Evaluation of the early-stage entrepreneurship activity in the United States during the COVID-19 pandemic

Pengsheng Kang¹, Lin Guo²*, Zhou Lu³ and Lili Zhu⁴

¹Macau University of Science and Technology, Macao, Macao SAR, China, ²Tianjin University of Commerce, Tianjin, China, ³Qingdao City University, Qingdao, China, ⁴Shenandoah University, Winchester, VA, United States

This paper examines the effects of the COVID-19 pandemic (measured by total cases and deaths per 100K people) on the early-stage entrepreneurship activity (measured by the Kauffman Early-Stage Entrepreneurship indicators) in the United States. The empirical analyses are based on the panel dataset of 51 States between 2020 and 2021. The findings show that the COVID-19 pandemic negatively affects early-stage entrepreneurship activity. Further analyses indicate the positive impact of the COVID-19 pandemic on the startup’s early survival rate. However, new entrepreneurs’ rate and opportunity share are negatively affected by the COVID-19 pandemic. Implications for the post-COVID-19 era are also discussed.

KEYWORDS
COVID-19 pandemic, pandemic, early-stage entrepreneurship activity, startup’s early survival rate, entrepreneurship

Introduction

The COVID-19 pandemic has changed various dimensions of the economic system and has significantly affected various indicators. The COVID-19 pandemic created an external shock, which affected entrepreneurship activities (1). At the begging of the pandemic, the critical target of the policymakers was to decrease the cases of infections and death caused by an unknown virus (2). Different countries’ governments have responded to the first wave of lockdown by providing stimulus packages (3). However, the responses have significantly changed across countries since the economic conditions were not the same at the begging of the pandemic (4). For instance, wages were paid in some countries, such as the United Kingdom, but other countries, such as the United States, adopted alternative solutions, such as direct income payment (5). Therefore, implications for the business world and the employees have become necessary during the first wave of lockdown (6, 7).

According to various models, entrepreneurship is the engine of economic growth (8–14). It is the main driving force behind the sustainability force of the free market economies under strong institutions and the rule of law. New inventions provided to potential buyers and firms (sellers) can grow with the market economy (15). Therefore, one of the critical policy implications for the policymakers in free market economies is
to sustain the businesses’ activities alive (16). Policymakers must provide fertile ground for business activities and open up links for other market economies (17, 18). At this stage, new business opportunities and successful entrepreneurship are the keys to creating new jobs during the COVID-19 era (19–21). However, it is essential that many entrepreneurs’ activities were ignored during the second and third waves of lockdowns. Therefore, for various reasons, early-stage entrepreneurship activity, evaluation of entrepreneurial performance, entrepreneurial legitimacy, and entrepreneurial passion are crucial indicators for policymakers.

Given this backdrop, this paper investigates the direct impact of the COVID-19 pandemic (measured by total cases and deaths per 100K people) on the early-stage entrepreneurship activity (measured by the Kauffman Early-Stage Entrepreneurship indicators) in the United States. The empirical analyses are based on the panel dataset of 51 States of the country between 2020 and 2021. Several papers examine the effects of the COVID-19-related shocks on entrepreneurial performance. However, most of these papers have focused on the case of developing countries. In this paper, we focus on the subject of the United States at the state level between 2020 and 2021 to examine the direct impact of the COVID-19 pandemic on early-stage entrepreneurship activity. However, previous papers analyze the effects of the COVID-19 pandemic on economic indicators. To the best of our knowledge, there is no paper in the empirical literature to examine the direct impact of the COVID-19 pandemic on early-stage entrepreneurship activity in the United States. Our paper aims to fill this gap in the literature.

According to the empirical findings, the COVID-19 pandemic negatively affects early-stage entrepreneurship activity in the United States. Further analyses show the positive impact of the COVID-19 pandemic on the startup’s early survival rate. However, new entrepreneurs’ rate and opportunity share are negatively affected by the COVID-19 pandemic in the United States.

The remaining parts of the paper are organized as follows. Section Literature review provides a brief review of the literature investigating the effects of the COVID-19 pandemic on entrepreneurial performance. Section Data, model and methodology explains the details of the data, the empirical model, and the methodology. Section Empirical results discusses the empirical results. Section Concluding remarks provides the concluding remarks.

### Literature review

Several previous papers focus on the effects of the COVID-19 pandemic on entrepreneurial performance (22, 23). For instance, Lu et al. (24) focus on the effects of the COVID-19 pandemic on small and medium-sized enterprises in China. The authors conducted an online questionnaire and follow-up interviews on 4,807 small and medium-sized enterprises in Sichuan. The authors observe that most firms were negatively affected by disrupted supply chains and declined market demand. These issues created cash-flow risks for various small and medium-sized enterprises in China and negatively affected entrepreneurial performance.

Mu et al. (25) examined the effects of openness on entrepreneurial performance during the COVID-19 pandemic. The paper implements an online questionnaire survey to 238 entrepreneurs of small and micro firms in China from February 18, 2020, to February 26, 2020. The authors find openness increases entrepreneurial performance during the COVID-19 pandemic in related Chinese firms.

Shafi et al. (26) also investigated the role of the COVID-19 pandemic on micro, small, and medium-sized enterprises in Pakistan. The paper creates the data from an online questionnaire survey for 184 firms. The authors observe that most firms are negatively affected by the COVID-19-related shocks. The main problems are lack of credit sources, supply chain disruption, and demand reduction. Most firms go through the wait-and-see policy (over 83% of enterprises), and the authors concluded that the COVID-19 pandemic has negatively affected the entrepreneurial performance in Pakistan. Lu et al. (27) also show that small firms in the United States have been significantly affected by the COVID-19-related shocks. The paper uses the state-level data for the accommodation, food services, hospitality, and leisure sectors from January 10, 2020, to June 24, 2021.

