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Are private equity and venture capital helping small and medium-sized enterprises during the COVID-19 pandemic? Evidence from China

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Abstract

The rapid spread of COVID-19 worldwide since 2020 has, undeniably, negatively influenced the global economy and environment. Small and medium-sized enterprises (SMEs) are among the worst-hit victims of COVID-19, particularly in developing countries. As primary channels financing SMEs, what roles have private equity and venture capital (PE/VC) played in this crisis? Using the 2010–2021 data of 4462 listed companies, we aimed to assess the impact of PE/VC on financial risk among Chinese SMEs. We constructed a capital structure selection model to assess the risk preference of PE/VC and explored the roles of PE/VC in the financial risk management of enterprises during COVID-19. Based on both theory and empirical evidence, PE/VC negatively impacts the financial risk of enterprises, implying that intervention by the management of PE/VC can aggravate the financial risk. However, in reality, PE/VC positively impacted enterprise financial risk during COVID-19. Thus, the government should implement some easing policies to stimulate access and investment policies of PE/VC as well as provide more practical policies to support investment institutions in China and other counties.

1. Introduction

The COVID-19 pandemic continues to sweep across the world. Several small and medium-sized enterprises (SMEs) have been severely affected by the pandemic and the resultant lockdowns. Especially in developing countries, SMEs have faced multiple issues: financial problems, supply chain disruption, logistic blocks, labor shortages, decreases in demand, reduction in sales and profit, etc. (Dai et al., 2021; Zhang and Sogn-Grundvåg, 2022). Shafi et al. (2020) report that >83% of the affected enterprises in Pakistan were neither prepared nor had any plan of action to handle such a crisis. Moreover, some scholars, including Yagi and Managi (2021), think that the economic damage from the 2020 COVID-19 crisis is greater than that from the 2008 global financial crisis. Analysis of the impact of COVID-19 on the economy and ways to overcome these impacts has become a hot research topic.
Some scholars suggest that appropriate intervention by the government, such as direct fiscal recovery policy measures in terms of the economy (Can et al., 2021), strict lockdown for firm performance (Ren et al., 2021), the establishment of regulatory and legal systems in stable countries (Ho et al., 2022), closing schools, imposing restrictions on internal movement, organizing public awareness campaigns, income support, international aid in exchange rate volatility (Feng et al., 2021), and increasing credit guarantee ratio in financial risk (Taghizadeh-Hesary et al., 2022), could help mitigate the negative impacts of COVID-19. However, some scholars also believe that not every government intervention would positively affect economic development. For instance, Gao (2022) believes that both lockdown policies and FinTech can negatively impact new firm creation in the manufacturing sector. Moreover, Łopatka and Fedorowicz (2021) believe that the Polish state aid offered to enterprises during the COVID-19 pandemic, although effective, left a few questions unanswered: if enterprises without normal businesses failed on the free market, could they be artificially sustained even after the end of the pandemic? Besides, Hu et al. (2021) report that stringent government responses can negatively impact the stock prices of most energy enterprises.

Considering the uncertainty in the effects of government intervention, some scholars have sought survival paths for enterprise development. Many scholars, including Fitriasari (2020), Papadopoulos et al. (2020), Roffia and Mola (2022), Bai et al. (2021), Muhmad et al. (2021), Halina and Wiercioch (2021), and Obrenovic et al. (2020), agree that the use of digital technology and the complexity of information infrastructures are effective ways via which enterprises can cope with COVID-19. Enterprises with strong managers can develop digital strategies; in contrast, this may be difficult for enterprises to have not-so-strong managers (Kong et al., 2021). Meanwhile, providing enterprises with stable finances is undoubtedly an efficient and critical approach (Naoyuki and Farhad, 2019). If enterprises can attract enough funding for their activities, they can play a pivotal role in mitigating the negative effects of COVID-19 (Farhoud et al., 2021).

In developed countries, private equity and venture capital (PE/VC) are effective in obtaining financing for SMEs. The rapid growth of the PE/VC market in China has led to PE/VC becoming increasingly important in the financial risk control of SMEs as well as enterprise governance. According to the PE/VC data statistics of Wind Information Technology Co., LTD (WIND), PE/VC-related investments in China increased from 322.96 billion yuan to 8463.92 billion yuan from 2004 to 2020, with a growth rate of 25.21%. Even now, the PE/VC market is continually developing into a popular investment field in China’s capital market. Apart from providing financial support to SMEs, PE/VC aids enterprise governance and influences the operation and management of SMEs for their own interests (Reid et al., 1997; Kortum and Lerner, 2000). PE/VC also plays a critical role in enterprises’ financial strategic decisions and risk control. Hence, the following questions arise: what role has PE/VC played in the financial risk management of SMEs before and after COVID-19 and will PE/VC continue to benefit SMEs as long as the COVID-19 pandemic continues?

To explore these issues, the present study assessed PE/VC and focused on analyzing the influence of PE/VC intervention on the financial risk of holding enterprises before and after the COVID-19 pandemic. Our study aimed to make two main contributions to the existing literature.

First, we constructed a capital structure selection model based on the risk preference of major shareholders to theoretically confirm that as a major shareholder, PE/VC significantly affects the financial risk of the holding enterprise. An empirical test was performed, which confirmed the above theoretical results. Our study provides reliable theoretical and empirical bases for the management of enterprise financial risk in China, thereby adding to the available literature on enterprise finance.

Second, considering the effects of the COVID-19 pandemic, we further analyzed the impact of PE/VC on enterprise financial risk by applying COVID-19 as a factor in the above-mentioned capital structure selection model. When a big change or crisis occurs, PE/VC changes its operations and management modes by focusing on risk aversion. PE/VC has continued to play positive roles in the management of enterprise financial risk during the COVID-19 pandemic. Our study provided a new research perspective for understanding the roles of PE/VC in enterprise financial risk.

The rest of this study has been organized as follows. Section 2 presents a review of the existing literature. Section 3 provides the theoretical background and proposes a hypothesis. Section 4 presents the data and model specifications. Sections 5 and 6 present the empirical results. Finally, the paper is concluded in the last section.

2. Literature review

The primary aim of this study was to explore the role of PE/VC in the management of enterprise financial risk during the COVID-19 pandemic. Accordingly, the existing literature can be represented as two different strands: the first strand contained studies related to the varying impacts of COVID-19 on firms, whereas the second strand mainly concentrated on the various impacts of PE/VC on enterprises.

