Macroeconomic lockdown effects of COVID-19 on small business in China: empirical insights from SEM technique

Daiyou Xiao1 · Jinxia Su2

Received: 19 January 2022 / Accepted: 30 March 2022 / Published online: 22 April 2022
© The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature 2022

Abstract
The coronavirus (COVID-19) outbreak in the China has exposed small- and medium-sized enterprises (SMEs) to a variety of challenges, some of which are potentially life-threatening to their sustainability. Therefore, this study aims to investigate the macroeconomic lockdown effects of COVID-19 on small business in China. A survey questionnaire with 313 participants was used to collect the data. In this study, the SEM technique was used to analyse model. The data have been gathered for the study from the managers and employees of Chinese SMEs. The findings of the study show that COVID-19 has a significant negative impact on financial performance, operational performance, profitability, access to finance, and customer satisfaction. According to the study’s findings, external support aids have a greater impact on SMEs’ ability to survive and thrive through innovation than on their actual performance. The findings of this study have a number of important practical consequences for small- and medium-sized business owners, governments, and policymakers.

Keywords  Financial performance · Operational performance · Macroeconomic lockdown · COVID-19 · Small- and medium-sized enterprises

Introduction
Pandemics and epidemics have a lasting effect on the economy and society as a whole (Ahmad et al. 2022; Hussain et al. 2022). According to Yang et al. (2022), the epidemic in the early 1830s, when cholera struck France (and other parts of central Europe) hard, was a case in point. Despite the fact that the disease killed at least 3% of Parisians in the first month, it was instrumental in spurring France’s industrial revolution (Ahmad et al. 2020; Ahmad and Wu 2022; Wen et al. 2022). Politics and social inequality were also exacerbated as poverty-stricken neighbourhoods were disproportionately affected, while wealthy neighbourhoods were able to flee pandemic-hit areas and lessen their contact with the local community (Elavarasan et al. 2021).

In many ways, the COVID-19 pandemic is unprecedented. First and foremost, it puts millions of lives at risk around the world (Ahmad et al. 2020; Shah et al. 2020; Shao et al. 2021). By the end of June 2021, it had nearly four million people have already died as a result across the globe (Le and Nguyen 2022). Social distancing guidelines to contain the virus also affected the service sector, which relies more heavily on larger number of micro and small businesses which relies more heavily on large corporations (Fang et al. 2022).

A similar lack of liquidity and solvency has been brought on by the lower profits of medium-sized and small enterprises (SMEs). Economic downturns of 2008–2009 exacerbated constraints on small- and medium-sized business working capital (SMEs) (Zamfir and Iordache 2022). Recessionary across the productive sectors, the economic impact is not evenly distributed; businesses in the tourism and transportation industries, as well as smaller businesses, are more vulnerable to the effects of social distance or confinement (Irfan and Ahmad 2021). Multidimensional shocks and their cross-industry interactions can only be taken into account in a framework that explicitly models the heterogeneity of...
firm vulnerability (Irfan and Ahmad 2022). To put it more succinctly: CGE models have recently been used to quantify indirect pandemic impacts. As a result, this includes studies that measure the impact of pandemics, whether they are global or country-specific (Chopdar et al. 2022). According to our knowledge, there are no intersectoral models for analysing business structure.

The Chinese central bank has announced a reduction in the required reserve ratio for banks beginning in February 2020 (Ahmad et al. 2021a; Fu et al. 2021; W. Iqbal et al. 2021a, b). A crisis-related package of assistance for small- and medium-sized businesses (SMEs) was unveiled by the government (Irfan et al. 2022). Deferred tax payments for small businesses, lower rent, waived administrative fees, subsidising R&D costs for small businesses and additional funding for SME loans were among the policies announced for small businesses in China at the regional level (Abbasi et al. 2022; B. Ahmad et al. 2021a, b, c; Irfan et al. 2021b). In response to the COVID-19 pandemic, 54 national governments instituted emergency policies and measures, according to the 2021 Global Entrepreneurship Monitor (GEM) report (Ali et al. 2021; Chandio et al. 2021; Islam et al. 2021). Global economies were supported with unprecedented amounts of state aid (Hao et al. 2021; Irfan et al. 2021c). While fiscal, administrative, and monetary tools have been deployed to chip the decline in ultimatum and employment, it appears unlikely that these measures will be sufficient to achieve a full offset. Top-down and bottom-up approaches are needed to address COVID-19, such as public and private rather than dying industries or failing businesses, initiatives to support productive entrepreneurs (Irfan et al. 2021d).

The role of SMEs is crucial in most economies because they stimulate economic growth, create jobs, and open new markets (Ahmad et al. 2020; Ahmad and Wu 2022; Fatima et al. 2019). Despite their importance to economic growth, SMEs are frequently the most affected by major public crises (Tanveer et al. 2021; Xiang et al. 2022). To sum it up, the lack of preparedness, vulnerability, reliance on central government and local agencies as well as an increased stress level for owner-managers all contribute to the greater impact on small businesses during times of crisis (Irfan et al. 2021e, 2020). But as far as we know, there have been very little prior research post-disaster policy needs of SMEs affected by disasters (Ganlin et al. 2021; Le and Ikram 2021; Paul et al. 2017; Ullah 2020; Zaverzhnetes and Łobacz 2021). Unlike environmental hazards, epidemics can have long-lasting and devastating effects on the general economy and the population, which is why it is important to keep an eye on both (Wellalage et al. 2021).