There are also previous papers to analyze the effects of the COVID-19 pandemic on different economic indicators using state-level data in the United States. For instance, Zhang et al. (28) find that employment has been significantly affected by the COVID-19 pandemic at the state level in the United States from January 8, 2020, to May 30, 2020. The results are also valid in the employment of five different sectors. Using the data from January 24, 2020, to June 10, 2020, at the national and state levels, Dong et al. (29) observe that personal consumption expenditures in the United States have been negatively affected by the COVID-19-related shocks.

In short, several previous papers have examined the effects of the COVID-19-related shocks on entrepreneurial performance. However, most of these papers have focused on the case of developing countries, such as China and Pakistan. At this stage, our paper focuses on the case of the United States at the state level. As we have discussed, previous papers analyze the effects of the COVID-19 pandemic on economic indicators. However, there is no paper in the empirical literature to examine the direct impact of the COVID-19 pandemic on early-stage entrepreneurship activity in the United States.
TABLE 1  Descriptive statistics for all states.

| Variable                              | Mean   | Standard Dev. | Min.   | Max.   | Observation |
|---------------------------------------|--------|---------------|--------|--------|-------------|
| Rate of new entrepreneurs (RNE)       | 0.003  | 0.0008        | 0.001  | 0.006  | 102         |
| Opportunity share of new entrepreneurs (OSN) | 0.803  | 0.058         | 0.651  | 0.951  | 102         |
| Startup early job creation (SJC)      | 4.524  | 1.073         | 2.546  | 7.985  | 102         |
| Startup early survival rate (SSR)     | 0.794  | 0.033         | 0.628  | 0.895  | 102         |
| Kauffman early-stage entrepreneurship index (KESE) | 0.261  | 2.655         | −8.086 | 8.805  | 102         |
| Total cases per 100K (TC)            | 6,217  | 4,997         | 288    | 1,5623 | 102         |
| Total deaths per 100K (TD)           | 105    | 81            | 6      | 289    | 102         |

Data source: Chetty et al. (34) and Fairlie (30, 31).

Data, model and methodology

Data

This paper focuses on the panel dataset of 51 States in the United States between 2020 and 2021. There are 102 observations in total. Four indicators measure early-stage entrepreneurial activity (30, 31):

1) The rate of new entrepreneurs: This indicator shows the number of new entrepreneurs in a related year. Therefore, it is the widest indicator of the potential for business creation by population.

2) The opportunity share by new entrepreneurs: This indicator is the percentage of new entrepreneurs who created their businesses due to seeing it as an opportunity instead of a necessity. Measuring the number of people who created their businesses as a choice rather than a necessity is essential.

3) The startup’s early job creation: This indicator measures the total number of jobs created by start-ups per capita.

4) The startup’s early survival rate measures new firms’ 1-year average survival rate.

A summary index of entrepreneurship activity is defined as the Kauffman Early-Stage Entrepreneurship (KESE) indicator. The KESE indicator measures the early-stage entrepreneurial activity, and the data are obtained from Fairlie (30, 31). The KESE indicator is defined as the equal weights of the four indicators. The Kauffman Early-Stage Entrepreneurship (KESE) indicator is defined as an equally-weighted composite of the four indicators of early entrepreneurship activity.

Each indicator is based on the regional (state) level sample of more than 500,000 observations each year. The data covers more than 5 million employer businesses in the United States, focusing on the United States Census Bureau and Bureau of Labor Statistics (32, 33). Therefore, the KESE indicator follows entrepreneurial activity over the years across different regions (states) within a large longitudinal dataset (30, 31).

We also measure the effects of the COVID-19 pandemic. For this purpose, we use two indicators: The first is the reported total COVID-19 cases, and the second is the total deaths per 100,000 people. These indicators are measured at the state level, and the daily average values in 2020 and 2021 are considered in the panel dataset. The related state-level data in the United States are downloaded from Chetty et al. (34).

A summary of the descriptive statistics is provided in Table 1.

The rate of new entrepreneurs is an average of 0.003, and the standard deviation of 0.0008. The opportunity share by new entrepreneurs also has an average of 0.803 and a standard deviation of 0.058. The startup’s early job creation averages 4.524 and a standard deviation of 1.073. The startup’s early survival rate averages 0.794 and has a standard deviation of 0.033. Finally, the KESE indicator has an average of 0.261 with a standard average of 2.655. Regarding the COVID-19 pandemic, the average daily case is 6,217, with a standard deviation of 4,997 across the states. The average daily death number is 105, with a standard deviation of 81.

Table 2 reports the correlation matrix, which shows the correlations between the indicators of early-stage entrepreneurship activity and the COVID-19 pandemic.