In terms of the first strand, many studies have assessed the impacts of COVID-19 on firms. Clearly, these impacts are predominantly negative. Zhang and Sogn-Grundvåg (2022) reported that the COVID-19 pandemic resulted in decreases in firm revenue and raised the demand for liquidity, thereby resulting in increased financial stress among firms worldwide, particularly small firms and firms with limited access to finance. Dai et al. (2021) believed that the COVID-19 outbreak and the resultant lockdowns took a heavy toll on SMEs, which were principally afflicted by blocks in logistics, labor shortages, and drops in demand. A large number of scholars, including Gao (2022), Shafie et al. (2020), Hu et al. (2021), Giddy and Rogerson (2021), Afriza (2021), Oyewale et al. (2020), Fabeil et al. (2020), Farhoud et al. (2021), and Ren et al. (2021), supported this view and believed that the COVID-19 outbreak and the lockdown policies may have inhibited the
Table 1
Summary of previous studies.

| Authors                          | Research objective                          | Major attitudes                                                                 |
|----------------------------------|---------------------------------------------|----------------------------------------------------------------------------------|
| Zhang and Sogn-Grundvåg (2022)   | Negative impacts of COVID-19 on firms       | The COVID-19 pandemic decreased firm revenue and increased the demand for liquidity, resulting in increased financial stress on firms worldwide, particularly small firms and firms with limited access to finance. The COVID-19 pandemic and the resultant lockdowns took a heavy toll on SMEs, mainly causing issues such as blocks in logistics, labor shortages, and drops in demand. The COVID-19 outbreak and lockdown policies will inhibit the survival of SMEs. |
| Dai et al. (2021)                |                                             |                                                                                  |
| Gao (2022), Shafi et al. (2020), Hu et al. (2021), Giddy and Rogerson (2021), Afriwa (2021), Oyewale et al. (2020), Faber et al. (2020), Farhoud et al. (2021), and Ren et al. (2021) | The COVID-19 outbreak and lockdown policies will inhibit the survival of SMEs. |
| Markovic et al. (2021)           | Positive impacts of COVID-19 on firms       | SMEs made relevant innovations in business-to-business corporate partners during the COVID-19 pandemic. |
| Roffia and Mola (2022)           |                                             |                                                                                  |
| Reid et al. (1997) and Samila and Sorenson (2011) | Positive impacts of PE/VC on enterprises | PE/VC often actively intervenes in enterprise governance decisions; it can improve the enterprise governance structure and obtain high returns to avoid downside risks to the performance of enterprises. VC has great advantages in the development of enterprises. Compared with enterprises without PE/VC support, those with PE/VC support perform better in terms of innovation ability, profitability, improvement of internal governance structure, stock price performance, and innovation capacity. |
| Wright and Robbie (1996)         |                                             |                                                                                  |
| Statman (1999), Kortum and Lerner (2000), Liang and Jiang (2012), Zhang and Yeqing (2016) |                                             |                                                                                  |
| Hirukawa and Ueda (2011)         | Negative impacts of PE/VC on enterprises    | PE/VC cannot improve the innovation ability of enterprise but can invest in enterprises with a potentially high innovation capability. VC tends to participate in politically connected enterprises; however, the positive effects of VC on the performance of such enterprises are weakened after listing. PE/VC exhibits chaotic phenomena such as surprise shareholding, PE corruption, right share trading, performance change, etc. |
| Zhang et al. (2015)              |                                             |                                                                                  |
| Zhao et al. (2015)               |                                             |                                                                                  |

survival of SMEs. However, a few scholars think this pandemic is an opportunity for enterprises to transform and develop innovations, although the COVID-19 pandemic has undeniably been a severe disaster. Markovic et al. (2021) reported that some SMEs made relevant innovations in terms of business-to-business corporate partners during the COVID-19 pandemic. Halina and Wiercioch (2021) stated that the rate of the use of financial-accounting programs in remote work has improved during the COVID-19 pandemic. Roffia and Mola (2022) suggested that the COVID-19 pandemic enhanced SMEs’ intentions to adopt enterprise resource planning (ERP) systems by mitigating barriers that hinder the adoption of ERP systems.

The second strand considers the impact of PE/VC on enterprise governance. These discussions have been mainly focused on the elaboration of two aspects. First, scholars maintain their opinion that PE/VC positively impacts enterprise governance and management. Reid et al. (1997) and Samila and Sorenson (2011) insisted that PE/VC often actively influences the decisions of enterprise governance and thus improves the structure of enterprise governance and obtains high returns to avoid downside risks to the enterprise’s performance. Wright and Robbie (1996) showed that VC is more advantageous in an enterprise’s development; they also reported that compared with enterprises without PE/VC support, those with PE/VC support perform better in terms of innovation ability, profitability, improvement of internal governance structure, stock price performance, and innovation capacity (Statman, 1999; Kortum and Lerner, 2000; Liang and Jiang, 2012; Zhang and Yeqing, 2016). In contrast, some scholars believed that PE/VC has barely any positive effects on the governance and operation management of enterprises and that it may even inhibit the development of enterprises. Hirukawa and Ueda (2011) believed that PE/VC cannot improve the innovation ability of enterprises but can invest in enterprises with a potentially high innovation capability. Zhang et al. (2015) reported that VC tends to participate in politically connected enterprises; however, the positive effects of VC on the performance of such enterprises are weakened after listing. In addition, Zhao et al. (2015) suggested that PE/VC exhibits chaotic phenomena such as surprise shareholding, PE corruption, right share trading, and performance change in China.

Table 1 presents details of the above-mentioned studies regarding the impacts of PE/VC and COVID-19 on enterprises.
3. Theoretical hypothesis

When considering a representative enterprise, the assets can be divided into the rights of creditors and investors, expressed with the same equation “Assets = Liabilities + Owners”. Assuming that an enterprise’s assets are $A$, liabilities are $L$, and owners' equity is $E$, the following accounting identity exists: $A = L + E$.

Assuming that the rate of interest of the debt is fixed and marked as $r_d$, the amount of principal + interest that the enterprise needs to repay at the end of the period is $L (1 + r_d)$, where the return on enterprises’ assets is the random variable $r$ that is uniformly distributed as $[-1, a]$ and $a > 0$. Therefore, when the assets are lower than the amounts of the principal and interest of liabilities at the end of the period, the enterprise will be insolvent, denoted as $\text{Financialfailure}=1$; otherwise, $\text{Financialfailure}=0$. Then, the probability of financial failure or bankruptcy of the enterprise could be expressed as follows:

$$P(\text{Financialfailure} = 1) = P(A(1 + r) < L(1 + r_d))$$

$$= P(r < \frac{(1 + r_d)}{A}) = \frac{1}{a} \left(1 - \frac{1}{1 + a}\right)$$  \hspace{1cm} (1)

$p$ is the ratio of the probability of financial failure or bankruptcy to the probability without financial failure or bankruptcy, known as the probability of financial failure or bankruptcy of the enterprise:

$$p = \frac{P(\text{Financialfailure} = 1)}{P(\text{Financialfailure} = 0)}$$

To simplify the analysis, the principal–agent cost was not considered in this study; however, the goals of the major shareholders and managers were kept consistent. Based on the static tradeoff theory, debt financing has a tax shield effect—financial failure or bankruptcy does not occur, and debt financing can reduce taxes and fees and indirectly increase the enterprise’s after-tax earnings. However, in the event of financial failure or bankruptcy, debt financing will increase the risk of an enterprise’s financial failure or bankruptcy and thus add to the costs. Therefore, when debt financing is performed, the net income is as follows:

$$\text{NetProfit} = \begin{cases} 
L \cdot r_d \cdot t & \text{Financialfailure} = 0 \\
-c_0 & \text{Financialfailure} = 1 
\end{cases}$$  \hspace{1cm} (2)

Where $t$ is the income tax rate, $c_0$ is assumed as fixed, and $r_d$ and $t$ are exogenous variables of the model.

