects, the firms in the sample were classified as either large or small and medium-sized enterprises (SMEs)\(^2\) and the Model (2) results re-examined. Model (2) was designed to explore the COVID-19 outbreak impact on the investment in firms of different sizes. The coefficient for the crossover term Large*Post in column (2) in Table 4 was significantly negative, which indicates that the COVID-19 impact on firm investment behavior was stronger for large firms.

This finding was not consistent with prior research, which found that when faced with adverse external shocks, SMEs with weaker anti-risk abilities suffer from greater short term impacts, greater financing constraints, and higher financing costs than larger firms (Min, 2015). Myers and Majluf (1984) pointed out that firms with investment opportunities that outstrip their operating cash flows and which have used up their ability to issue low-risk debt, may forego good investments rather than issue risky securities to finance them. Therefore, SMEs can demonstrate greater investment flexibility and sensitivity during crises. One possible explanation is that although the anti-risk ability of large enterprises is stronger, the drop in the number of orders, insufficient available personnel, excessive fixed cost burdens, supply chain interruptions, and the associated credit and debt risks generated by the pandemic could have caused difficulties for large firms. As COVID-19 hindered progress on planned new investment projects and ongoing project construction, the outbreak had a greater impact.

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\(^2\) We base this classification on the “Large, Medium, Small and Micro Enterprises Classification Method” (2017) criteria available at [http://www.stats.gov.cn/tjgz/tzgb/201801/t201801031569254.html](http://www.stats.gov.cn/tjgz/tzgb/201801/t201801031569254.html).

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**Table 3**
Baseline estimation results: COVID-19 and investment.

| VARIABLES | (1) Invest |
|-----------|------------|
| Post      | -1.331***  |
|           | (0.187)    |
| TobinQ    | -0.112*    |
|           | (0.057)    |
| Size      | 2.083***   |
|           | (0.423)    |
| Cflow     | 0.002      |
|           | (0.005)    |
| Roa       | -2.100*    |
|           | (1.132)    |
| Debt      | -1.731**   |
|           | (0.769)    |
| Rein      | 0.260      |
|           | (0.254)    |
| Inde      | 7.654      |
|           | (5.269)    |
| Dual      | 0.688*     |
|           | (0.365)    |
| Constant  | -48.06***  |
|           | (10.940)   |
| IndustryDum | Yes       |
| SeasonDum | Yes        |
| Observations | 6319     |
| R-squared | 0.241      |

Robust standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.
on large firms that had global investment ambitions. In addition, many large firms were expected to shoulder major social responsibilities by resuming production and leading economic growth, which may have made them more cautious in their investment behaviors.

4.2.3. Moderating effect of geographical location on investment expenditure after the COVID-19 outbreak

To confirm the impact of the regional differences on the investment behavior of firms during the epidemic, the sample firms were divided into eastern and central and western firms according to the province in which they were registered. Model (2) was designed to explore the impact of COVID-19 on firm investment expenditures by geographical location.

Column (3) in Table 4 shows the regression results. The coefficient for the crossover term Eastern*Post was significantly negative, confirming that COVID-19 had a greater impact on the investment behaviors of the eastern Chinese firms. The differences in location advantage, resource advantage, and economic development between the eastern and central and western regions of China inevitably led to varied levels of economic development (Shen Yufang, 2000). The reform and opening up process means that marketization varies between the eastern and central and western regions (Cai Fang, 2000), with the eastern region as a whole having higher levels of economic development and marketization, better industrial structures, greater economic efficiencies, and a higher degree of firm extroversion. However, because of the non-synchronization of the economic development between the eastern and the central and western regions, even though the eastern areas have more strategic resources such as capital and technology, they may have been more sensitive to the crisis because of their higher marketization and firm extroversion degrees. Previous adverse external shocks such as the 2008 financial crisis and SARS had a relatively large direct impact on the economic development in the eastern region, and the global pandemic affected the export-oriented economy of both the upstream and downstream firms, which has had a more negative impact on firm investment spending.