SMEs in China have been instrumental in the country’s growth (Khan et al. 2021; Rauf et al. 2021). Most Chinese small and medium enterprises (SMEs) operate in the same way and face the same obstacles as those in other countries' SMEs (Razzaq et al. 2021; Shi et al. 2022). Both developed and developing by comparison, the COVID-19 pandemic has a far greater impact on countries than any other large-scale environmental catastrophe (Razzaq et al. 2020). SMEs have been particularly hard hit. The specific policies may be devised by the government to assist small- and medium-sized businesses (SMEs) by better understanding the challenges and demands they face at the onset of an epidemic. In this study, based on an online survey of thousands of Chinese SMEs in Sichuan Province, the impact of the COVID-19 epidemic on Chinese small and medium enterprises (SMEs) was examined as a timely reference for other countries.

For the Chinese economy, this paper presents a general equilibrium model that disentangles intersectoral relationships in order to separate the productive flows of small and large firms. An evaluation of the COVID-19 pandemic-related production restrictions is possible with this methodological framework. This analysis is particularly relevant to China because of the wide range of sectors affected by these restrictions, which are heavily reliant on the service sector in general and tourism in particular. This article adds to the body of knowledge in the field of economy and the study of how aggregate fluctuations affect small businesses arise in networks.

The effects of workforce shocks should be quantified in a more precise manner, according to our proposal on small businesses and what happens when a shock hits the economy as a whole (Tang et al. 2022; Wu et al. 2021). Wei and Lihua (2022) proposed a hypothetical extraction method (HEM) to determine the relative importance of SMEs in sustaining the economy's activity and employment, particularly during the recession of COVID-19. Additionally, this research contributes to the development of a quantitative approach for incorporating part of the research methodology that incorporates industrial sector structure. Small and large businesses are separated in the System of National Accounts' supply and use tables, which makes this possible. We describe the mechanisms of income distribution in greater detail. Long Jr. and Plosser's real business cycle model is the most widely used framework for studying the link sectoral shocks and overall fluctuations are interconnected (Jun et al. 2022). Many seminal works in this tradition include: (Ansari et al. 2022), and (Elhajjar and Yacoub 2022). Input–output framework analysis is the focus of these studies, so they provide only a limited view of sectoral economic interactions when using this approach to study the economic activity's response to sectoral shocks that are unique to that sector.

The paper has now been arranged in this way. Section 2 provides a timely review of the literature for pandemic modelling, as well as a specific review of pandemic modelling by firm size. Methodology will be discussed in Sect. 3. A summary of the dataset and some descriptive statistics are
presented in Sect. 4. Section 5 summarises and clarifies the findings presented in the preceding sections and concludes the research lines that could be pursued in the future.

**Literature review**

Containment and mitigation strategies have been employed by numerous countries in the face of COVID-19, which is both an economic and a health problem (Elhajjar and Yacoub 2022). The pandemic was successfully contained in China, but concerns have been raised about the effectiveness of China’s measures elsewhere (M. Ahmad et al. 2021a; Deleon Frisnedi et al. 2022; Irfan et al. 2019, 2021a; Yasir et al. 2022). Forcibly limiting people’s freedom of movement became standard practice when the pandemic became out of control in Italy on March 9, 2020. This policy was then copied by governments in other countries in Europe, who also implemented nationwide lockdowns in March 2020. Lockdowns were then implemented across the majority of Asia, Africa, and the Americas as a precautionary measure.

Many industries have been adversely affected by the pandemic’s strict control measures (Ritika et al. 2022). However, according to Kurtaliqi et al. (2022), disasters affect the economy differently depending on the sector (Gao et al. 2020; Wu et al. 2022; Xu et al. 2022). Restrictions on people’s ability to move have manufacturing and retail sectors relying on physical stores were greatly affected by this, as well as the potential reduction in consumer spending as a result (Anser et al. 2020; Cucignatto et al. 2022; HUANG et al. 2022; Rao et al. 2022; Yu et al. 2021). The longer restrictions on human mobility are in place, the more detrimental they are to both personal and business-level behaviour. Tourism and hospitality-related spending on goods and services, for example, has been significantly reduced as a result of a dramatic decrease in consumer confidence (M. Ahmad et al. 2021b; Alzaied and Shehawy 2022; Irfan and Ahmad 2022; Jabeen et al. 2021). E-commerce, online education, and online meetings have all seen an increase in demand many people are working from home (Alzaied and Shehawy 2022), despite the widespread fear of infection from these kinds of encounters. Additionally, the pandemic’s health care demands have put a strain on the health and medical care sectors. It is important to look at the impact of the pandemic on different industries, as some have been affected more than others, and others have been given the opportunity to thrive.

In the majority of papers, SEIR (susceptible, exposed, infected, and recovered) models of disease transmission are presented, which were pioneered by Duong et al. (2022). This framework has been used to show Control measures and how pandemics spread. Epidemiological models that incorporate an objective function allow us to calculate the true costs of an infection, as well as potential remedies (Saha et al. 2022). More and more papers continue this tradition by examining the various determinants of morbidity as well as the economic optimal and trade-offs policy analysis. This paper takes a more recent approach, which looks at intersectoral relationships through the lens of an input–output model (Aguirre et al. 2021).