Financial risks increase shareholder wealth risks and result in an irreversible situation. Therefore, the present study defined the opening root of the probability of financial failure or bankruptcy of enterprise $p$ as the financial risk factor and divides the wealth utility of major shareholders into the opening root of the income factor of wealth $E(W)$ and the strengthening risk factor $p \text{Var}(W)$:

$$E(U(W)) = E(W) - \alpha \gamma \sqrt{\text{Var}(W)}$$  \hspace{1cm} (3)

Where $\alpha$ is the proportion factor set at 0.5 for simplification and $\gamma$ is the degree of the risk aversion of major shareholders ($\gamma \geq 0$). The greater the risk preference of major shareholders, the lower the risk aversion degree, indicating that when the major shareholder is a risk seeker, $1 > \gamma \geq 0$, and when the major shareholder is a risk averter, $\gamma \geq 1$.

Assuming that only major shareholders receive enterprise dividends and that the dividends remain unchanged, when the enterprise conducts debt financing, the wealth function of the major shareholders will be as follows:

$$W = (\text{NetProfit} - RI)\gamma + Rr$$  \hspace{1cm} (4)

Where $RI$ refers to the retained earnings of the enterprise, NetProfit refers to the net income obtained from debt financing of the enterprise, and $(\text{NetProfit} - RI)$ refers to the dividends paid by the enterprise to the major shareholders. Assuming that the major shareholders primarily use the dividends to make risk-free investments and that the investment income is $r$, the return rate $r$ obtained from the retained earnings investment will be the same as the return on assets, and both will follow a uniform distribution on $[-1, a]$, satisfying the criterion of $a > 0$.

Therefore, the major shareholders should choose an optimal solution to maximize their expected utility function of wealth, which can be expressed as follows:

$$\max_{L} \left\{ L_r r_d \gamma - \gamma (L_r r_d + c_0) \frac{(1 + r_d)}{A(1 + a)} - R r_d + RI \cdot \frac{a - 1}{2} - \frac{\gamma (L_r r_d + c_0) (1 + r_d)}{A(1 + a)} \right\}$$  \hspace{1cm} (5)

So, the optional $L^*$ is as follows:

$$L^* = \frac{A(a + 1)}{2(1 + r_d)(1 + \frac{c_0}{r_d})} - \frac{c_0}{2r_d}$$  \hspace{1cm} (6)

Therefore, the smaller $\gamma$ is, the larger $L^*$ is, indicating that the lesser the risk aversion of major shareholders, the higher the enterprise’s financial risk. As a special investor, PE/VC not only provides financial support to the enterprise but also participates in an enterprise's operational management and financial strategic decisions after investing in the enterprise (Reid et al., 1997; Kortum and Lerner, 2000). Thus, PE/VC usually plays an important role in the personnel management of
an enterprise (Cochrane, 2005). Besides, Ennis and Sebastian (2005) and Conroy and Harris (2007) report that PE/VC always has a high tolerance to risk. Thus, PE/VC usually enjoys the regulatory power of the enterprise as a major shareholder after investing in the enterprise; moreover, to maximize their returns, PE/VC often has a higher risk tolerance than the other investors. Thus, to pursue higher returns, PE/VC usually prefers risk over other investment institutions; that is, the risk aversion of PE/VC is smaller. To sum up, Hypothesis 1 can be proposed as follows.

Hypothesis 1. PE/VC plays a deteriorating role in the financial risk of enterprises.

In the above-mentioned selection model, the risk aversion of PE/VC is assumed to be constant; however, in reality, the risk aversion changes according to the economic environment. Thus, when a big change or crisis occurs, PE/VC will consciously strengthen the companies’ risk controls and tend to invest in a manner that helps avoid high risk.

Therefore, as a major shareholder, PE/VC will have different risk preferences in different economic environments (e.g., COVID-19). Thus, we adjusted Eq. (3) and introduced the economic environment factor $c$. Accordingly, the expected utility function of the wealth of the major shareholders could be expressed as follows:

$$E\{U(W)\} = E(W) - \alpha(1 + \gamma(c))\sqrt{\text{pVar}(W)}$$  \hspace{1cm} (7)

The economic environment factor $c$ is a dummy factor; it is 1 when a big change or crisis occurs in the economic environment; otherwise, it is 0. It satisfies $\gamma(0) = \gamma_0 < 1$, where $\gamma_0$ is a positive constant and $\gamma(1) = \gamma_1 \geq 1$.

Similar to the above derivation, the optimization problem faced by the major shareholders is as follows:

$$\max \left\{ L_{rd} - r_f (L_{rd} + c_0) \frac{U(1 + r_d)}{A(1 + a)} - R_h r_f + R_l \cdot \frac{a - 1}{2} - \frac{1 + \gamma(c) (L_{rd} + c_0) U(1 + r_d)}{A(1 + a)} \right\}$$

The optional $L^{**}(c)$ is as follows:

$$L^{**}(c) = \frac{A(a + 1)}{2(1 + r_d)(1 + \frac{1 + \gamma(c)}{2r_f})} - \frac{c_0}{2r_d}$$  \hspace{1cm} (8)

Therefore, the smaller the $\gamma(c)$ is, the larger the $L^{**}(c)$ is, indicating that the lower the risk aversion of the major shareholders is, the higher the enterprise financial risk is. When a big change or crisis occurs, the PE/VC will change its operation and management modes by increasing risk aversion. Thus, $L^{**}(1) < L^{**}(0)$. Hypothesis 2 can accordingly be proposed.

Hypothesis 2. PE/VC plays a positive role in the financial risk of enterprises during the COVID-19 pandemic.

4. Statistical description and model selection

4.1. Sample selection and data sources

Our main aim was to study the differences in the impact of PE/VC on financial risk before and after the COVID-19 pandemic. We used the data of 4462 listed companies from 2010 to 2021 as research samples. The basic information and financial data of all these listed companies were mainly obtained from the China Stock Market & Accounting Research Database (CSMAR Database). Moreover, the data on Chinese PE/VC companies were mainly obtained from the WIND database.

4.2. Variable selection and definition

We aimed to study the roles of PE/VC in the financial risk of SMEs during the COVID-19 pandemic. Thus, we selected explained variables, core explanatory variables, the COVID-19 variable, and control variables.