Table 4
Moderating effect of firm-level characteristics on investment expenditure after the COVID-19 outbreak.

| VARIABLES | (1) SOE and Non-SOE Invest | (2) Large and SMEs Invest | (3) Eastern, Central and Western Invest |
|-----------|-----------------------------|---------------------------|---------------------------------------|
| SOE       | 3.281**                     |                           |                                       |
| SOE*Post  | −4.285***                   |                           |                                       |
| Large     | −0.875**                    | −0.539**                  | −1.289***                             |
| Large*Post| −1.159***                   | (0.239)                   |                                       |
| East      | 3.296*                      |                           |                                       |
| East*Post | −1.993*                     |                           |                                       |
| Post      | −0.005***                   | −0.539**                  | −1.289***                             |
| TobinQ    | −0.111*                     | −0.171**                  | 0.029                                 |
| Size      | 2.021***                    | 2.292***                  | 3.859***                              |
| Cflow     | 0.002                       |                           |                                       |
| Roa       | −2.189***                   | −2.129*                   | −7.007                                |
| Roe       | 0.208*                      | 0.236**                   | 1.025*                                |
| Debt      | −1.718**                    | −1.459**                  | (5.403)                               |
| Reinf     | −0.261                      | 0.255                     | 0.635                                 |
| Inde      | 7.516                       | 6.947                     | 21.100                                |
| Dual      | 0.742*                      | 0.649*                    | 2.131                                 |
| Constant  | −47.13***                   | −51.62***                 | −96.87***                             |
| IndustryDum | Yes                      | Yes                      |                                       |
| SeasonDum | Yes                        | Yes                      |                                       |
| Observations | 6.319                    | 6.319                     | 1.276                                 |
| R-squared | 0.246                       | 0.244                     | 0.419                                 |

Robust standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.
4.3. Role of cash flexibility

4.3.1. DID (difference-in-differences) estimate

DID estimation was used to investigate the role of cash flexibility during the adverse external shock period. Due to the significant heterogeneity in the sample, PSM was first used to select a group of “non-high-cash-flexibility firms” with “as similar as possible” characteristics as the processing group.

The natural experiment DID evaluation method can be used to compare the effects of a measure or policy before and after implementation, and can effectively separate “time effects” from “policy processing effects.” Therefore, to effectively eliminate the impact of other factors on the explained variables and to ensure that only the impact of the event itself was evaluated, a DID model was employed to estimate the differences in investment expenditures before and after the COVID-19 outbreak. For this “quasi-natural experiment”, COVID-19 was taken as a completely exogenous shock to evaluate its impact, with the “high-cash-flexible firms” being the treatment group (Treated = 1) and the “low-cash-flexible firms” (Treated = 0) being the control group. The quarter in which the virus broke out was Post = 1 (the first quarter of 2020), otherwise Post = 0 (the fourth quarter of 2019). The multivariate DID model was therefore set as follows:

\[
\text{Invest}_{it} = \alpha_0 + \alpha_1 \text{Treated}_{it} + \alpha_2 \text{Post}_{it} + \alpha_3 \text{Treated}_{it} \times \text{Post}_{it} + \alpha_4 \text{Controls}_{it} + C_i + C_t + \epsilon_{it}
\]  

(3)

where \(\text{Invest}_{it}\) was the investment expenditure of listed firm \(i\) in \(t\) period. \(\text{Post}, \text{Treat},\) was the cross term for \(\text{Post}\) and \(\text{Treat},\) where \(\text{Post}\) was a dummy variable that specified whether season \(t\) was before or after the COVID-19 outbreak, and \(\text{Treat}\) was another dummy variable. The coefficient for the \(\text{Post}, \text{Treat}\), reflected the investment differences before and after COVID-19 between the treated and control groups. The firm-level control variables included \(\text{TobinQ}, \text{Size}, \text{Cflow}, \text{Roa}, \text{Roe}, \text{Debt}, \text{Rein}, \text{Inde}\) and \(\text{Dual}\). To account for the potential time-specific shocks and any unobservable industry shocks, time and industry fixed effects were also included, and \(\epsilon_{it}\) was the random error term.