They don’t explain the importance of small- and medium-sized businesses, but two factors can help bridge the gap. There are two reasons for this: First, new statistical data have made it possible to integrate the in-depth analysis of the productive structure into a more general input–output model. As for the second, there has been a recent shift that emphasises the role of sectoral or firm-specific idiosyncratic shocks in explaining overall economic activity. Using aggregated data over time, studies of business bankruptcy often use idiosyncratic shocks to measure aggregate volatility, as Iancu et al. (2022) point out in their paper. Although an economy has a wide range of economic sectors, the central limit theorem has been used to calculate the impact of aggregate volatility on the business level, which assumes that all economic sectors are equally represented in an economy. An old school view holds that idiosyncratic shocks at the corporate level and overall fluctuations have their greatest impact when they affect large numbers.

In an industrialised economy, there are millions of companies that interact, so a small number of idiosyncratic shocks from large corporations or a collection of SMEs would likely have a negligible impact. Disaggregated microeconomic analysis at the firm- or sector-level has macroeconomics that has long ruled out the diversification argument. When there is a wide range of business sizes, the central limit theorem should not be used, according to a study by Yeon et al. (2022) and Wu (2021) that this argument was questioned.

Research by Mitręga and Choi (2021) and Malesios et al. (2021) and others shows that when firms size distribution follows a power-law distribution, idiosyncratic shocks do not cancel out and can thus generate significant aggregate fluctuations. Additionally, Khurana et al. (2021) argue it’s possible that the consequences of microeconomic shocks go far beyond the circumstances in which they occurred because of the existence of intersectoral interconnections. As a matter of fact, In the event of a microeconomic shock, it is possible for its effects to cascade throughout the entire economy, and have a significant aggregate impact on the economic performance of other businesses. Theoretical frameworks such as Turaev and Ganiev (2021), Wahyono and Hutahayan (2021), and Dias et al. (2022) can be used to characterise mechanism of shock transmission and the scope of aggregate fluctuations as an economic propagation instrument in vulnerable economic situations.

This COVID-19 pandemic could benefit greatly from better models that take into account business failure, credit...
rationing, and cross-sectoral ties at various firm sizes (SMEs and large companies). Economic agents' behaviour must be linked at both the macroeconomic and firm levels in order to study aggregate volatility more thoroughly and in greater detail during periods of economic turbulence. This requires robust and information-intensive instruments. There must be the collecting data on the various ways in which economic actors interact, so that it is possible to study how one sector's actions affect other sectors. It is therefore possible to make policy recommendations to drive government strategies that aim to minimise the impact of both large companies and small businesses ceasing operations.

It is well known that pandemics and natural disasters can have a negative impact on business. Natural disasters have been shown to retail, with fewer small businesses opening and more large ones going out of business, as well as lower private consumption spending, will have a significant impact (Latif et al. 2021; Yumei et al. 2021). Many studies have focused on manufacturing and agriculture, but few have looked at the effects of disasters and pandemics across multiple sectors of the economy (S. Iqbal et al. 2021a, b; Latif et al. 2021; Liu et al. 2021; Mohsin et al. 2021), despite the fact that various economic sectors have been found to be affected differently by pandemics and disasters. Figure 1 shows the macroeconomic lockdown effects of COVID-19 on small business in China.

Hypotheses

The following hypotheses have been developed as a result of the literature review:

H1: COVID-19 has positive impact on SMEs financial performance
H2: COVID-19 has positive impact on SMEs operational performance
H3: COVID-19 has positive impact on SMEs access to finance
H4: COVID-19 has positive impact on SMEs mergers and acquisition
H5: COVID-19 has positive impact on SMEs profitability
H6: COVID-19 has positive impact on SMEs remote work
H7: COVID-19 has positive impact on SMEs stakeholder satisfaction

Research method

Sample selection

A questionnaire survey and in-depth interviews conducted in early February 2021 provided the data for this study. A survey of SMEs in China’s was conducted to gauge how the COVID-19 epidemic is affecting those firms. In collaboration with six well-trained business management students, we distributed 500 self-administered questionnaires, 27 questionnaires were excluded from the total of 500 questionnaires because of missing data. The final data analysis utilised 313 questionnaires, resulting in a response rate of 61.3%. Male respondents made up 53% of the total sample size. Average age was 31 years, and the majority of participants had a bachelor's degree or more. Moreover, SMEs are selected with revenues, assets, and employees that fall below a predetermined threshold. However, the standards used to identify SMEs differ across countries and industries. SMEs are defined in China as businesses that fall below a certain threshold for one or more indicators in a specific industry sector. As a result, only those Chinese SMEs with less than 200 employees and annual revenues of less than $35.6 million US dollars were included in the sample. There are four categories of SMEs: primary industry, secondary industry,
tertiary industrial, and the new economy for the sake of statistical convenience. According to the National Bureau of Statistics, primary, secondary, and tertiary industries contributed 7.1%, 39.0%, and 53.9% of GDP in 2019, respectively. The term “new economy” refers to new, fast-growing industries. China’s new economy sectors have accelerated the country’s shift to higher-quality development in recent years. The demographics of the respondents are shown in Table 1.