4.2.1. Explained variables

Altman (1968) and Altman et al. (2017) indicate that the Z value can be used to analyze and predict the possibility of financial failure or bankruptcy in listed companies by integrating their financial data scores. The lower the Z value is, the more likely the listed companies are to go bankrupt; i.e., the financial risk is greater here. Therefore, we considered the probability of financial failure or bankruptcy (Zscore) of the listed companies in the accounting year as a proxy variable of the explained variable. If the Z value is <1.81, the enterprise is under a latent bankruptcy crisis. According to the z value critical point of the bankruptcy crisis of the enterprise, the dummy variable $Z\text{scoredummy}$ is defined as an auxiliary proxy variable of the explained variable; this value is 1 when the z value of the accounting year of the listed enterprise is <1.81; otherwise, the value is 0.
Table 2  
Definition and description of the variables used. 
Source: Authors.  

| Variables     | Definition of variables |
|---------------|-------------------------|
| Zscore        | Z value of the enterprise |
| Zscoredummy   | Dummy variable; when the Z value of the enterprise is <1.81, the value is 1; otherwise, the value is 0 |
| COVID_19      | Dummy variable; when time is considered in the COVID-19 period, it is 1; otherwise, it is 0 |
| PEVCdummy     | Dummy variable; when the listed enterprise has PE/VC shareholding, the value is 1; otherwise, it is 0 |
| PEVCnum       | The number of PE/VC in the top 10 shareholders |
| PEVCradio     | The shareholding ratio of PE/VC in the top 10 shareholders |
| ROA           | The rate of return on total assets |
| EV            | Total market value of equity |
| Assets        | Total assets, unit: Yuan |
| Debttoasset   | Asset–liability ratio = total liabilities/total assets |
| Totalshares   | Total share capital, units: shares |
| Freefloatshares | Free float, unit: shares |
| Top10         | Total shareholding ratio of top 10 shareholders |

Table 3  
Descriptive data statistics.  
Source: Author calculations using STATA.  

| Variables     | Sample | Mean   | Median  | Max       | Min       | Std    | Q25%   | Q75%   |
|---------------|--------|--------|---------|-----------|-----------|--------|--------|--------|
| Zscore        | 32077  | 5.3297 | 3.0859  | 1860.963  | −700.877  | 16.6109| 1.7880 | 5.5839 |
| Zscoredummy   | 32077  | 0.2544 | 0       | 1         | 0         | 0.4355 | 0      | 1      |
| COVID_19      | 33617  | 0.2492 | 0       | 1         | 0         | 0.4325 | 0      | 0      |
| PEVCdummy     | 33617  | 0.3712 | 0       | 1         | 0         | 0.4831 | 0      | 1      |
| PEVCnum       | 33617  | 0.5336 | 0       | 7         | 0         | 0.8396 | 0      | 1      |
| PEVCradio     | 33617  | 1.8187 | 0       | 41.47     | 0         | 4.7977 | 0      | 0.8    |
| ROA           | 33302  | 0.0280 | 0.0367  | 22.0051   | −48.3159  | 0.4510 | 0.0131 | 0.0674 |
| EV            | 32709  | 1.34e+10| 3.83e+09| 2.51e+12  | 3.08e+07  | 7.04e+10| 1.92e+09| 8.09e+09|
| Assets        | 33617  | 6.11e+10| 3.31e+10| 3.33e+13  | 0         | 7.92e+11| 1.50e+09| 8.69e+09|
| Debttoasset   | 33616  | 0.4587 | 0.4223  | 178.3455  | 0.0071    | 1.1444 | 0.2566 | 0.5976 |
| Totalshares   | 33573  | 1.71e+09| 4.77e+08| 3.56e+11  | 3.47e+07  | 1.22e+10| 2.37e+08| 1.01e+09|
| Freefloatshares| 33573 | 1.46e+09| 3.68e+08| 3.56e+11  | 0         | 1.16e+10| 1.44e+08| 8.19e+08|
| Top10         | 33617  | 59.2492| 60.24   | 100       | 1.32      | 16.1279| 47.79  | 71.4   |

4.2.2. Core explanatory variables  
To analyze the effects of PE/VC on the financial risk of the listed companies in China, the dummy variable of the existence of PE/VC in the listed companies was considered the core explanatory variable. The definition of VC background established by Wu and Yuan (2017) was used as a reference: PEVCdummy = 1 if the top 10 shareholder names of the listed enterprises contained keywords related to PE/VC; otherwise, PEVCdummy = 0. To analyze the robustness of the results, PEVCnum and PEVCradio were used as auxiliary proxy variables.

4.2.3. The COVID-19 variable  
To analyze the effects of COVID-19 on SMEs, the existence of the COVID-19 pandemic was considered the dummy variable, denoted as COVID_19.

4.2.4. Control variables  
PE/VC may influence the financial risk of the listed companies in China on three levels: enterprise finance, enterprise capital structure, and enterprise equity. The financial level of the enterprise variables mainly refers to the return on total assets (ROA), the total market value of equity (EV), and total assets (Assets). The capital structure of the enterprise variables mainly refers to the asset–liability ratio (Debttoasset). Enterprise equity mainly refers to the total shares (Totalshares), free-float shares (Freefloatshares), and top 10 shareholders’ shareholding ratios (Top10).  
Based on the above analysis of the variables, the definition and description of the variables used in this study are presented in Table 2.

4.3. Statistical description of the data  
After deleting outliers and missing values from the original research sample, we conducted a preliminary statistical analysis of the data and obtained the below-mentioned descriptive statistics table (Table 3).  
According to Table 3, the mean and median values of the variable Zscore were 5.3297 and 3.0859, respectively. Both these values were >2.675, indicating that the financial status of the listed Chinese companies was generally good and that the possibility of financial failure or bankruptcy was low. The mean and median values of the variable PEVCdummy were
In China, Beijing and Shanghai are important political and economic centers, and investment by PE/VC in these regions is usually quite different from that in other regions. In addition, the investment frequency and amount of PE/VC companies in each Chinese province are strongly associated with the PE/VC’s investment decisions, and these decisions directly affect the financial risks of SMEs. Therefore, this paper selected the dummy variables (PEVCdummy) in the province in which the enterprise headquarter was located (Shanghai or Beijing) as the instrumental variable. The study also selected the investment frequency of the PE/VC companies (PEVCInvest) in the province as another instrumental variable.

### 4.4. Model selection

This study assessed the role of PE/VC in managing the financial risk of SMEs before and after the COVID-19 pandemic. Considering that in China PE/VC tends to aid companies with higher financial risks in the investment process, the greater financial risks may not have been caused by PE/VC entering the enterprise. Thus, the samples selected in this study may have been subjected to a “selectivity bias”; that is, the multiple linear regression model may have been endogenous. To reduce the endogeneity of the model as much as possible, we adopted the instrumental variable method, which represented tool variables with differing multitudes.