Rate of New Entrepreneurs (RNE), Opportunity Share of New Entrepreneurs (OSN), Startup Early Job Creation (SJC), and Kauffman Early-Stage Entrepreneurship Index (KESE) all have positive correlations. As expected, these indicators negatively correlate with the Startup Early Survival Rate (SSR). However, there are mixed correlations between the indicators of early-stage entrepreneurship activity and the COVID-19 pandemic. Rate of New Entrepreneurs (RNE), Opportunity Share of New Entrepreneurs (OSN), Startup Early Job Creation (SJC), and Kauffman Early-Stage Entrepreneurship Index (KESE) negatively correlated with the Total COVID-19 Cases per 100K (TC) and Total COVID-19 Related Deaths per 100K (TD). The COVID-19 indicators positively correlate with the Startup Early Survival Rate (SSR). In addition, two measures of the COVID-19 pandemic, Total COVID-19 Cases per 100K (TC) and Total COVID-19 Related Deaths per 100K (TD), are positively correlated as expected.
Empirical model and estimation methodology

At this stage, we estimate the following model using fixed effects estimation techniques, the standard econometric methodology in various empirical papers. We consider the robust standard errors clustered at the state level in the fixed effects estimations.

\[
\text{ESAA}_{it} = \alpha_0 + \alpha_1 \text{COVID}_{it} + \theta_i + \mu_j + \epsilon_{it} \quad (1)
\]

\(\text{ESAA}_{it}\) presents the early-stage entrepreneurship activity, which is measured by the Rate of New Entrepreneurs (RNE), Opportunity Share of New Entrepreneurs (OSN), Startup Early Job Creation (SJC), Startup Early Survival Rate (SSR) and the Kauffman Early-Stage Entrepreneurship Index (KESE). 

\(\text{COVID}_{it}\) is the COVID-19-related indicators, which are the Total COVID-19 Cases per 100K (TC) and the Total COVID-19 Related Deaths per 100K (TD). \(\theta_i\) represents the time-fixed effects in 2020 and 2021. \(\mu_j\) Indicates the state-fixed effects. \(\epsilon_{it}\) represents the error terms in the estimations.

Empirical results

Table 3 provides state-level early-stage entrepreneurship indicators in the United States in 2020. According to the results in Table 3, the level of the Kauffman Early-Stage Entrepreneurship (KESE) indicator has the highest value in Florida (8.805), Oklahoma (5.019), and New Mexico (4.445), respectively. The lowest values are in Rhode Island (−6.035) and the District of Columbia (−3.286). Florida and New Mexico are again the top states in the Rate of New Entrepreneurs (0.0061 and 0.0055), respectively. The Opportunity Share of New Entrepreneurs has the highest scores in Arkansas and Utah. The Startup Early Job Creation scores the highest in Florida and the District of Columbia. Finally, Startup Early Survival Rate has the largest value in Washington and Illinois.

It seems that Florida has been the state with the highest value in terms of the Kauffman Early-Stage Entrepreneurship (KESE) indicator. New Mexico maintained a good score from 2020 to 2021. Rhode Island has the lowest score both in 2020 and 2021. Some states, such as Washington, gained a place from 2020 to 2021, but California seemed to be lost place between 2020 and 2021.

Table 5 provides the results for the COVID-19 Related Indicators in the United States in 2020 and 2021. Table 5 shows North Dakota, South Dakota, and Louisiana have the greatest values for the total COVID-19 cases per 100K people in 2020. Interestingly, these findings did not change significantly in 2021, as the largest values for the total COVID-19 cases per 100K people were observed in North Dakota, South Dakota, and Rhode Island in 2021. In addition, New Jersey, New York, and Connecticut have the biggest values for the total COVID-19-related deaths per 100K people in 2020. Interestingly, this evidence slightly changed in 2021 as the greatest values for the total COVID-19-related deaths per 100K people were observed in New Jersey, Mississippi, and Massachusetts in 2021. Note that COVID-19 vaccines have been fully effective in 2021, and there is a significant change in the randomness of the virus spread.

Table 6 also reports the findings of the fixed effects estimations with the robust standard errors clustered at the state level. According to the findings in Table 6, both total cases per 100K people and total COVID-19-related deaths per 100K people have significantly and negatively affected the...
TABLE 3  State level early-stage entrepreneurship indicators in the United States in 2020.