Columns (1) and (2) in Table 5 report the estimation results from Model (3). The coefficients for \(\text{Post}, \text{Treated}\), were all significantly positive at the 1% level, which indicated that the investment by the treated group significantly increased after the outbreak. This confirmed that cash flexibility was a buffer mechanism against external shocks and allowed for the maintenance of normal business activities when faced with finance constraints. During a crisis, the investments by firms with cash flexibility are less affected by uncertainty as the effective use of cash reserves can provide the necessary support for

| VARIABLES | (1) Before PSM | (2) | Invest | Invest |
|-----------|---------------|-----|--------|--------|
| Treated   | -0.872***     | -0.892*** |
|           | (0.242)       | (0.235) |
| Treated*Post | 0.990*** | 1.047*** |
|           | (0.233)       | (0.319) |
| Post      | -1.459***     | -1.472*** |
|           | (0.192)       | (0.195) |
| TobinQ    | -0.0918*      | -0.107* |
|           | (0.050)       | (0.057) |
| Size      | 2.036***      | 2.084*** |
|           | (0.405)       | (0.423) |
| Cflow     | 0.002         | 0.002 |
|           | (0.005)       | (0.005) |
| Roa       | -1.834*       | -1.879* |
|           | (1.062)       | (1.078) |
| Roe       | 0.183**       | 0.196** |
|           | (0.091)       | (0.097) |
| Debt      | -1.877***     | -1.873*** |
|           | (0.787)       | (0.787) |
| Rein      | 0.260         | 0.261 |
|           | (0.252)       | (0.255) |
| Inde      | 7.654         | (5.270) |
|           |               | (0.365) |
| Dual      | 0.686*        | 0.686* |
|           |               | (0.365) |
| Constant  | -44.00***     | -47.93*** |
|           | (8.790)       | (10.910) |
| IndustryDum | Yes         | Yes |
| SeasonDum | Yes          | Yes |
| Observations | 6.458    | 6.319 |
| R-squared | 0.239         | 0.242 |

Robust standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1
a firm’s investment behavior and maintain investment levels. These findings were consistent with the research conclusions in previous studies (Arslan, Florackis, & Ozkan, 2006; Lian Yujun & Zhi, 2010), which found that when faced with finance constraints, firms were able to maintain high liquidity by using their cash holdings to increase the value of their future investment options. These findings were also in line with our expectations that firms with larger cash reserves had higher cash flexibility and a better ability to undertake investment when internal operations were blocked and external finance was difficult to obtain (Acharya, Almeida, & Campello, 2007; Heitor, Murillo, & Weisbach, 2003). This also shows that the precautionary motive for corporate cash holdings becomes vital important to protect firms against adverse external crisis.

4.3.2. Propensity score matching (PSM)

Because listed firms have many different characteristics, to ensure there were no significant differences between the treated and control groups, to mitigate the impact of these endogenous problems and study the net effect of firm resistance to external COVID-19 shocks on investment, a matched group of domestic firms was selected for each high-cash-flexibility firm using the PSM algorithm, after which a DID test was conducted. Before the PSM treatment, a probit model based on all sample firm average data was first estimated using the following equation:

$$\text{Probit}(\text{Cash}_t) = \beta_0 + \beta_1 \text{MV}_t + \epsilon_t$$

where $\text{Cash}_t$ was a dummy variable representing whether the firms are with high cash flexibility, and if it equals to 1, it means that these firms can make more use of cash reserves to provide funds for their investment activities during crises, and $\text{MV}_t$ was the vector for the characteristics that could affect a firm’s cash flexibility: value of firm (TobinQ), firm size (Size), cash flow (Cflow), net profit rate of total assets (Roa), return on net assets (Roe), asset liability ratio (Debt) and cash reinvestment ratio (Rein). Based on these variables, each treated group was matched using a 1:1 nearest-neighbor matching method; therefore, 456 listed firms with high cash flexibility comprised the treated group, and each treated firm was matched with a control counterpart. Then, the investment expenditure differences between the treated and control groups before and after the start of the epidemic were compared.

Table 6 reports the descriptive statistics for the key variables for the samples after the PSM (6,319 firm-season observations in total). Fig. 2 shows the kernel density functions, which more directly indicate that there were no significant differences between the treated and control groups after using PSM, which suggested that the matching process removed

![Fig. 2. Kernel density for the treated and control groups before and after PSM.](image-url)
Therefore, the control demonstrates the showing endogeneity. In 4.4.1. Hypothesis were that Jiang, Hou, and others (2019) showed that two-stage Heckman model, a method for addressing endogenous variables, was used to study the outbreak’s impact on investment (Heckman, 1979). In the first-stage model, the deposit balance at financial institutions at the end of the year (Deposit) in the province in which the firm was located was used as the exogenous instrument variable that affected firm cash-holding behaviors. Table 9 shows the results from the Heckman two-stage estimation, which after controlling for possible financial flexible reserve endogeneity, remained positive, and the results robust for the Post∗Treat coefficient.