1. **Instrumental variable two-stage linear regression (2SLS model):**

   \[
   PEVCdummy_{it} = \gamma_0 + \omega\text{Instructors}_{it} + \eta\text{Controls}_{it} + u_{it}
   \]

   \[
   Zscore_{it} = \alpha_0 + \alpha_1\text{PEVCdummy}_{it} + \lambda\text{Controls}_{it} + v_{it}
   \]

2. **Instrumental variable probit regression (IVProbit model):**

   \[
   PEVCdummy_{it} = \gamma_0 + \omega\text{Instructors}_{it} + \eta\text{Controls}_{it} + u_{it}
   \]

   \[
   Zscore_{it} = \alpha_0 + \alpha_1\text{PEVCdummy}_{it} + \lambda\text{Controls}_{it} + v_{it}
   \]

   \[
   Zscore_{it} = I_{[0,\infty]}(Zscore_{it}^*)
   \]

Instructors are observable instrumental variables, whereas PEVCdummy* and Zscore* are unobservable variables, indicating the probabilities of PE/VC shareholding and financial failure or bankruptcy. \(I_{[0,\infty]}(\cdot)\) is the indicative function of set \(A\). The perturbation term \((u_{it},v_{it})\) is assumed to obey two-dimensional normal distribution with an expected value of 0:

\[
\begin{pmatrix}
  u_{it} \\
  v_{it}
\end{pmatrix} \sim N
\begin{pmatrix}
  0 \\
  0
\end{pmatrix},
\begin{pmatrix}
  \sigma_u^2 & \rho \sigma_u \sigma_v \\
  \rho \sigma_u \sigma_v & \sigma_v^2
\end{pmatrix}
\]

Where, the variance of \(v_{it}\) is normalized to 1 and \(\rho\) is the correlation coefficient of \((u_{it},v_{it})\). If the correlation coefficients of the two \(\rho = 0\) are valid, \(PEVCdummy\) is an exogenous variable; otherwise, endogeneity exists.

In China, Beijing and Shanghai are important political and economic centers, and investment by PE/VC in these regions is usually quite different from that in other regions. In addition, the investment frequency and amount of PE/VC companies in each Chinese province are strongly associated with the PE/VC’s investment decisions, and these decisions directly affect the possibility of local companies being invested by PE/VC. Therefore, this paper selected the dummy variables (Area) of the province in which the enterprise headquarter was located (Shanghai or Beijing) as the instrumental variable. The study also selected the investment frequency of the PE/VC companies (PEVCInvest) in the province as another instrumental variable.

### Table 4

| Variables | PEVCdummy = 1 | t-test | Wilcoxon’s signed-rank test | PEVCdummy = 0 |
|-----------|---------------|--------|-----------------------------|---------------|
|           | Sample Mean   | Median | t-test         | Wilcoxon’s signed-rank test | Sample Mean   | Median |
| Zscore    | 11879         | 5.1914 | 3.0774         | (1.14)          | 20198         | 5.4110 |
| Zscoredummy | 11879       | 0.2461 | 0              | (2.61)***       | 20198         | 0.2592 |
| ROA       | 12344         | 0.0258 | 0.0387         | (0.67)          | 20958         | 0.0293 |
| EV        | 12086         | 9.85e+09 | 3.39e+09       | (6.96)***       | 20623         | 1.55e+09 |
| Assets    | 12478         | 3.90e+10 | 1.04e+09       | (5.37)***       | 21139         | 7.90e+10 |
| Debttoassets | 12477    | 0.4470 | 0.4068         | (1.45)          | 21139         | 0.4657 |
| Totalshares | 12462     | 1.23e+10 | 4.35e+08       | (3.61)***       | 21111         | 2.00e+09 |
| Freefloatshares | 12462 | 9.78e+08 | 3.17e+08       | (5.82)***       | 21111         | 5.06e+08 |
| Top10     | 12478         | 3.09e+10 | 3.04e+09       | (5.37)***       | 21139         | 7.90e+10 |
|           | 12462         | 6.00e+09 | 6.23e+09       | (12.62)***      | 21139         | 58.3981 |
|           | 12462         | 9.78e+08 | 3.17e+08       | (5.82)***       | 21111         | 5.06e+08 |

Note: T values are provided in brackets in the t-test column, whereas Z values are provided in brackets in Wilcoxon’s signed-rank test column. The symbols ‘***’, ‘**’, and ‘*’ in the upper right corner of the brackets indicate significance levels at 1%, 5%, and 10%, respectively (double-tailed).
Table 6: We noted three main points. First, there was a significant negative relation between the \( Zscore \) variable and between the \( PEVCnum \) variable and \( Zscore \) variable at the 1% level. Second, there was a significant positive relationship between the \( PEVCdummy \) variable and \( P(Zscore_{dummy}=1|X) \), the \( PEVCnum \) variable and \( P(Zscore_{dummy}=1|X) \) variable, and the \( PEVCradio \) variable and \( P(Zscore_{dummy}=I|X) \) variable at the 5% level. Third, the instrumental variables were all significantly related to the endogeneity of the \( PEVCdummy \), \( PEVCnum \), or \( PEVCradio \) variables, and the selection of the instrumental variables was rational. Thus, we concluded that intervention by PE/VC

5. Basic empirical results and analysis

5.1. The influence of PE/VC on financial risk

This section mainly presents the findings of the analysis of the influence of PE/VC on the financial risk of its holding enterprise. Instrumental variable 2SLS two-stage regression and IV/Probit regression were performed using (1) the variable of models 1–3 indicate that, at the level of 1%, the \( Zscore \) of the explained variable is significantly negatively correlated with the existence of PE/VC. This indicates that the intervention of PE/VC will reduce the \( Zscore \) of its holding enterprise before or after the COVID-19 pandemic; thus, the intervention of PE/VC will increase the possibility of financial failure or bankruptcy of its holding enterprise before or after COVID-19. In contrast, the \( Zscore \) of the enterprise declined by approximately 5.0721%, with PE/VC holding before COVID-19; however, this ratio will increase to 7.4576% once the COVID-19 pandemic ends.

b. The results of the first-stage regression of models 1–3 indicate that the regression coefficients of \( Area \) or the \( PEVCinvest \) variable are significantly correlated with the core explanatory \( PEVCdummy \) variables at the 1% level. In the meantime, the Hausman test for endogeneity and the overidentifying restrictions test were performed. The results of these tests indicated that the selection of instrumental variables was rational.