| State                | Rate of new entrepreneurs | Opportunity share of new entrepreneurs | Startup early job creation | Startup early survival rate | Kauffman early-stage entrepreneurship (Kese) index |
|----------------------|---------------------------|----------------------------------------|---------------------------|-----------------------------|-------------------------------------------------|
| Alabama              | 0.0025                    | 0.7987                                 | 4.0521                    | 0.7855                      | −2.0343                                         |
| Alaska               | 0.0048                    | 0.7844                                 | 3.5307                    | 0.7946                      | 3.0797                                          |
| Arizona              | 0.0038                    | 0.8142                                 | 4.8657                    | 0.7686                      | 0.9188                                          |
| Arkansas             | 0.0033                    | 0.9107                                 | 4.1707                    | 0.7714                      | 1.1253                                          |
| California           | 0.0043                    | 0.7969                                 | 6.3980                    | 0.8149                      | 4.1195                                          |
| Colorado             | 0.0035                    | 0.7695                                 | 6.5930                    | 0.7800                      | 0.7437                                          |
| Connecticut          | 0.0028                    | 0.7448                                 | 3.9758                    | 0.8702                      | 1.1113                                          |
| Delaware             | 0.0027                    | 0.8529                                 | 6.1348                    | 0.7609                      | −0.6328                                         |
| District of Columbia | 0.0024                    | 0.7719                                 | 7.9859                    | 0.7725                      | −1.2416                                         |
| Florida              | 0.0053                    | 0.8572                                 | 6.2217                    | 0.7650                      | 5.4653                                          |
| Georgia              | 0.0036                    | 0.8396                                 | 5.3224                    | 0.7556                      | 0.6489                                          |
| Hawaii               | 0.0041                    | 0.8441                                 | 3.1779                    | 0.7619                      | 0.9767                                          |
| Idaho                | 0.0038                    | 0.8800                                 | 6.2919                    | 0.8044                      | 3.8674                                          |
| Illinois             | 0.0027                    | 0.7848                                 | 4.1516                    | 0.7931                      | −1.4004                                         |
| Indiana              | 0.0025                    | 0.8103                                 | 3.4678                    | 0.7783                      | −2.3225                                         |
| Iowa                 | 0.0031                    | 0.8312                                 | 3.3973                    | 0.7971                      | 0.0949                                          |
| Kansas               | 0.0030                    | 0.8947                                 | 3.9341                    | 0.7547                      | −0.5803                                         |
| Kentucky             | 0.0027                    | 0.7945                                 | 3.6588                    | 0.7885                      | −1.6211                                         |
| Louisiana            | 0.0037                    | 0.7693                                 | 4.2002                    | 0.8025                      | 0.9372                                          |
| Maine                | 0.0040                    | 0.8556                                 | 4.4367                    | 0.7833                      | 2.3477                                          |
| Maryland             | 0.0026                    | 0.7929                                 | 3.9328                    | 0.7649                      | −2.7217                                         |
| Massachusetts        | 0.0027                    | 0.6597                                 | 5.0531                    | 0.8033                      | −2.5546                                         |
| Michigan             | 0.0029                    | 0.7430                                 | 4.1285                    | 0.7704                      | −2.4118                                         |
| Minnesota            | 0.0018                    | 0.6647                                 | 3.5717                    | 0.8067                      | −4.9027                                         |
| Mississippi          | 0.0032                    | 0.8387                                 | 3.8054                    | 0.7934                      | 0.2947                                          |
| Missouri             | 0.0037                    | 0.7902                                 | 4.9635                    | 0.7480                      | −0.3946                                         |
| Montana              | 0.0035                    | 0.7815                                 | 5.4788                    | 0.8084                      | 1.5446                                          |
| Nebraska             | 0.0027                    | 0.8238                                 | 4.8581                    | 0.7962                      | −0.3706                                         |
| Nevada               | 0.0032                    | 0.7991                                 | 5.3043                    | 0.7552                      | −1.0495                                         |
| New Hampshire        | 0.0031                    | 0.8273                                 | 3.5831                    | 0.7682                      | −1.0303                                         |
| New Jersey           | 0.0036                    | 0.7984                                 | 6.2993                    | 0.7931                      | 1.7584                                          |

(Continued)
TABLE 3 (Continued)

| State                | Rate of new entrepreneurs | Opportunity share of new entrepreneurs | Startup early job creation | Startup early survival rate | Kauffman early-stage entrepreneurship (Kese) index |
|----------------------|---------------------------|----------------------------------------|---------------------------|----------------------------|--------------------------------------------------|
| New Mexico           | 0.0051                    | 0.8075                                 | 4.0868                    | 0.7972                     | 4.3910                                           |
| New York             | 0.0039                    | 0.8388                                 | 4.9857                    | 0.7629                     | 1.4155                                           |
| North Carolina       | 0.0031                    | 0.8040                                 | 4.9010                    | 0.7745                     | −0.5621                                          |
| North Dakota         | 0.0032                    | 0.9512                                 | 4.3776                    | 0.7842                     | 1.9200                                           |
| Ohio                 | 0.0025                    | 0.7339                                 | 3.7249                    | 0.7876                     | −2.9550                                          |
| Oklahoma             | 0.0044                    | 0.8390                                 | 5.6188                    | 0.7878                     | 3.6147                                           |
| Oregon               | 0.0029                    | 0.8572                                 | 5.0302                    | 0.8631                     | 3.2502                                           |
| Pennsylvania         | 0.0018                    | 0.8309                                 | 3.6171                    | 0.7892                     | −3.0198                                          |
| Rhode Island         | 0.0016                    | 0.8071                                 | 3.5923                    | 0.7585                     | −5.1373                                          |
| South Carolina       | 0.0026                    | 0.8525                                 | 5.4242                    | 0.7733                     | −0.8227                                          |
| South Dakota         | 0.0029                    | 0.8297                                 | 4.2442                    | 0.7723                     | −1.1091                                          |
| Tennessee            | 0.0035                    | 0.8802                                 | 4.5755                    | 0.8337                     | 3.4338                                           |
| Texas                | 0.0038                    | 0.7963                                 | 5.5792                    | 0.7940                     | 1.9849                                           |
| Utah                 | 0.0024                    | 0.8602                                 | 5.2979                    | 0.7667                     | −1.5018                                          |
| Vermont              | 0.0040                    | 0.7917                                 | 2.9681                    | 0.7811                     | 0.7779                                           |
| Virginia             | 0.0023                    | 0.8009                                 | 5.1322                    | 0.7609                     | −2.7185                                          |
| Washington           | 0.0027                    | 0.7397                                 | 4.5496                    | 0.6287                     | −8.0868                                          |
| West Virginia        | 0.0016                    | 0.8531                                 | 3.2289                    | 0.8953                     | 0.6977                                           |
| Wisconsin            | 0.0021                    | 0.8335                                 | 3.5003                    | 0.7881                     | −2.3543                                          |
| Wyoming              | 0.0040                    | 0.8799                                 | 5.7010                    | 0.7685                     | 2.8178                                           |