4.4.4. Robustness checks

4.4.4.1. Heckman two stage

Although the PSM method eliminated the differences in the cash flexibility probability between the treatment and control groups due to endogenous factors, endogeneity concerns remained between financial flexibility and investment. Therefore, a Heckman two-stage estimation was employed to study the outbreak’s impact on investment (Heckman, 1979). In the first-stage model, the deposit balance at financial institutions at the end of the year (Deposit) in the province in which the firm was located was used as the exogenous instrument variable that affected firm cash-holding behaviors. Table 9 shows the results from the Heckman two-stage estimation, which after controlling for possible financial flexible reserve endogeneity, remained positive, and the results robust for the Post∗Treat coefficient.

4.4.4.2. Variable substitution

In Table 10, the logarithm of firm investment growth rate was used as an alternative measure for investment to examine the positive relationship between invest and Treated∗Post. The results were consistent with the main findings and supported Hypothesis 3.

4.4.4.3. Different PSM methods

In Table 11, different PSM methods were used to replace the 1:1 proximity PSM matching. The coefficients for Treated∗Post were still significantly positive in all three matching methods, indicating that the main results were robust.

## Table 7

Results for the parallel trend tests.

| VARIABLES     | (1) Invest |
|---------------|-----------|
| Before1       | 0.032     |
|               | (0.077)   |
| Current       | 0.097     |
|               | (0.089)   |
| After1        | −0.285*** |
|               | (0.064)   |
| TobinQ        | −0.0912***|
|               | (0.022)   |
| Size          | 0.629***  |
|               | (0.076)   |
| Cflow         | 0.001     |
|               | (0.001)   |
| Roa           | −0.648    |
|               | (1.575)   |
| Roe           | 0.853     |
|               | (0.856)   |
| Debt          | 0.267     |
|               | (0.225)   |
| Rein          | 0.007     |
|               | (0.049)   |
| Inde          | 0.495     |
|               | (0.843)   |
| Dual          | 0.184***  |
|               | (0.059)   |
| Constant      | −14.90*** |
|               | (1.869)   |
| IndustryDum   | Yes       |
| SeasonDum     | Yes       |
| Observations  | 4,188     |
| R-squared     | 0.268     |

Robust standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Notes: This table shows the results for the parallel-trend test. Due to the availability of quarterly financial reports, the main explanatory variables Before1, Current and After1 were all dummy variables and respectively represented one season before the outbreak of COVID-19, the COVID-19 outbreak, and one season after the COVID-19 outbreak.
4.4.4. Placebo test

A placebo test is an additional way to test the robustness and endogeneity of empirical results. To further verify the robustness of the empirical results, the time node of the COVID-19 outbreak was changed to test the real impact of the pandemic based on the DID estimation results. By advancing or delaying the virtual time node for the policy implementation (COVID-19 outbreak) and running the regression 500 times, the regression t value distribution at the virtual policy time point was obtained, as shown in Fig. 3. The estimated coefficient had an inverted U-shape with 0 as the axis symmetry, which indicated that the virtual policy impact had no treatment effect on the dependent variables, and that the original policy impact rather than the security placebo played a role. The robustness of the empirical results was therefore further verified.

![Placebo Test](image.png)