5.2. Robustness test

To verify the stability of the above results, auxiliary proxy variables were used to assess the regressions shown in Table 6. We noted three main points. First, there was a significant negative relation between the \( PEVCnum \) variable and \( Zscore \) variable and between the \( PEVCradio \) variable and \( Zscore \) variable at the 1% level. Second, there was a significant positive relationship between the \( PEVCdummy \) variable and \( P(Zscore_{dummy}=1|X) \), the \( PEVCnum \) variable and \( P(Zscore_{dummy}=1|X) \) variable, and the \( PEVCradio \) variable and \( P(Zscore_{dummy}=I|X) \) variable at the 5% level. Third, the instrumental variables were all significantly related to the endogeneity of the \( PEVCdummy \), \( PEVCnum \), or \( PEVCradio \) variables, and the selection of the instrumental variables was rational. Thus, we concluded that intervention by PE/VC
would decrease the Zscore of its holding enterprises, thereby increasing the possibility of financial failure or bankruptcy. The decrease was approximately 2.8276% for each PE/VC seat in the top 10 shareholders and approximately 0.8333% for each addition in terms of the number of PE/VC shares held.

6. Further empirical results and analysis

In Section 5, the influence of PE/VC on the financial risk of its holding enterprises has been discussed. We mainly assessed the role of PE/VC in the management of the financial risk of SMEs before and after the COVID-19 pandemic. A new variable of COVID_19 was introduced, and an adaptive model should be immediately adopted.

6.1. Model selection

In this section, we chose a difference-in-difference (DID) model for preliminary analysis and the propensity score matching-DID (PSM-DID) model for the robustness test:

\[
Z\text{score}_{it} = \alpha + \lambda D\text{ID}_{it} + \gamma P\text{EVCDummy}_{it} + \beta \text{COVID}_19_{it} + \eta \text{Controls}_{it} + u_i + \epsilon_{it} \\
D\text{ID}_{it} = P\text{EVCDummy}_{it} * \text{COVID}_19_{it}, \ i = 1, \ldots, n, \ t = 1, 2
\]

(11)

Where PEVCDummy\textsubscript{i\textsubscript{t}} is the treatment dummy variable with or without the support of PE/VC, COVID\textsubscript{19\textsubscript{t}} is the COVID-19 dummy variable before or after the COVID-19 pandemic, Controls\textsubscript{it} are the control variables, u\textsubscript{i} is an unobservable individual characteristic, and \epsilon_{it} is a residual term.

6.2. Further sample processing

To obtain a good sample-matching result, we deleted the samples of companies listed after 2010 and those having null values based on previous study samples; this reduced the sample size to 2025.

6.3. Influence of COVID-19 on the impact of PE/VC on companies' financial risks

According to Eq. (11), we obtained DID regress at the first step (Table 7). There was a significant positive relationship between the DID\textsubscript{t} variable and the Zscore variable at the 10% level after 2011, indicating that the influence of PE/VCs' holding on enterprises' financial risk could change from positive to negative after the COVID-19 pandemic. PE/VC protects
### Table 7
Results of the DID regression.
Source: Authors calculation using STATA.

| Models | Explanatory/Explained variables | Model 9 | Model 10 | Model 11 | Model 12 | Model 13 |
|--------|---------------------------------|---------|---------|---------|---------|---------|
| DID    |                                 | 1.0237  | 1.0541* | 1.2021* | 0.9645* | 1.0790* |
|        |                                 | (1.53)  | (1.73)  | (1.88)  | (1.70)  | (1.82)  |
| PEVCdummy |                               | −0.4996 | −0.3501 | −0.4914 | −0.0194 | −0.1371 |
|        |                                 | (−1.47) | (−1.19) | (−1.57) | (−0.08) | (−0.50) |
| COVID_19 |                               | −1.9617*** | −1.9517*** | −2.0948*** | −0.3926 | −0.4523 |
|        |                                 | (−4.55) | (−3.75) | (−3.82) | (−1.12) | (−1.25) |
| ROA    |                                 | −0.3997 | −0.4709 | −0.0194 | −0.1371 |
|        |                                 | (−0.15) | (−0.17) | (−0.08) | (−0.50) |
| Ln(EV) |                                 | 5.7907*** | 5.9053*** |         |         |         |
|        |                                 | (7.13)  | (6.94)  |         |         |         |
| Ln(Assets) |                              | −6.3431** | −6.7152** |         |         |         |
|        |                                 | (−2.14) | (−2.01) |         |         |         |
| Ln(Totalshares) |                         | 3.2565  | 3.4009  |         |         |         |
|        |                                 | (1.34)  | (1.28)  |         |         |         |
| Ln(Freefloatshares) |                      | −2.4712*** | −2.2337*** |         |         |         |
|        |                                 | (−6.54) | (−6.17) |         |         |         |
| Top10  |                                 | 0.0468  | 0.0464  |         |         |         |
|        |                                 | (1.59)  | (1.33)  |         |         |         |
| Constant |                               | 5.3986*** | 5.3109*** | 5.4530*** | −1.7999 | −3.7272 |
|        |                                 | (21.67) | (14.57) | (13.79) | (−0.44) | (−0.86) |
| Samples |                                 | ALL     | Year ≥ 2011 | Year ≥ 2012 | Year ≥ 2011 | Year ≥ 2012 |
| No. obs |                                 | 21601   | 19617   | 17640   | 19617   | 17640   |

Note: The t values of the corresponding coefficients have been presented in parentheses; ‘***’, ‘**’, and ‘*’ represent significance at levels of 1%, 5%, and 10%, respectively (double-tailed).

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enterprises from financial risks during the COVID-19 pandemic. Meanwhile, the Zscore of enterprises with PE/VC holding would be approximately 1% higher than that of enterprises without PE/VC holding after the COVID-19 pandemic.

We obtained PSM-DID regress with 1:3 (treatment group samples: control group samples) matching samples for further robustness tests. The matching characters were as follows: total assets (ROA), total market value of equity (EV), total assets (Assets), total shares (Totalshares), free-float shares (Freefloatshares), and top 10 shareholders’ shareholding ratio (Top10). The mean Zscores of the enterprises before and after matching by year are presented in Fig. 1.

Fig. 1 indicates that around 2019, the mean Zscores of the enterprises with PE/VC holding were higher than those without PE/VC holding.

The density of the matching pscores before and after matching the results are described by year in Fig. 2. The effect of matching was fine, and the densities of matching pscores with or without PE/VC support were almost identical, indicating that the difference in the matching characters between enterprises with or without PE/VC support was weakened.