Data source: Fairlie (30, 31).
| State         | Rate of new entrepreneurs | Opportunity share of new entrepreneurs | Startup early job creation | Startup early survival rate | Kauffman early-stage entrepreneurship (Kese) index |
|--------------|---------------------------|----------------------------------------|---------------------------|-----------------------------|-------------------------------------------------|
| Alabama      | 0.0026                    | 0.7722                                 | 3.4588                    | 0.7795                      | −2.5810                                         |
| Alaska       | 0.0042                    | 0.7761                                 | 3.5555                    | 0.8027                      | 1.9035                                          |
| Arizona      | 0.0039                    | 0.7843                                 | 4.7146                    | 0.8165                      | 2.4049                                          |
| Arkansas     | 0.0035                    | 0.9306                                 | 3.9182                    | 0.8054                      | 2.8989                                          |
| California   | 0.0043                    | 0.7757                                 | 5.7297                    | 0.8256                      | 4.0257                                          |
| Colorado     | 0.0042                    | 0.7259                                 | 6.0851                    | 0.8195                      | 2.9168                                          |
| Connecticut  | 0.0031                    | 0.6938                                 | 3.9780                    | 0.8129                      | −1.1055                                         |
| Delaware     | 0.0026                    | 0.7999                                 | 4.7410                    | 0.8231                      | −0.0149                                         |
| District of Columbia | 0.0022 | 0.7662 | 6.4622 | 0.7506 | −3.2868 |
| Florida      | 0.0061                    | 0.8608                                 | 6.5273                    | 0.8049                      | 8.8057                                          |
| Georgia      | 0.0047                    | 0.8156                                 | 5.7386                    | 0.7981                      | 4.3765                                          |
| Hawaii       | 0.0035                    | 0.7983                                 | 3.0252                    | 0.7341                      | −2.1592                                         |
| Idaho        | 0.0033                    | 0.8933                                 | 6.1123                    | 0.8085                      | 3.0410                                          |
| Illinois     | 0.0027                    | 0.7372                                 | 4.3184                    | 0.8480                      | 0.1600                                          |
| Indiana      | 0.0023                    | 0.7633                                 | 3.8109                    | 0.8359                      | −1.0486                                         |
| Iowa         | 0.0022                    | 0.8688                                 | 2.8399                    | 0.8375                      | −0.1085                                         |
| Kansas       | 0.0028                    | 0.8635                                 | 3.9048                    | 0.7679                      | −1.1004                                         |
| Kentucky     | 0.0029                    | 0.7229                                 | 3.2233                    | 0.8013                      | −1.8391                                         |
| Louisiana    | 0.0037                    | 0.8254                                 | 4.0898                    | 0.8000                      | 1.6110                                          |
| Maine        | 0.0042                    | 0.7911                                 | 4.3411                    | 0.8292                      | 3.4212                                          |
| Maryland     | 0.0029                    | 0.8072                                 | 2.6637                    | 0.8121                      | −0.5115                                         |
| Massachusetts | 0.0027                  | 0.6874                                 | 4.4657                    | 0.8209                      | −1.6042                                         |
| Michigan     | 0.0029                    | 0.6512                                 | 3.5882                    | 0.7893                      | −3.2415                                         |
| Minnesota    | 0.0020                    | 0.7630                                 | 3.4212                    | 0.8204                      | −2.5648                                         |
| Mississippi  | 0.0037                    | 0.8194                                 | 3.4065                    | 0.8243                      | 2.2428                                          |
| Missouri     | 0.0037                    | 0.8166                                 | 4.7426                    | 0.7712                      | 0.8169                                          |
| Montana      | 0.0036                    | 0.7576                                 | 6.1407                    | 0.8104                      | 1.7081                                          |
| Nebraska     | 0.0028                    | 0.7754                                 | 4.8399                    | 0.7639                      | −2.1321                                         |
| Nevada       | 0.0034                    | 0.7636                                 | 6.0649                    | 0.8321                      | 2.2196                                          |
| New Hampshire| 0.0029                    | 0.7227                                 | 3.7092                    | 0.7700                      | −2.9583                                         |

(Continued)
| State            | Rate of new entrepreneurs | Opportunity share of new entrepreneurs | Startup early job creation | Startup early survival rate | Kauffman early-stage entrepreneurship (Kese) index |
|------------------|---------------------------|----------------------------------------|---------------------------|-----------------------------|--------------------------------------------------|
| New Jersey       | 0.0037                    | 0.7227                                 | 5.8782                    | 0.7995                      | 0.9987                                           |
| New Mexico       | 0.0055                    | 0.8309                                 | 3.3012                    | 0.7758                      | 4.4450                                           |
| New York         | 0.0038                    | 0.8186                                 | 4.0834                    | 0.7924                      | 1.4865                                           |
| North Carolina   | 0.0034                    | 0.7647                                 | 5.7844                    | 0.8274                      | 1.9352                                           |
| North Dakota     | 0.0029                    | 0.9129                                 | 4.2145                    | 0.7825                      | 0.5884                                           |
| Ohio             | 0.0028                    | 0.7377                                 | 3.6897                    | 0.8139                      | -1.3676                                          |
| Oklahoma         | 0.0044                    | 0.8456                                 | 5.6800                    | 0.8231                      | 5.0189                                           |
| Oregon           | 0.0034                    | 0.7661                                 | 4.9315                    | 0.7838                      | -0.2053                                          |
| Pennsylvania     | 0.0017                    | 0.7791                                 | 3.4309                    | 0.8333                      | -2.5525                                          |
| Rhode Island     | 0.0019                    | 0.6694                                 | 3.5368                    | 0.7714                      | -6.0358                                          |
| South Carolina   | 0.0029                    | 0.8400                                 | 3.9249                    | 0.8234                      | 0.9551                                           |
| South Dakota     | 0.0024                    | 0.8474                                 | 3.9213                    | 0.8099                      | -0.5856                                          |
| Tennessee        | 0.0035                    | 0.8114                                 | 4.5577                    | 0.8072                      | 1.4072                                           |
| Texas            | 0.0037                    | 0.7957                                 | 5.1833                    | 0.8190                      | 2.4699                                           |
| Utah             | 0.0025                    | 0.9140                                 | 6.0240                    | 0.8183                      | 1.7987                                           |
| Vermont          | 0.0042                    | 0.7517                                 | 2.5466                    | 0.7854                      | 0.5605                                           |
| Virginia         | 0.0026                    | 0.7989                                 | 4.5891                    | 0.7954                      | -1.1570                                          |
| Washington       | 0.0029                    | 0.7567                                 | 4.4610                    | 0.8917                      | 2.5975                                           |
| West Virginia    | 0.0017                    | 0.8228                                 | 3.4415                    | 0.8108                      | -2.7846                                          |
| Wisconsin        | 0.0022                    | 0.8524                                 | 3.6937                    | 0.8235                      | -0.6371                                          |
| Wyoming          | 0.0041                    | 0.8518                                 | 3.8752                    | 0.7656                      | 1.6708                                           |