Results and discussion

Common method bias

The present study collected data using a cross-sectional approach, and it is possible that common method bias (CMB) is a problem in the measurement model. Using Harman’s single factor test (Podsakoff et al. 2003), we tested for CMB, and all construct items in the proposed model were divided into various factors, with the first element accounting for 20% of the total variance. The findings are consistent with prior literature standards and demonstrate that CMB was not a problem in our study, as previously reported. In addition, we calculated the Skew value and Kurtosis values for each of the constructs, and the results were within an acceptable range of results. The findings revealed that all of the constructs are statistically significant, which confirmed the normality of the data. The statistical significance of all variables in the normality test indicates that the sample size is sufficient for the investigation under consideration. In addition to examining the validity and reliability of the data, we looked into the possibility of multicollinearity in the current study. We computed the variance inflation factor (VIF) and tolerance values for each of the constructs under consideration. Ahmad et al. (2021b) hypothesised that multicollinearity did not exist in the dataset if the VIF values were less than 10 and the tolerance values were greater than 0.10, respectively. The findings revealed that the VIF values have ranged from 1.01 to 1.19 over the course of the research. As a result, there are no significant multicollinearity problems with this study.

Confirmatory factor analysis (CFA)

The researcher used CFA to figure out the factor structure. Factor loadings have been used to test the validity of the factors. According to Patil et al. (2008), the validity threshold for factor loadings is 0.6. Based on Table 2, it is clear that none of the variables are invalid because their factor loadings have all exceeded the cut-off value. In addition, the researcher used composite reliability and Cronbach Alpha to assess the reliability of the latent constructs. Having reliability values above a certain threshold is preferable 0.7, but it is also acceptable if the value is greater than or equal to 0.6. Because of this, remote work has a Cronbach Alpha of 0.692, while the composite reliability for the same variable is 0.828, as shown by the measurement model. This demonstrates the statistical reliability of all constructs (Akroush et al. 2015; Breyton et al. 2021; Das 2017; Pícha and Navrátil 2019; Poudel et al. 2014).

Conversely, the concept of convergent validity is employed to establish the existence of a relationship between two variables (Alolayyan et al. 2022). It was found that convergent validity can be determined by an AVE threshold of 0.5 in the same research. No latent construct has a convergent validity lower than 0.619, which is significantly higher than the 0.5 level of significance.

The HTMT ratio can be used to assess discriminant validity in addition to ensuring that a pair of latent constructs is distinct from each other. It was found that a value of 0.9 was the maximum acceptable value in a study by Jensen et al. (2020). So there is no infringement of the assumption of discriminant validity because there are no associations with a value greater than 0.9 as shown in Table 3.

Path assessment

In order to determine the significance of all the variables, the researcher used bootstrapping, which is a resampling technique. Table 4 and Fig. 2 summarise the findings in this study’s final findings. According to the results, COVID-19
| Variables | Indicators | Factor Loadings | Composite Reliability | Cronbach's Alpha | AVE  |
|-----------|------------|----------------|-----------------------|------------------|------|
| **Financial performance** | FP1 | 0.750 | 0.849 | 0.833 | 0.797 |
| | FP2 | 0.799 | | | |
| | FP3 | 0.783 | | | |
| | FP4 | 0.875 | | | |
| **Operational performance** | OP1 | 0.786 | 0.867 | 0.787 | 0.690 |
| | OP2 | 0.862 | | | |
| | OP3 | 0.865 | | | |
| | OP4 | 0.967 | | | |
| **Access to Finance** | AF1 | 0.759 | 0.846 | 0.840 | 0.815 |
| | AF2 | 0.818 | | | |
| | AF3 | 0.911 | | | |
| | AF4 | 0.862 | | | |
| **Mergers and Acquisitions** | MAA1 | 0.900 | 0.912 | 0.875 | 0.775 |
| | MAA2 | 0.860 | | | |
| | MAA3 | 0.958 | | | |
| | MAA4 | 0.906 | | | |
| **Profitability** | PRO1 | 0.821 | 0.850 | 0.939 | 0.869 |
| | PRO2 | 0.926 | | | |
| | PRO3 | 0.924 | | | |
| | PRO4 | 0.891 | | | |
| **Remote Work** | RW1 | 0.756 | 0.888 | 0.792 | 0.719 |
| | RW2 | 0.764 | | | |
| | RW3 | 0.663 | | | |
| | RW4 | 0.750 | | | |
| **Customer Satisfaction** | CS1 | 0.773 | 0.747 | 0.826 | 0.853 |
| | CS2 | 0.883 | | | |
| | CS3 | 0.624 | | | |
| | CS4 | 0.769 | | | |
| **COVID-19** | CV1 | 0.858 | 0.834 | 0.769 | 0.858 |
| | CV2 | 0.874 | | | |
| | CV3 | 0.967 | | | |