**Fig. 3.** Placebo Test.
Table 9
Robustness test: Heckman two stage.

| VARIABLES  | (1) Invest |          | (2) Growth Rate |          |
|------------|------------|----------|-----------------|----------|
| Deposit    | -0.888***  | (0.234)  | -0.08           | (0.108)  |
| Treated    | 1.028***   | (0.352)  |                 |          |
| Post*Treat | -1.491***  | (0.236)  |                 |          |
| lambda     | -10.09***  | (2.851)  |                 |          |
| TobinQ     | -0.342***  | (0.099)  |                 |          |
| Size       | 1.773***   | (0.345)  |                 |          |
| Cflow      | 0.002      | (0.005)  |                 |          |
| Roa        | -12.56***  | (3.815)  |                 |          |
| Roe        | 0.931***   | (0.267)  |                 |          |
| Debt       | 13.45***   | (3.706)  |                 |          |
| Rein       | 0.317      | (0.291)  |                 |          |
| Inde       | 9.315*     | (5.608)  |                 |          |
| Dual       | 1.320***   | (0.495)  |                 |          |
| Constant   | -30.33***  | (7.207)  |                 |          |
| IndustryDum| Yes        |          |                 |          |
| SeasonDum  | Yes        |          |                 |          |
| Observations | 6,319     |          |                 |          |
| R-squared  | 0.243      |          |                 |          |

Robust standard errors in parentheses*** p < 0.01, ** p < 0.05, * p < 0.1.

Table 10
Robustness test: investment substitution.

| VARIABLES  | (1) Invest |          | (2) Growth Rate |          |
|------------|------------|----------|-----------------|----------|
| Treated    | -0.424***  | (0.146)  |                 | (0.108)  |
| Treated*Post | 0.483***   | (0.138)  |                 | (0.021)  |
| Post       | -0.793***  | (0.139)  |                 | (0.044)  |
| TobinQ     | -0.0957*** | (0.022)  |                 | (0.036)  |
| Size       | 0.655***   | (0.084)  |                 | (0.056)  |
| Cflow      | 0.00398*** | (0.001)  |                 | (0.000)  |
| Roa        | -5.240*    | (2.842)  |                 | (2.302)  |
| Roe        | 2.815*     | (1.569)  |                 | 1.818    |
| Debt       | -0.118     | (0.234)  |                 | 0.611    |
| Rein       | -0.0353    | (0.072)  |                 | 0.117    |
| Inde       | 0.624      | (0.893)  |                 | 1.366    |
| Dual       | 0.178**    | (0.070)  |                 | 0.104    |

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Table 10 (Continued)

| VARIABLES        | (1) Invest | (2) Growth Rate |
|------------------|------------|-----------------|
| Constant         | -14.70***  | -7.960***       |
|                  | (1.947)    | (1.218)         |
| IndustryDum      | Yes        | Yes             |
| SeasonDum        | Yes        | Yes             |
| Observations     | 1,506      | 1,340           |
| R-squared        | 0.379      | 0.575           |

Robust standard errors in parentheses*** p < 0.01, ** p < 0.05, * p < 0.1.

Table 11

Robustness test: PSM methods.

| VARIABLES        | (1) 1: 1 Proximity Matching Invest | (2) Radius Matching Invest | (3) Nuclear Matching Invest |
|------------------|-----------------------------------|---------------------------|-----------------------------|
| Treated          | -0.424***                         | -0.864***                 | -0.891***                   |
|                  | (0.146)                           | (0.230)                   | (0.239)                     |
| Treated*Post     | 0.483***                          | 0.992***                  | 1.026***                    |
|                  | (0.138)                           | (0.303)                   | (0.315)                     |
| Post             | -0.793***                         | -1.421***                 | 1.467***                    |
|                  | (0.139)                           | (0.197)                   | (0.195)                     |
| TobinQ           | -0.0957***                        | -0.105*                   | -0.110*                     |
|                  | (0.022)                           | (0.059)                   | (0.057)                     |
| Size             | 0.655***                          | 2.133***                  | 2.120***                    |
|                  | (0.084)                           | (0.449)                   | (0.445)                     |
| Cflow            | 0.00398***                        | 0.002                     | 0.002                       |
|                  | (0.001)                           | (0.005)                   | (0.005)                     |
| Roe              | -5.240*                           | -3.637**                  | -2.031*                     |
|                  | (2.842)                           | (1.819)                   | (1.199)                     |
| Roe              | 2.815*                            | 0.173                     | 0.037                       |
|                  | (1.569)                           | (0.111)                   | (0.076)                     |
| Debt             | -0.118                            | -2.231**                  | -2.066**                    |
|                  | (0.234)                           | (0.926)                   | (0.873)                     |
| Rein             | -0.0353                           | 0.692                     | 0.256                       |
|                  | (0.072)                           | (0.537)                   | (0.253)                     |
| Inde             | 0.624                             | 7.822                     | 7.902                       |
|                  | (0.893)                           | (5.426)                   | (5.457)                     |
| Dual             | 0.178**                           | 0.697*                    | 0.687*                      |
|                  | (0.070)                           | (0.365)                   | (0.364)                     |
| Constant         | -14.70***                         | -49.01***                 | -48.76***                   |
|                  | (1.947)                           | (11.530)                  | (11.460)                    |
| IndustryDum      | Yes                               | Yes                        | Yes                         |
| SeasonDum        | Yes                               | Yes                        | Yes                         |
| Observations     | 1,506                             | 6,300                      | 6,314                       |
| R-squared        | 0.379                             | 0.243                      | 0.242                       |