Data source: Fairlie (30, 31).
| State                  | Total cases per 100K (2020) | Total cases per 100K (2021) | Total deaths per 100K (2020) | Total deaths per 100K (2021) |
|-----------------------|-----------------------------|-----------------------------|-------------------------------|-----------------------------|
| Alabama               | 2,163                       | 12,639                      | 36                            | 240                         |
| Alaska                | 1,258                       | 11,844                      | 6                             | 60                          |
| Arizona               | 1,838                       | 13,095                      | 41                            | 246                         |
| Arkansas              | 1,986                       | 13,052                      | 31                            | 213                         |
| California            | 1,245                       | 10,310                      | 22                            | 155                         |
| Colorado              | 1,291                       | 10,066                      | 30                            | 124                         |
| Connecticut           | 1,564                       | 9,678                       | 103                           | 228                         |
| Delaware              | 1,730                       | 11,582                      | 50                            | 175                         |
| District of Columbia  | 1,681                       | 7,289                       | 68                            | 156                         |
| Florida               | 2,042                       | 12,321                      | 39                            | 194                         |
| Georgia               | 1,863                       | 11,457                      | 41                            | 200                         |
| Hawaii                | 485                         | 3,448                       | 6                             | 43                          |
| Idaho                 | 1,940                       | 12,068                      | 20                            | 137                         |
| Illinois              | 1,824                       | 11,339                      | 50                            | 200                         |
| Indiana               | 1,699                       | 12,105                      | 44                            | 208                         |
| Iowa                  | 2,378                       | 12,620                      | 34                            | 193                         |
| Kansas                | 1,749                       | 12,020                      | 21                            | 182                         |
| Kentucky              | 1,339                       | 11,951                      | 21                            | 164                         |
| Louisiana             | 2,468                       | 12,038                      | 84                            | 247                         |
| Maine                 | 374                         | 5,399                       | 9                             | 66                          |
| Maryland              | 1,552                       | 7,722                       | 49                            | 154                         |
| Massachusetts         | 1,573                       | 10,391                      | 95                            | 255                         |
| Michigan              | 1,367                       | 9,961                       | 61                            | 203                         |
| Minnesota             | 1,687                       | 11,242                      | 30                            | 136                         |
| Mississippi           | 2,255                       | 12,511                      | 63                            | 266                         |
| Missouri              | 1,642                       | 11,217                      | 28                            | 171                         |
| Montana               | 1,516                       | 11,917                      | 18                            | 166                         |
| Nebraska              | 2,052                       | 12,266                      | 21                            | 131                         |
| Nevada                | 1,894                       | 11,603                      | 33                            | 194                         |
| New Hampshire         | 626                         | 7,684                       | 24                            | 100                         |
| New Jersey            | 2,080                       | 11,340                      | 140                           | 289                         |
| New Mexico            | 1,477                       | 10,643                      | 34                            | 205                         |
| New York              | 2,074                       | 6,833                       | 138                           | 207                         |
| State             | Total cases per 100K (2020) | Total cases per 100K (2021) | Total deaths per 100K (2020) | Total deaths per 100K (2021) |
|------------------|-----------------------------|-----------------------------|-------------------------------|-------------------------------|
| North Carolina   | 1,402                       | 10,509                      | 22                            | 132                           |
| North Dakota     | 2,840                       | 15,623                      | 37                            | 210                           |
| Ohio             | 1,229                       | 10,280                      | 30                            | 170                           |
| Oklahoma         | 1,650                       | 12,730                      | 19                            | 183                           |
| Oregon           | 616                         | 5,705                       | 10                            | 74                            |
| Pennsylvania     | 1,178                       | 9,695                       | 51                            | 213                           |
| Rhode Island     | 2,189                       | 14,469                      | 79                            | 251                           |
| South Carolina   | 1,834                       | 12,785                      | 39                            | 201                           |
| South Dakota     | 2,636                       | 14,758                      | 31                            | 229                           |
| Tennessee        | 2,044                       | 13,886                      | 25                            | 191                           |
| Texas            | 1,649                       | 11,212                      | 30                            | 188                           |
| Utah             | 1,925                       | 13,806                      | 11                            | 77                            |
| Vermont          | 288                         | 4,366                       | 9                             | 44                            |
| Virginia         | 1,243                       | 8,395                       | 26                            | 130                           |
| Washington       | 805                         | 6,607                       | 19                            | 84                            |
| West Virginia    | 853                         | 10,368                      | 15                            | 175                           |
| Wisconsin        | 1,892                       | 12,495                      | 21                            | 139                           |
| Wyoming          | 1,436                       | 12,438                      | 11                            | 148                           |