| Variable | Financial performance | Operational performance | Access to Finance | Mergers and Acquisitions | Profitability | Remote Work | Customer Satisfaction | COVID-19 |
|----------|-----------------------|-------------------------|-------------------|--------------------------|--------------|-------------|-----------------------|----------|
| Financial performance | 0.536 | | | | | | | |
| Operational performance | 0.087 | 0.045 | | | | | | |
| Access to Finance | 0.691 | 0.319 | 0.504 | | | | | |
| Mergers and Acquisitions | 0.707 | 0.860 | 0.616 | 0.431 | | | | |
| Profitability | 0.506 | 0.769 | 0.511 | 0.525 | 0.658 | | | |
| Remote Work | 0.505 | 0.498 | 0.780 | 0.478 | 0.658 | 0.584 | | |
| Customer Satisfaction | 0.499 | 0.498 | 0.410 | 0.478 | 0.658 | 0.509 | 0.511 | |
| COVID-19 | 0.582 | 0.589 | 0.503 | 0.478 | 0.658 | 0.562 | 0.558 | 0.552 |
has a statistically significant negative effect on SMEs financial performance, \(B = -0.514; p \text{ value } 0.001\). The findings reveal that due to microeconomic lockdown in different cities of China, 0.514% financial performance of SMEs is reduced. There was a negative impact on China’s SMEs in terms of business norms, which means that operational procedures can be improved by incorporating innovative elements. COVID-19 also had a statistically significant and positive impact on the population on remote work \(B = 0.092; p \text{ value } 0.001\). The findings show that COVID-19 had a statistically significant and beneficial impact on operational performance, but the impact on profitability statistically significant and negative \(B = -0.429; p \text{ value } 0.001\). It means that profitability of SMEs reduces during the COVID-19 period. SMEs’ profitability and customer satisfaction were both shown to have decreased as a result of the COVID-19 macroeconomic lockdown. In the end, it can be said that COVID-19 has had a positive impact on business practices. However, China’s SMEs saw a decline in business performance.

**Predictive relevance and quality of the model**

In order to certify a model’s predictive relevance, the Q-square must be above 0 Menkeh (2021) blindfolding method. Table 5 shows the results in terms of R-squared and Q-square. Except for mergers and acquisitions, the results show that all models are sufficiently predictive. According to COVID-19, the model’s quality is determined by the variation in the model’s variance, which accounts for 24.67% of the novel operating processes that may differ from one another, acquisitions, profitability, and remote work.

### Table 4 Hypothesis testing

| Hypothesis | Path | Coefficient | T Statistics | P Values |
|------------|------|-------------|-------------|---------|
| H1         | COVID-19 -> Financial performance | -0.514*** | 12.93       | 0.000   |
| H2         | COVID-19 -> Operational performance | 0.092*** | 1.523       | 0.001   |
| H3         | COVID-19 -> Access to Finance | -0.641*** | 15.92       | 0.000   |
| H4         | COVID-19 -> Mergers and Acquisitions | 0.065 | 14.361       | 0.152   |
| H5         | COVID-19 -> Profitability | -0.429*** | 7.448       | 0.000   |
| H6         | COVID-19 -> Remote Work | 0.452** | 10.436       | 0.005   |
| H7         | COVID-19 -> Customer Satisfaction | -0.44*** | 9.938       | 0.000   |

### Table 5 R-squared and Q-square

| Variable            | R Square | R Square Adjusted | Q-squared |
|---------------------|----------|-------------------|-----------|
| Financial performance | 0.271    | 0.268             | 0.166     |
| Operational performance | 0.369    | 0.365             | 0.201     |
| Access to Finance    | 0.421    | 0.419             | 0.158     |
| Mergers and Acquisitions | 0.350    | 0.348             | 0.210     |
| Profitability        | 0.289    | 0.286             | 0.216     |
| Remote Work          | 0.448    | 0.445             | 0.270     |
| Customer Satisfaction | 0.243    | 0.241             | 0.371     |
Discussion

COVID-19's influence on business practices and performance was comprehensively investigated in this research. According to the findings in the preceding section, the COVID-19 has had a substantial impact on Chinese SMEs' performance and operational standards. The results of the path assessment show that Innovative operating processes of SMEs have been influenced greatly by COVID-19. According to previous research, COVID-19 has had a significant impact on the development of new operational procedures. Restrictions placed on businesses by COVID-19 have necessitated the development of innovative operational procedures to ensure efficient business operations in uncertain situations, as outlined by Apicella et al. (2022). Similarly, according to Nurlaelah (2022), as a result, businesses have been forced to reshape themselves in response to the new market conditions in their operations or inventing themselves as per the situation of COVID-19, as per the study. When it comes to small firms' innovative operational methods, COVID-19 has a considerable impact.

Furthermore, this study's primary findings show that COVID-19 had a significant but negative impact on the performance of SMEs. The detrimental Throughout the scientific literature, the influence of COVID-19 on a company's bottom line has long been documented, as evidenced by numerous studies. Kharlanov et al. (2022) claim that the COVID-19 pandemic and the ensuing lockdowns have harmed SMEs by causing logistical blockages, labour shortages, and a significant drop in customer demand. The COVID-19 pandemic has had a significant impact on the company's profitability as a result of these issues. In contrast, the study's primary findings show no connection between COVID-19 and acquisitions and mergers. According to the study (Gusti and Purnamawati 2022), which claims that the COVID-19 pandemic is causing most business deals to fall through, as a result, the majority of businesses are holding back until the market is more stable before engaging in merger and acquisition activity. COVID-19 has a significant impact on remote work, stakeholder satisfaction, and safety, as the primary findings of this study confirm. Finally, the findings of this study show that Innovative operational techniques, profitability, stakeholder satisfaction, and safety are all impacted by COVID-19. Remote work by SMEs is also impacted by COVID-19, all of which were examined in depth.