Table 8 presents the results of the DID regress depending on the matching samples. The DID variable remained significantly positively related to the Zscore variable at the 10% level after matching in the year 2011. Moreover, the COVID_19 variable significantly negatively influenced the Zscore variable. Our results showed that the COVID-19 pandemic...
Fig. 2. The density of matching pscores before and after matching by year.  
Source: Drawn by the authors using STATA.
Table 8
Results of the PSM-DID regression.
Source: Calculated by the authors using STATA.

| Models          | Model 14          | Model 15          | Model 16          |
|-----------------|-------------------|-------------------|-------------------|
| Explanatory/Explained variables | Zscore             | Zscore             | Zscore             |
| DID             | 0.5015            | 0.6177*           | 0.7368*           |
|                 | (0.66)            | (1.65)            | (1.90)            |
| PEVCDummy       | -0.2163           | -0.3326           | -0.4515           |
|                 | (-0.64)           | (-1.16)           | (-1.49)           |
| COVID_19        | -1.9766**         | -1.9471***        | -2.1029***        |
|                 | (-2.22)           | (-3.46)           | (-3.47)           |
| Constant        | 5.5028***         | 5.4733***         | 5.6290***         |
|                 | (14.45)           | (10.97)           | (10.28)           |
| Samples         | ALL               | Year ≥ 2011       | Year ≥ 2012       |
| No. obs         | 17434             | 15862             | 14234             |

Note: The t values of the corresponding coefficients are presented in parentheses; ‘****’, ‘***’, and ‘*’ represent significance at levels of 1%, 5%, and 10%, respectively (double-tailed).

would exacerbate financial risks for companies; however, using PE/VC can adjust the company's financial structure, reduce its financial risks, and buffer the impact of COVID-19. Moreover, as an umbrella effect, PE/VC will protect companies during the COVID-19 pandemic.

7. Conclusions and policy recommendations

This study primarily assessed the role of PE/VC in the financial risk of SMEs. First, based on a theoretical analysis of the debt ratio and financial risk of the listed companies, an enterprise capital structure selection model was constructed according to the risk preference of the major shareholders. Next, based on a research theory, the research hypothesis was proposed, and an empirical analysis of the impact of PE/VC as a major shareholder on the financial risk of its holding enterprises before and after the COVID-19 pandemic was performed. Finally, imputing the COVID_19 factor in the capital structure selection model, the impact of PE/VC on the financial risk of SMEs during the COVID-19 pandemic was assessed.

This paper draws the following two conclusions:

a. PE/VC plays a negative role in the financial risk of SMEs in China. Compared with enterprises without PE/VC holdings, those with PE/VC holdings had greater financial risks, indicating that PE/VC could deteriorate an enterprise’s financial risks. Thus, to pursue higher returns, PE/VC usually prefers risk over other investment institutions, so the financial risk of enterprises with PE/VC support is usually greater than that of other enterprises without PE/VC holding.

b. PE/VC has played a positive role in the financial risk of enterprises during the COVID-19 pandemic. When a crisis occurs, PE/VC will consciously strengthen the companies’ risk control and tends to invest with a lower risk to avoid high risk. Thus, PE/VC are smart investors who can change their risk preferences based on the international situation anytime, helping enterprises survive during the COVID-19 pandemic.

Based on these conclusions, some policy recommendations can be made:

i. The government must focus on strengthening PE/VC enterprise risk control in SMEs. It is necessary to formulate relevant capital market policies and supervision systems to block the negative effects, which can help maintain the steady development of the capital market.

ii. During the ongoing COVID-19 pandemic, it is necessary for governments to execute some easing policies for the access and investment policies of PE/VC; these can promote the positive impacts of PE/VC on the financial risk management of SMEs, thus helping them survive during this crisis.

iii. The government should focus on smarter investment institutions, such as PE/VC, which can identify potential enterprises and provide strong financial support, thereby helping potential enterprises to thrive during the COVID-19 pandemic.

Although the contributions of this study to the existing literature are clear and new insights have been provided for scholars and policymakers, future studies should focus on aspects of investment institutions, such as how supportive investment institutions can help SEMs survive after the COVID-19 pandemic and provide more practical policies for such institutions in China and other countries.

Declaration of competing interest

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

Data availability

The data used to support the findings of this study are included within the article and supplementary information file.
Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.eap.2022.07.007.

References

Afriza, E.S.D., 2021. Indonesian small-medium enterprise (SME) can survive during covid-19: facts or illusions. Int. J. Bus. Econ. Law 24 (2), 11–20. http://ijbel.com/wp-content/uploads/2021/04/IJBEL24-035.pdf.

Altman, E.I., 1968. Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. J. Finance 23 (4), 589–609. http://dx.doi.org/10.1111/j.1546-2566.1968.tb00843.x.

Altman, E.I., Iwanicz-Drozdowska, M., Laitinen, E.K., et al., 2017. Financial distress prediction in an international context: A review and empirical analysis of Altman’s Z-score model. J. Int. Financ. Manag. Account. 28 (2), 131–171. http://dx.doi.org/10.1111/jifm.12053.

Bai, C.C., Quayson, M., Sarkis, J., 2021. COVID-19 pandemic digitization lessons for sustainable development of micro-and small- enterprises. Sustain. Prod. Consum. 27 (3), 1909–2001. http://dx.doi.org/10.30897/jspc.2021.04.035.

Can, U., Can, Z., Bocuoglu, M., et al., 2021. The effectiveness of the post-Covid-19 recovery policies: evidence from a simulated DSGE model for Turkey. Econ. Anal. Policy 71 (9), 694–708. http://dx.doi.org/10.1016/j.eap.2021.07.006.

Cochrane, J.H., 2005. The risk and return of venture capital. J. Financ. Econ. 75 (1), 3–52. http://dx.doi.org/10.1016/j.jfineco.2004.03.006.

Conroy, R.M., Harris, R.S., 2007. How good are private equity returns? J. Appl. Corp. Finance 19 (3), 96–108. http://dx.doi.org/10.2139/ijb.v2021i00211.

Cox, G.F., Yang, H., Gong, Q., et al., 2021. What is the exchange rate volatility response to COVID-19 and government interventions? Econ. Anal. Policy 69 (3), 705–719. http://dx.doi.org/10.1016/j.eap.2021.01.018.

Fitrirasari, F., 2020. How do small and medium-sized enterprises (SME) survive the COVID-19 outbreak? J. Inov. Econ. 5 (2), 53–62. http://dx.doi.org/10.22219/jikivo.v5i3.11838.

Gao, J.Y., 2022. Has COVID-19 hindered small business activities? The role of Fintech. Econ. Anal. Policy 74 (6), 297–308. http://dx.doi.org/10.2139/ijb.jeap.2022.02.008.

Giddy, J.K., Rogerson, J.M., 2021. Nature-based tourism enterprise adaptive responses to COVID-19 in south Africa. Geoj. Tour. Geosites 36 (2sp1), 698–707. http://dx.doi.org/10.30892/etg.362sp1.18-700.

Halina, B., Wiercioch, M., 2021. The use of IT systems in financial and accounting services for enterprises in the conditions of the COVID-19 pandemic. Procedia Comput. Sci. 192 (3), 4112–4119. http://dx.doi.org/10.1016/j.procs.2021.09.186.

Hirukawa, M., Ueda, M., 2011. Venture Capital and innovation: which is first? Pac. Econ. Rev. 16 (4), 421–465. http://dx.doi.org/10.1111/j.1468-2327.2011.00115.x.