Robust standard errors in parentheses*** p < 0.01, ** p < 0.05, * p < 0.1.

5. Conclusion

This paper examined the impact of the COVID-19 outbreak on Chinese firm investment in the first quarter of 2020, and found that the pandemic curtailment measures had significantly reduced investment, with this negative impact being more pronounced in the large, state-owned firms located in eastern China. With a focus on the advantages of financial flexibility, PSM and DID estimation were conducted, which found that during the outbreak, the investment by high-cash-flexibility firms significantly increased, which confirmed the supposition that cash flexibility serves as an effective buffer during crises and assists in providing funds for daily operations and investment. To account for possible endogeneity concerns, the Heckman two-stage estimation was used on the instrumental variables, from which the robustness of the results was proven. An alternative investment index, different PSM methods and a placebo test were also employed to further confirm the robustness of the main regression results.

The COVID-19 pandemic has had a significant impact on firm finances and investment activities, and has resulted in a sharp decrease in business income and profits, a shortage of cash flow, and a significant reduction in investment. Faced with external environment uncertainty, firms with cash reserves have an effective buffer to continue their business activities during crises and allow for the continuation of investment activities.
As the pandemic was brought under control in China, the domestic upstream and downstream industrial chains resumed operations. Firms with high cash reserves had shown strong resilience and have been able to continue with their original capital expenditure plans or even increase their capital expenditure. In general, the adverse impacts of the outbreak were short term and controllable.

Emerging infrastructure construction investments, such as 5G, artificial intelligence, and industrial internet, as well as the development of digital production, new service research, and office upgrading offer future investment opportunities. It was shown that during the initial stage of the pandemic crisis, firms that had high cash flexibility were not only able to resist the crisis, but had the confidence and ability to actively transform and develop for the future, which is particularly critical for firms seeking to maintain their competitiveness in the aftermath of the pandemic. Firms should therefore, reasonably arrange its flexible cash reserve, establish effective risk prevention mechanisms, improve their abilities to resist risks, and weaken the adverse effects of external uncertainty. The government should deepen financial supply-side structural reforms, provide more financing support to alleviate the lack of investment caused by external shocks, actively expand domestic consumer demand and adopt preferential policies to boost investor confidence.

Through empirical tests, this study revealed that cash flexibility based on high cash holdings could play a positive role in risk prevention during a crisis and emphasized the role of preventive cash holdings in corporate crisis periods. However, due to the limitations associated with data acquisition, the data time window was short. Although the buffering effect of cash flexibility based on high levels of cash holdings was verified as playing a positive role in mitigating risk during a crisis, excessive cash holdings can lead to insufficient investment and other issues. Future studies could consider the impact of corporate cash flexibility on firm investment behaviors by examining the over- and under-investment of listed firms during the COVID-19 crisis. Research with longer windows and wider perspectives such as financial constraints and cash flow sensitivities can be further developed in the future.

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References

Acharya, V. V., Almeida, H., & Campello, M. (2007). Is cash negative debt? A hedging perspective on corporate financial policies. *Journal of Financial Intermediation*, 16(4), 515–554.

Altman, E. I. (1988). Financial ratios, discriminant analysis and prediction of corporate bankruptcy. *The Journal of Finance*, 23(4), 589–609.

Arslan, Z., Florackis, C., & Ozkan, A. (2006). The role of cash holdings in reducing investment-cash flow sensitivity: Evidence from a financial crisis period in an emerging market. *Emerging Markets Review*, 7(4), 320–338.