Aidoo et al. (2021) state that the pandemic has affected China's economy and SMEs in a variety of ways, both on the supply and demand sides. Companies in China have had to deal with a shortage of workers because many of them are sick, which has had an impact on the country's productivity. A wide variety of products are also in high demand grew as a result. However, the supply has been affected and certain policies have been developed as a result macroeconomic lockdown limits due to a lack of productivity. According to Zainal et al. (2022), more than 5800 businesses in the country were forced to close because of approximately 40% of the staff was laid off as a result of the epidemic. Because of this, the country's overall economy was affected, and 80% of small businesses have not been able to reopen since the pandemic began in 2020. Due to low product demand, many companies were forced to close their doors, which had an impact on supply-side factors (Younis and Elbanna 2021). SMB losses are expected to fall by 20%, resulting in $167 billion in losses for small- and medium-sized businesses, respectively.

Conclusion and policy recommendations

A survey questionnaire was used to gather the primary quantitative data needed to meet the study's primary objective. These data have been analysed using the SEM model technique confirmatory factor analysis and path assessment are two methods of testing. According to this study's findings, COVID-19 has a significant impact on financial performance, operational performance, profitability, remote work, and customer satisfaction. COVID-19, on the other hand, appears to have no significant impact on SMEs' mergers and acquisitions. Small- and medium-sized businesses in China's tertiary sector have experienced a 46% drop in their normal capacity since the beginning of the pandemic and its ensuing macroeconomic lockdown measures in the first quarter of 2020. Furthermore, this study's primary findings show that COVID-19 had a significant but negative impact on the performance of SMEs. SMEs in China are currently being negatively impacted by COVID-19, according to the study's findings, which focus on the following aspects. Due to COVID-19, the researcher was able to fill in the void dealing with China's present small- and medium-sized business concerns and problems.

Our approach contributes to the frontier of knowledge where small business economics and the source of aggregate variations are studied academically. Initially, we examine how the COVID-19 pandemic affects the economic activity of different business sizes. Consistent macroeconomic accounting frameworks can be used to establish the link between shocks in SMEs and large enterprises and their aggregated impacts. In addition, our approach contributes to academic studies of the micro-basis of macroeconomic fluctuations that are more mainstream (i.e. standard business cycle theory, with micro-features, and the granular origins of aggregate fluctuations).
Based on our findings from SEM, it is clear that both small and large businesses are critical to the economy. With these findings, we are able to reconcile our mixed narratives about how these categories contribute to economic activity. The specific industry that is disrupted needs to be considered in order to take into account the relative importance of each factor on small- and medium-sized businesses. Small- and medium-sized businesses (SMEs) experienced a 43% decline in activity as a result of the COVID-19 pandemic. Employers lost two-thirds of their workforce to small- and medium-sized businesses. As a result, while large firms are more critical to the stability of the economy, small- and medium-sized businesses are critical to the stability of the economy, particularly small- and medium-sized businesses (SMEs) and microenterprises in particular have a significant impact on employment.

Policy implications

1. SMEs need to have a crisis plan in place in order to handle a situation like COVID-19 effectively. In order to accomplish this, human resources must create a comprehensive crisis plan that involves all levels of the organisation and is widely disseminated in a timely manner.

2. A company’s actual revenues and expenses, both variable and fixed, should be properly assessed, too. Using these data, entrepreneurs will be able to make more informed decisions about their company’s future. The company’s profitability may be less affected by COVID-19 as a result of this.

3. The SMEs have also been advised to examine the viability of their current business model, as well. In the light of the market’s rapid shifts, companies must reevaluate their business models and the current state of their operations in the light of these assumptions about costs and revenues.

4. International transaction expenses have gone up and travel has decreased as a result of a decrease in employment, and a decrease in demand for services that require proximity between people have all been examined in business model for pandemic analysis in computing environments (Wendt et al. 2021). Due to the simultaneous impact on both supply and demand, general equilibrium models are required when putting an end to economic activity.

5. In the China, SMEs are a major focus of business support policies. A first approximation shows, for example, that the financial sector contributes significantly to the preservation of economic activity. When these companies are disrupted, we predict that demand will fall further. In the light of these findings, credit policies for SMEs that have a significant impact on GDP could be supported by these findings. It appears that SMEs had a significant impact on the Chinese economy, particularly on microenterprises (those with fewer than ten employees) and smaller firms under 50 employees.

Limitations and future research direction

A major limitation of this study is its focus on SMEs. The scope of this study can be expanded by incorporating multinational corporations (MNCs) into future studies. In addition, the study’s lack of qualitative data was a major drawback. A mixed-methods research design can thus be used to provide more definitive results in the future.

Author contribution Xiao Daiyou1 contributed to conceptualisation, data curation, methodology, writing—original draft, and supervision; Su Jinxia contributed to visualisation, editing, and software.

Funding This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability The data can be available on request.

Declarations

Ethical approval and consent to participate The authors declare that they have no known competing financial interests or personal relationships that seem to affect the work reported in this article. We declare that we have no human participants, human data, or human tissues.

Consent for publication N/A.

Competing interest statement The authors declare no conflict of interest.