Ho, K.C., Yao, C., Zhao, C.F., et al., 2022. Modern health pandemic crises and stock price crash risk. Econ. Anal. Policy 74 (6), 448–463. http://dx.doi.org/10.2139/ijb.jeap.2022.03.010.

Hu, H.Q., Di, CH., Fu, Q., 2021. Does a government response to COVID-19 hurt the stock price of an energy enterprise? Emerg. Mark. Finance Trade 58 (4), 1–10. http://dx.doi.org/10.1080/1540496X.2021.1911803.

Kong, X., Fei, J., Xuexin, L., 2021. Strategic deviance, diversification and enterprise resilience in the context of COVID-19: heterogeneous effect of managerial power. Emerg. Mark. Finance Trade 57 (6), 1547–1565. http://dx.doi.org/10.1080/1540496X.2021.1904882.

Kortum, S., Lerner, J., 2000. Assessing the contribution of venture capital to innovation. Rand J. Econ. 31 (4), 674–692. http://dx.doi.org/10.2307/2665354.

Liang, J.M., Jiang, W., 2012. Changes in the performance of GEM companies before and after IPO and the impact of venture capital. Secur. Mark. Guide 4, 66–71+8. http://www.cnki.com.cn/Article/CJFDTOTAL-ZQBD201404012.htm.

Loatka, A., Fedorowicz, K., 2021. Evaluation of the effectiveness of state aid offered to enterprises during the COVID-19 pandemic. Procedia Comput. Sci. 192 (9), 4828–4836. http://dx.doi.org/10.1016/j.procs.2021.09.261.

Markovic, S., Koporcic, N., Arslanagic-Kalajdzic, M., et al., 2021. Business-to-business open innovation: COVID-19 lessons for small and medium-sized enterprises from emerging markets. Technol. Forecast. Soc. Change 170 (9), 1–5. http://dx.doi.org/10.1016/j.techfore.2021.120883.

Muhammad, S., Kusairi, S., Man, M., et al., 2021. Digital adoption by enterprises in Malaysian industrial sectors during COVID-19 pandemic: a data article. Data Brief 37 (5), 1–7. http://dx.doi.org/10.1016/j.dib.2021.107197.

Naoyuki, Y., Farfad, T.H., 2019. Optimal credit guarantee ratio for small and medium-sized enterprises’ financing: evidence from Asia. Econ. Anal. Policy 62 (6), 342–356. http://dx.doi.org/10.2139/ijb.jeap.2018.09.011.

Obrenovic, B., Du, J.G., Godinic, D., et al., 2020. Sustaining enterprise operations and productivity during the COVID-19 pandemic: enterprise effectiveness and sustainability model. Sustainability 12 (15), 1–27. http://dx.doi.org/10.3390/su12155901.

Oyevchie, A., Ayunniji, A., Olaguny, K., 2020. Estimating the impact of COVID-19 on small and medium scale enterprise: evidence from Nigeria. In: African Economic Conference. https://aec.afdb.org/sites/default/files/papers/estimating_the_impact_of_covid-19_on_small_and_medium_scale_enterprise_-_evidence_from_nigeria_pdf.pdf.

Papadopoulos, T., Baltas, K., Balta, M., 2020. The use of digital technologies by small and medium enterprises during COVID-19: implications for theory and practice. Int. J. Inf. Manage. 55 (4), 1–4. http://dx.doi.org/10.1016/j.jinfomgt.2020.102192.

Reid, G.C., Terry, N.G., Smith, J.A., 1997. Risk management in venture capital investors? Investee relations. Eur. J. Finance 3 (1), 27–47. http://dx.doi.org/10.1080/13518479734775255.

Ren, Z., Zhang, X., Zhang, Z., 2021. New evidence on COVID-19 and firm performance. Econ. Anal. Policy 72 (11), 213–225. http://dx.doi.org/10.1016/j.jeap.2021.08.002.

Roffia, P., Mola, L., 2022. Is COVID-19 enough? Which underestimated conditions characterise the adoption of complex information infrastructures in small and medium-sized enterprises. J. Bus. Res. 144 (2), 1249–1255. http://dx.doi.org/10.1016/j.jbusres.2021.12.083.

Samila, S., Sorenson, O., 2011. Venture capital, entrepreneurialism, and economic growth. Rev. Econ. Stat. 93 (1), 338–349. http://dx.doi.org/10.2139/ssrn.1183576.

Shaft, M., Liu, J., Ren, W., 2020. Impact of COVID-19 pandemic on micro, small, and medium-sized enterprises operating in Pakistan. Res. Glob. 2 (1), 1–14. http://dx.doi.org/10.1016/j.rsglo.2020.100018.

Statman, M., 1999. Behavioral finance: past battles and future engagements. Financ. Anal. J. 55 (6), 18–27. http://dx.doi.org/10.2469/faj.v55.n6.2311.
Taghizadeh-Hesary, F., Phoumin, H., Rasoulinezhad, E., 2022. COVID-19 and regional solutions for mitigating the risk of SME finance in selected ASEAN member states. Econ. Anal. Policy 74 (6), 506–525. http://dx.doi.org/10.1016/j.eap.2022.03.012.

Wright, M., Robbie, K., 1996. Venture capitalists, unquoted equity investment appraisal and the role of accounting information. Account. Bus. Res. 26 (2), 153–168. http://dx.doi.org/10.1080/00014788.1996.9729506.

Wu, C.P., Yuan, ZH., 2017. Empirical research on the impact of venture capital on dividend policy of listed companies. Financ. Res. 447 (9), 178–191, http://www.cnki.com.cn/Article/CJFDOTAL-JRYJ201709013.htm.

Yagi, M., Managi, S., 2021. Global supply constraints from the 2008 and COVID-19 crises. Econ. Anal. Policy 69 (1), 514–528. http://dx.doi.org/10.1016/j.eap.2021.01.008.

Zhang, D.J., Sogn-Grundvåg, G., 2022. Credit constraints and the severity of COVID-19 impact: empirical evidence from enterprise surveys. Econ. Anal. Policy 74 (3), 337–349. http://dx.doi.org/10.1016/j.eap.2022.03.005.

Zhang, T.S., Xinyuan, CH., Jun, H., 2015. Political relevance, venture capital investment and firm performance. Nankai Manag. Rev. 18 (5), 18–27, http://www.cnki.com.cn/Article/CJFDOTAL-LKGP201505003.htm.

Zhao, X.Y., Yeqing, ZH., 2016. Venture Capital, innovation capability and post-IPO performance. Econ. Res. J. 51, 112–125, http://www.cnki.com.cn/Article/CJFDOTAL-JYJJ201610010.htm.

Zhao, J.M., Lili, F., Yu, SH., 2015. Venture Capital and corporate productivity: help or hinder? Financ. Res. 425 (11), 163–178, http://www.cnki.com.cn/Article/CJFDOTAL-JRYJ201511011.htm.