Data source: Chetty et al. (34).
TABLE 6  Fixed effects estimations for the effects of the COVID-19 pandemic on early-stage entrepreneurship indicators.

| Indicators       | RNE     | RNE     | OSN     | OSN     | SJC     | SJC     | SSR     | SSR     | KESE    | KESE    |
|------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Total Cases      | -0.734  | -       | -0.207** | -       | -0.231** | -       | 0.220** | -       | -0.573** | -       |
| per 100K         | (0.524) | (0.067) | (0.086) | (0.056) | (0.285) |
| Total Deaths     | -       | -0.567  | -0.139** | -       | -0.168** | -       | 0.141** | -       | -0.371** | -       |
| per 100K         | (0.350) | (0.042) | (0.054) | (0.036) | (0.175) |
| Countries        | 102     | 102     | 102     | 102     | 102     | 102     | 102     | 102     | 102     | 102     |
| R-squared (adjusted) | 0.039  | 0.051   | 0.163   | 0.164   | 0.125   | 0.146   | 0.157   | 0.141   | 0.054   | 0.050   |

The dependent variables are five early-stage entrepreneurship indicators. The constant terms are included. The robust standard errors are reported in parentheses. **p < 0.01; ***p < 0.05.

Source: Authors’ estimations.

Opportunity Share of New Entrepreneurs (OSN), the Startup Early Job Creation (SJC), the and the Kauffman Early-Stage Entrepreneurship Index (KESE). The related coefficients of the total cases per 100K people and total COVID-19-related deaths are significant at the 1% level for the Opportunity Share of New Entrepreneurs (OSN), the Startup Early Job Creation (SJC), the Startup Early Survival Rate (SSR). At the same time, they are statistically significant at the 5% level for the Kauffman Early-Stage Entrepreneurship Index (KESE). It is important to note that the effects of the total cases per 100K people and total COVID-19-related deaths on the Rate of New Entrepreneurs (RNE) are adverse, but the coefficients are statistically insignificant.

The effects of the total cases per 100K people and total COVID-19-related deaths on the Startup Early Survival Rate (SSR) are positive. The related coefficients are statistically significant at the 1% level. Finally, the Adjusted R-squared scores change from 0.039 to 0.164.

Concluding remarks

In this paper, we examined the effects of the COVID-19 pandemic, which is measured by total cases and deaths per 100K people on the early-stage entrepreneurship activity, measured by the Kauffman Early-Stage Entrepreneurship indicators in the United States. The empirical analyses are based on the panel dataset of 51 States from 2020 to 2021. It has been found that the COVID-19 pandemic has negatively affected early-stage entrepreneurship activity. Further empirical analyses showed the positive impact of the COVID-19 pandemic on the startup’s early survival rate. However, new entrepreneurs’ rate and opportunity share are negatively affected by the COVID-19 pandemic.

Overall, our paper shows the adverse effects of the COVID-19 pandemic on the Kauffman Early-Stage Entrepreneurship indicators. However, our findings are limited to the United States economy. Future articles can focus on other developing and developed economies, where the early-stage entrepreneurship activity data are available. We suggest that the case of China and the United Kingdom can be notable countries to investigate the possible effects of the COVID-19-related uncertainty indicators on early-stage entrepreneurship activity.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

PK and LG: conceptualization and methodology. PK and LZ: formal analysis. PK and LG: writing—original draft. ZL and LZ: writing-revision. ZL: funding acquisition and project management. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.
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References

1. Etemad H. Managing uncertain consequences of a global crisis: SMEs encountering adversities, losses, and new opportunities. J Int Entrepreneurship. (2020) 18:125–44. doi: 10.1007/s11482-020-00279-z.

2. Goolkheee A, Syverson C, Feaz, lockdown, and diversion: comparing drivers of pandemic economic decline. 2020. J Public Econ. (2021) 193:104311. doi: 10.1016/j.jpubeco.2020.104311.

3. Gozgor G. Evidence on the determinants of public trust in governments during the COVID-19. Appl Res Qual Life. (2022) 17:559–78. doi: 10.1007/s11482-020-00992-6.

4. Roper S, Turner J. R&D and innovation after COVID-19: what can we expect? A review of prior research and data trends after the great financial crisis. Int Small Bus J (2020) 38:504–14. doi: 10.1016/j.isbjs.2020.04.006.

5. Chen T, Gozgor G, Koo CK. Pandemics and income inequality: what do the data tell for the globalisation era? Front Public Health. (2021) 9:674298. doi: 10.3389/fpubh.2021.674298.

6. Ketchen DJ, Craighead CW. Research at the intersection of entrepreneurship, supply chain management, and strategic management: opportunities highlighted by COVID-19. J Manage. (2020) 46:1330–41. doi: 10.1177/002221970945028.

7. Tønnessen Ø, Dhir A, Flåten BT. Digital knowledge sharing and creative performance: Work from home during the COVID-19 pandemic. Technol Forecast Soc Change. (2021) 170:120866. doi: 10.1016/j.techfore.2021.120866.

8. Aghion P, Howitt P. A model of growth through creative destruction. Econometrica. (1992) 60:323–51. doi: 10.2307/2951599.