References

Abbasi KR, Shahbaz M, Zhang J, Irfan M, Alvarado R (2022) Analyze the environmental sustainability factors of China: The role of fossil fuel energy and renewable energy. Renew Energy 187:390–402. https://doi.org/10.1016/j.renewen.2022.01.066

Aguirre S, Puertas E, Bruno G, Priarone PC, Settineri L. 2021 A sustainability maturity model for micro , small and medium-sized enterprises (MSMEs) based on a data analytics evaluation approach 311. https://doi.org/10.1016/j.jclepro.2021.127692

Ahmad B, Da L, Asif MH, Irfan M, Ali S (2021a) Understanding the Antecedents and Consequences of Service-Sales Ambidexterity : A Motivation-Opportunity-Ability (MOA) Framework. Sustainability 13:9675. https://doi.org/10.3390/su13179765

Ahmad B, Irfan M, Salem S, Asif MH (2022) Energy Efficiency in the Post-COVID-19 Era: Exploring the Determinants of Energy-Saving Intentions and Behaviors. Front Energy Res 9:824318. https://doi.org/10.3389/feng.2021.824318

Ahmad M, Iram K, Jabeen G (2020) Perception-based influence factors of intention to adopt COVID-19 epidemic prevention in China. Environ Res 190:109995. https://doi.org/10.1016/j.envres.2020.109995

Ahmad M, Jabeen G, Irfan M, Işık C, Rehman A (2021b) Do inward foreign direct investment and economic development improve local environmental quality: aggregation bias puzzle. Environ
Zaverzhenets M, Łobacz K (2021) Digitalising and visualising innovation process: comparative analysis of digital tools supporting innovation process in SMEs. Procedia Comput Sci 192:3805–3814. https://doi.org/10.1016/j.procs.2021.09.155

Podsakoff PM, MacKenzie SB, Lee JY, Podsakoff NP (2003) Common method biases in behavioral research: a critical review of the literature and recommended remedies. J Appl Psychol 88(5):879

Poudel S, Nyaupane GP, Budruk M (2014) Stakeholders’ Perspectives of Sustainable Tourism Development: A New Approach to Measuring Outcomes. J Travel Res 55:465–480. https://doi.org/10.1177/0047287514563166

Rao F, Tang YM, Chau KY, Iqbal W, Abbas M (2022) Assessment of energy poverty and key influencing factors in N11 countries. Sustain Prod Consum 30:1–15. https://doi.org/10.1016/j.syspc.2021.11.002

Rauf A, Ozturk I, Ahmad F, Shehzad K, Chandiao AA, Irfan M (2021) Do Tourism Development, Energy Consumption and Transportation Demolish Sustainable Environments? Evidence from Chinese Provinces. Sustainability 13:12361. https://doi.org/10.3390/su13221261

Razzaq A, Ajaz T, Li JC, Irfan M, Sukssatan W (2021) Investigating the asymmetric linkages between infrastructure development, green innovation, and consumption-based material footprint: Novel empirical estimations from highly resource-consuming economies. Resour Policy 74:102302. https://doi.org/10.1016/j.resourpol.2021.102302

Razzaq A, Sharif A, Aziz N, Irfan M, Jermisittiparsert K (2020) Asymmetric link between environmental pollution and COVID-19 in the top ten affected states of US: A novel estimations from quantile-on-quantile approach. Environ Res 191:110189. https://doi.org/10.1016/j.envres.2020.110189

Ritika, Himanshu, Kishor N, 2022 Modeling of factors affecting investment behavior during the pandemic: a grey-DEMATEL approach. J. Financ. Serv. Mark. 1–14 https://doi.org/10.1007/s41264-022-00141-4/FIGURES/4

Saha S, Mishra M, Bhuiyama A (Eds.), 2022. Economic and Societal Transformation in Pandemic-Trapped India. New Front Reg Sci: Asian Perspect 55 https://doi.org/10.1007/978-981-16-5755-9

Shah SAA, Longsheng C, Solangi YA, Ahmad M, Ali S (2020) Energy trilemma based prioritization of waste-to-energy technologies: Implications for post-COVID-19 green economic recovery in Pakistan. J Clean Prod 284:124729. https://doi.org/10.1016/j.jclepro.2020.124729

Shao L, Zhang H, Irfan M, 2021 How public expenditure in recreational and cultural industry and socioeconomic status caused environmental sustainability in OECD countries?. Econ Res Istraživanja 1–18https://doi.org/10.1080/1331677x.2021.2015614

Shi R, Irfan M, Liu G, Yang X, Su X (2022) Analysis of the Impact of Livestock Structure on Carbon Emissions of Animal Husbandry: A Sustainable Way to Improving Public Health and Green Environment. Front Public Heal 10:835210. https://doi.org/10.3389/fpubh.2022.835210

Tang C, Irfan M, Razzaq A, Daghar V (2022) Natural resources and financial development: Role of business regulations in testing the resource-curse hypothesis in ASEAN countries. Resour Policy 76:102612. https://doi.org/10.1016/j.resourpol.2022.102612

Tanveer A, Zeng S, Irfan M (2021) Do Perceived Risk, Perception of Self-Efficacy, and Openness to Technology Matter for Solar PV Adoption? An Application of the Extended Theory of Planned Behavior. Energies 14:5008. https://doi.org/10.3390/en14165008