Arslan-Ayaydin, Z., Florackis, C., & Ozkan, A. (2014). Financial flexibility, corporate investment and performance: Evidence from financial crises. *Review of Quantitative Finance and Accounting*, 42(2), 211–250.

Ashoka, M., & Fang-Yi, W. (1997). Explaining industrial growth in coastal China: Economic reforms . . . and what else? *The World Bank Economic Review*, 2, 2.

Bonaime, A. A., Hankins, K. W., & Harford, J. (2014). Financial flexibility, risk management, and payout choice. *Social Science Electronic Publishing*, 27(4), 1074–1101.

Bulan, L., & Subramanian, N. (2008). A closer look at dividend omissions: Payout policy, investment and financial flexibility. *SSRN Electronic Journal*. http://dx.doi.org/10.2139/ssrn.1335854.

Buzaconty, J. A. (1982). The fundamental principles of flexibility in manufacturing systems. *Proceedings of the First International Congress on Flexible Manufacturing Systems*. 15–22. 1982.

Byoun, S. (2011). Financial flexibility and capital structure decision. *SSRN Electronic Journal*. http://dx.doi.org/10.2139/ssrn.1108850.

Cai Fang, D. Y. (2000). Convergence and difference of regional economic growth in China: Implications for western development strategy. *Economic Research, China*, 10, 30–37.

Campello, M., Graham, J. R., & Harvey, C. R. (2010). The real effects of financial constraints: Evidence from a financial crisis. *Journal of Financial Economics*, 97(3), 478–487.

Campello, M., Giambona, E., Graham, J. R., & Harvey, C. R. (2011). Liquidity management and corporate investment during a financial crisis. *The Review of Financial Studies*, 6, 1944–1979.

Carroll, A. B. (1991). The pyramid of CSR - toward the moral management of organizational stakeholders. *Business Horizons*, 34(4), 48.

Costola, M., Iacopini, M., & Santanguitia, C. (2020). Public concern and the financial markets during the COVID-19 outbreak. *Social Science Electronic Publishing*. http://dx.doi.org/10.2139/ssrn.3591193.

DeAngelo, H., & DeAngelo, L. (2007). Capital structure, payout policy, and financial flexibility. *SSRN Electronic Journal*. http://dx.doi.org/10.2139/ssrn.916093.

Duong, H. N., Nguyen, J. H., Nguyen, M., & Rhee, S. G. (2020). Navigating through economic policy uncertainty: The role of corporate cash holdings. *Journal of Corporate Finance*, 62. http://dx.doi.org/10.1016/j.jcorpfin.2020.101607.

Ferreira, M., Custodio, C., & Raposo, C. (2005). Cash holdings and business conditions. *SSRN Electronic Journal*. http://dx.doi.org/10.2139/ssrn.608664.

Gh Jia, Z. M. (2008). Liquidity, financial adaptability, expected net cash inflow, profitability and market risk. *Accounting Research*, 5, 3–9.

Goodell, J. (2020). COVID-19 and finance: Agendas for future research. *Finance Research Letters*, 35, 101512. http://dx.doi.org/10.1016/j.frl.2020.101512.

Heckman, J. J. (1979). Sample selection Bias specification error. *Econometrica*, 47(1).

Heitor, A., Murillo, C., & Weisbach, M. S. (2003). The cash flow sensitivity of cash. *SSRN Electronic Journal*. http://dx.doi.org/10.2139/ssrn.345840.

Huang, J., Luo, Y., & Peng, Y. (2019). Corporate Financial Asset Holdings Under Economic Policy Uncertainty: Precautionary Saving or Speculating? *SSRN Electronic Journal*. http://dx.doi.org/10.2139/ssrn.3375314.

Huo, X., & Qiu, Z. (2020). How does China’s Stock Market React to The Announcement of The COVID-19 Pandemic Lockdown? *Economic and Political Studies*, 8, 1–26. http://dx.doi.org/10.1080/20954816.2020.178069.

Kaplan, S. N., & Zingales, L. (1995). Do Financing Constraints Explain Why Investment is Correlated with Cash Flow? *NBER Working Papers*, 112(1), 5267.

Keynes, J. M. (1936). The general theory of employment, interest and money. *Linnmology and Oceanography*, 12(1–2), 26–36.