9. Block JH, Thuirik R, Zhou H. What turns knowledge into innovative products? The role of entrepreneurship and knowledge spillovers. J Evol Econ. (2013) 23:693–718. doi: 10.1007/s00191-012-0263-9.

10. Block JH, Fisch CO, Van Praag M. The Schumpeterian entrepreneur: a review of the empirical evidence on the antecedents, behaviour and consequences of innovative entrepreneurship. Ind Innov. (2017) 24:61–93. doi: 10.1080/13662716.2016.1216397.

11. Schumpeter J. The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle. Piscataway, NJ: Transaction Publishers (1934).

12. Schumpeter JA. Capitalism, Socialism and Democracy. New York: Harper (1942).

13. Van Praag CM, Versloot PH. What is the value of entrepreneurship? a review of recent research. Small Bus Econ. (2007) 29:351–82. doi: 10.1007/s11187-007-9074-x.

14. Wennekers S, Thuirik R. Linking entrepreneurship and economic growth. Small Bus Econ. (1999) 13:27–56. doi: 10.1023/A:10080632 00484.

15. Meyer BH, Prescott B, Sheng XS. The impact of the COVID-19 pandemic on business expectations. Int J Forecast. (2022) 38:529–44. doi: 10.1016/j.ijforecast.2021.02.009.

16. Fairlie R, Fossen FM. The early impacts of the COVID-19 pandemic on business sales. Small Bus Econ. (2021) 58:1853–64. doi: 10.1007/s11187-021-00479-4.

17. Bartik AW, Bertrand M, Cullen Z, Glaeser EL, Luca M, Stanton C. The impact of COVID-19 on small business outcomes and expectations. Proc Nat Acad Sci. (2020) 117:17656–66. doi: 10.1073/pnas.2006991117.

18. Ratten V. COVID-19 and entrepreneurship: Future research directions. Strateg Chang. (2021) 30:91–8. doi: 10.1002/jsc.2392.

19. Forsythe E, Kahn LB, Lange F, Wiczer D. Labor demand in the time of COVID-19: Evidence from vacancy postings and UI claims. J Public Econ. (2020) 189:104238. doi: 10.1016/j.jpubeco.2020.104238.

20. Seetharaman P. Business models shifts: impact of Covid-19. Int J Inf Manage. (2020) 54:102173. doi: 10.1016/j.ijinfomgt.2020.102173.

21. Zahra SA. International entrepreneurship in the post Covid world. J World Bus. (2021) 56:101143. doi: 10.1016/j.jwb.2020.101143.

22. Bustos-Aguayo JM, Juárez-Najera M, García Larios C. Review of entrepreneurship in the COVID-19 era. Revista Ingenio. (2021) 9:1–15. doi: 10.22463/2011642X.3173.

23. Lunga AE, Bogodov IA, Stoica EA, Georgescu MR. From decision to survival—shifting the paradigm in entrepreneurship during the COVID-19 pandemic. Sustainability. (2021) 13:7674. doi: 10.3390/su13147674.

24. Lu Y, Wu J, Peng J, Lu L. The perceived impact of the COVID-19 epidemic: evidence from a sample of 4807 SMEs in Sichuan Province, China. Environ Hazards. (2020) 19:323–40. doi: 10.1080/17477891.2020.1763902.

25. Mu W, Xu J, Li F, Li S, Li X, Zhou M. Openness and entrepreneurial performance during COVID-19 pandemic: strategic decision comprehensiveness as an inconsistent mediator. Front Psychol. (2021) 12:806756. doi: 10.3389/fpsyg.2021.806756.

26. Shaif M, Liu J, Ren W. Impact of COVID-19 pandemic on micro, small, and medium-sized enterprises operating in Pakistan. Res Glob. (2020) 2:100018. doi: 10.1016/j.reglo.2020.100018.

27. Lu Z, Shang Y, Zhu L. The significant effects of the COVID-19 on leisure and hospitality sectors: evidence from the small businesses in the United States. Front Public Health. (2021) 9:753508. doi: 10.3389/fpubh.2021.753508.

28. Zhang X, Gozgor G, Lu Z, Zhang J. Employment hysteresis in the United States during the COVID-19 pandemic. Econ Res-Ekon Istraz. (2021) 34:3343–54. doi: 10.1080/13661767.X.2021.1875253.

29. Dong D, Gozgor G, Lu Z, Yan C. Personal consumption in the United States during the COVID-19 crisis. Appl Econ. (2021) 53:1311–6. doi: 10.1080/00036846.2020.1828808.

30. Fairlie, R. State Report on Early-Stage Entrepreneurship in the United States: 2020. Kansas City, MO: Kauffman indicators of entrepreneurship, Ewing Marion Kauffman Foundation (2021).

31. Fairlie, R. State Report on Early-Stage Entrepreneurship in the United States: 2021. Kansas City, MO: Kauffman indicators of entrepreneurship, Ewing Marion Kauffman Foundation (2022).

32. US Bureau of Labor Statistics. Current Population Survey (CPS), Washington, DC. U.S. Department of Labour (2022). Available online at: https://www.bls.gov/cps/.

33. US Bureau of Labor Statistics. Business Employment Statistics (BES), Washington, DC. U.S. Department of Labour (2022). Available online at: https://www.bls.gov/ces/.

34. Chetty R, Friedman JN, Hendren N, Stepner M. The economic impacts of COVID-19: Evidence from a new public database built using private sector data. National Bureau of Economic Research (NBER) Working Paper, No. 27431, NBER, Cambridge, MA (2020).