Turaev I, Ganiev F (2021) Management Strategy of Small and Medium Enterprises during the Pandemic Covid-19. J La Bisecoman 2:7–12. https://doi.org/10.37890/JOURNALLABISECOMAN. V21I321

Ullah B (2020) Financial constraints, corruption, and SME growth in transition economies. Q Rev Econ Financ 75:120–132. https://doi.org/10.1016/j.qref.2019.05.009

Wahyono, Hutahayon B (2021) The relationships between market orientation, learning orientation, financial literacy, on the knowledge competence, innovation, and performance of small and medium textile industries in Java and Bali. Asia Pacific Manag Rev 26:39–46. https://doi.org/10.1016/J. APMRV. 2020.07.001

Wei Z, Lihua H (2022) Effects of tourism and eco-innovation on environmental quality in selected ASEAN countries. Environ Sci Pollut Res 1:1–15. https://doi.org/10.1007/S11356-021-17541-Z/TABLES/9

Wellalage NH, Kumar V, Hunjra AI, Al-Faryan MAS, 2021. Environmental performance and firm financing during COVID-19 outbreaks: Evidence from SMEs. Financ Res Lett 102568https://doi.org/10.1016/J.FRL.2021.102568

Wen C, Akram R, Irfan M, Iqbal W, Daggar V, Acevedo-Duqued Á, Saydaliev HB (2022) The asymmetric nexus between air pollution and COVID-19: Evidence from a non-linear panel autoregressive distributed lag model. Environ Res 209:112848. https://doi.org/10.1016/j.envres.2022.112848

Wendt C, Adam M, Benlian A, Kraus S (2021) Let’s Connect to Keep the Distance: How SMEs Leverage Information and Communication Technologies to Address the COVID-19 Crisis. Inf Syst Front 1:1–19. https://doi.org/10.1007/S10796-021-10210-Z/TABLES/4

Wu B, Monfort A, Jin C, Shen X (2022) Substantial response or impression management? Compliance strategies for sustainable development responsibility in family firms. Technol Forecast Soc Change 174:121214. https://doi.org/10.1016/j.techfore.2021.121214

Wu H, Ba N, Ren S, Xu L, Chai J, Irfan M, Hao Y, Lu ZN, 2021 The impact of internet development on the health of Chinese residents: Transmission mechanisms and empirical tests. Socioecon Plann Sci 101178https://doi.org/10.1016/j.seps.2021.101178

Wu Z (2021) Problems and Countermeasures of International Trade Financing of Small and Medium-Sized Enterprises in China. Proc Bus Econ Stud. https://doi.org/10.26689/pbes.v4i4.2408

Xiang H, Chau KY, Iqbal W, Irfan M, Daggar V (2022) Determinants of Social Commerce Usage and Online Impulse Purchase: Implications for Business and Digital Revolution. Front Psychol 13:837042. https://doi.org/10.3389/fpsyg.2022.837042

Xu L, Chen W, Wang S, Mohammed BS, Lakshmana Kumar R, 2022 Analysis on risk awareness model and economic growth of finance industry. Ann Oper Res 1–22https://doi.org/10.1007/s10479-021-04516-z

Yang L, Murad M, Mirza F, Chaudhary NI, Saeed M (2022) Shadow of cyber ostracism over remote environment: Implication on remote work challenges, virtual work environment and employee mental well-being during a Covid-19 pandemic. Acta Psychol (amst) 225:103552. https://doi.org/10.1016/J.ACTPSY.2022.103552

Yasir A, Hu X, Ahmad M, Alvarado R, Anser MK, Işık C, Choo A, Ausaf A, Khan IA (2022) Factors Affecting Electric Bike Adoption: Seeking an Energy-Efficient Solution for the Post-COVID Era. Front Energy Res 0:1006. https://doi.org/10.3389/FENRG.2021.817107

Yeon G, Hong PC, Elangovan N, Divakar GM (2022) Implementing strategic responses in the COVID-19 market crisis: a study of small and medium enterprises (SMEs) in India. J Indian Bus Res. https://doi.org/10.1108/JIBR-04-2021-0137/FULL/PDF

Younis H, Elbanna S, 2021 How Do SMEs Decide on International Market Entry? An Empirical Examination in the Middle East. J Int Manag 100902https://doi.org/10.1016/j.intman.2021.100902

Yu J, Tang YM, Chau KY, Nazar R, Ali S, Iqbal W (2021) Role of solar-based renewable energy in mitigating CO2 emissions:
Evidence from quantile-on-quantile estimation. Renew Energy 182:216–226. https://doi.org/10.1016/j.renene.2021.10.002

Yumei H, Iqbal W, Nurunnabi M, Abbas M, Jingde W, Chaudhry IS (2021) Nexus between corporate social responsibility and firm’s perceived performance: evidence from SME sector of developing economies. Environ Sci Pollut Res 28:2132–2145. https://doi.org/10.1007/s11356-020-10415-w

Zainal M, Bani-Mustafa A, Alameen M, Toglaw S, Mazari AA (2022) Economic Anxiety and the Performance of SMEs during COVID-19: A Cross-National Study in Kuwait. Sustain 14:1112. https://doi.org/10.3390/SU14031112

Zamfir, I.C., Iordache, A.M.M., 2022. The influences of covid-19 pandemic on macroeconomic indexes for European countries. https://doi.org/10.1080/00036846.2022.2031858

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.