Li, C. (2014). Financial development, investment efficiency and corporate performance. *Economic Science*, 4, 80–92.

Lian Yujun, P. F., & Zhi, S. (2010). Financing constraints and liquidity management behavior. *Financial Research*, 10, 162–175.

Liu, H., Manzoor, A., Wang, C., Zhang, L., & Manzoor, Z. (2020a). The COVID-19 Outbreak and Affected Countries Stock Markets Response. *International Journal of Environmental Research and Public Health*, 17(8), 2800. http://dx.doi.org/10.3390/ijerph17082800.
Liu, H., Wang, Y., He, D., & Wang, C. (2020b). Short term response of Chinese stock markets to the outbreak of COVID-19. *Applied Economics, 52*(3), 1–14. http://dx.doi.org/10.1080/00036846.2020.1776837.

Ma, C. (2010). Design and empirical analysis of corporate financial flexibility index. *Systems Engineering, 10*(28), 61–66.

Min, S. (2015). Financing model analysis of SMEs based on supply chain finance. *Science and Technology Economic Market, 4*, 26–27.

Myers, S. C., & Majul, N. S. (1984). Corporate financing decisions when firms have information investors do not have. *Journal of Financial Economics, 13*(2), 187–221.

Narayan, P. (2020). Oil price news and COVID-19–Is there any connection? *Energy Research Letters*. http://dx.doi.org/10.46557/001c.13176.

Opler, T., Pinkowitz, L., Stulz, R., & Williamson, R. (1997). The determinants and implications of corporate cash holdings. *Nber Working Papers, 52*(1), 3–46.

Qianxi, Y. (2016). Financial flexibility, free cash flow and underinvestment: Empirical evidence from Chinese listed companies. *Journal of Hehai University, Philosophy and Social Sciences, 18*(4), 49–57.

Reisz, A., & Perlich, C. (2007). A market-based framework for bankruptcy prediction. *Journal of Financial Stability, 3*, 85–131. http://dx.doi.org/10.1016/j.jfs.2007.02.001.

Shen Yufang, L. Y. (2000). The current situation, problems and countermeasures of economic development imbalance in the eastern, middle and western regions of the Yangtze River Economic Belt. *World Geographic Research, 2*, 23–30.

Vito, A., & Gomez, J. (2020). Estimating the COVID-19 cash crunch: Global evidence and policy. *SSRN Electronic Journal*. http://dx.doi.org/10.2139/ssrn.3560612.

Wang Yong, L. Z., & Haidong, Z. (2013). Government intervention and market competitiveness of local state-owned enterprises: Based on the competitive effect of cash holdings. *Economic and Management Research, 8*, 30–40.

Wu, S., & Lu, X. (2001). A study of models for predicting financial distress in China’s listed companies. *Economic Research Journal, 6*, 46–55.

Xin, C., Dasgupta, S., Wong, C., & Voo, J. (2012). How do firms allocate internal cash flow? The effect of misvaluation and costly external financing. *Social Science Electronic Publishing*. http://dx.doi.org/10.2139/ssrn.1987850.

Xu, C., & Zou, J. (2011). A comparative study of social responsibility between state-owned enterprises and private enterprises. *Economic Review, 10*, 23–26.

Yang, L. (2013). Research on the relationship between accounts receivable and accounts payable, enterprise capital chain fracture. *Communication of Finance and Accounting, 24*, 107–110.

Yu Minggui, P. H. (2008). Government intervention, rule of law, financial development and bank loans of state-owned enterprises. *Financial Research, 9*, 5–26.

Yung, K., Li, D. Q. D., & Jian, Y. (2015). The value of corporate financial flexibility in emerging countries. *Journal of Multinational Financial Management, 32–33* (December), 25–41.

Zeng, A., & Wei, Z. (2013). Financial constraints, financial flexibility and investment? Cash flow sensitivity: Theoretical analysis and empirical evidence from listed companies in China. *Journal of Finance and Economics, 11*(3), 48–58.

Zeng, A., Fu, Y., & Wei, W. (2011). Financial crisis shock, flexible financial reserve and corporate financing. *The Journal of Financial Research, 10*, 155–169.

Zingales, L. (1998). Survival of the fittest or the fattest? Exit and financing in the trucking industry. *The Journal of Finance, 53*(3), 905–938.