How does COVID-19 pandemic affect entrepreneur anxiety? The role of threat perception and performance pressure

Yunjian Li, Hongchuan Chen*, Chunzhen Liu and Hong Liu

School of Management, Guangzhou University, Guangzhou, China

The entrepreneurial firms may be more vulnerable to the COVID-19 pandemic, and the entrepreneurs of entrepreneurial firms are also threatened by the revenues decline and business failure, which vehemently affect their well-being. The mental health of the entrepreneur decides whether the entrepreneurial firms can make the right decision, which is related to the healthy development of the entrepreneurial firms. Based on the event system theory and the cognitive appraisal theory, this paper aims to explore the effect of COVID-19 pandemic on the entrepreneur anxiety, and the threat perception and performance pressure are introduced to investigate the mediating mechanism and boundary of this effect. Using the simple random sampling to obtain questionnaire survey data, 168 entrepreneurs of entrepreneurial firms have participated in the empirical study, and the research results are as follows. First, the COVID-19 pandemic significantly positively affects entrepreneur anxiety. Second, the entrepreneur threat perception plays a mediating role between the COVID-19 pandemic and the entrepreneur anxiety, which means the COVID-19 pandemic can enhance the external threat perception of entrepreneurs, and then affect the entrepreneur anxiety. Third, the positive effect of the COVID-19 pandemic on the entrepreneur anxiety is strengthened by the entrepreneur performance pressure, while the positive effect of entrepreneur threat perception on entrepreneur anxiety is weakened by the entrepreneur performance pressure. The above findings are helpful to explore the mechanism of the COVID-19 pandemic and other critical crisis events on entrepreneurs’ mental health from the new perspective of cognitive appraisal theory and event system theory, filling the research gaps between the COVID-19 pandemic and entrepreneur anxiety. Besides, this study broadens the applied range of the cognitive appraisal theory and the event system theory in the fields of crisis situations and entrepreneur research, and enriches the research outputs. Furthermore, this study will help provide a new theoretical analysis insight for the related research on how the COVID-19 pandemic affects entrepreneurs’ psychology, and further deepen researchers to understand the mechanism of entrepreneur anxiety under the COVID-19 pandemic, providing theoretical inspirations for reducing entrepreneur anxiety. What’s more, this study finds that individual pressure can affect their cognitive appraisal, which means that future research should take the pressure influential mechanism into consideration in the process of exploring "external stimulus--cognitive appraisal--emotional response,” further expanding the
Introduction

Entrepreneurial Firms (EFs) have become a key driver of economic growth and job creation (OECD, 2020). The outbreak of the COVID-19 pandemic has exerted influence over economic development (Mckibbin and Fernando, 2021), threatening the survival and development of EFs (Hoang et al., 2022), and those entrepreneurs who play an important role in business development. Under the background of the currently poor entrepreneurial environment (Ramadani et al., 2022), in addition to the health risks of the COVID-19 pandemic, entrepreneurs are also threatened by economic shocks, the decline in business revenues and bankruptcies incurred by industry downturns, which affect their well-being (Xu and Jia, 2022). Under the influence of the COVID-19 pandemic, the entrepreneurs of EFs often face more severe financial pressure and uncertainty (Backman et al., 2021), which is not conducive to entrepreneurs to make the right decision for the sake of the long-term development of EFs. Therefore, it is of great significance to understand the influential mechanism of the COVID-19 pandemic on entrepreneurs’ mental health and to provide effective intervention measures.

According to the existing literature, some studies have probed into the relationship between the COVID-19 pandemic and entrepreneurial psychology (Backman et al., 2021; Mustafa et al., 2021; Torres et al., 2021; Chhatwani et al., 2022; Sornsenee et al., 2022). For instance, a survey of 816 SMEs’ entrepreneurs by Lathabhavan (2022a) finds that economic difficulties and financial threats caused by the pandemic are main causes of anxiety, pressure and depression among entrepreneurs. Xu et al. (2021) take small and micro entrepreneurs as research objects, discovering that economic pressure, uncertainty, operation-related pressure and social pressure are main sources of pressure. Xu and Jia (2022) find that the past performance of a start-up will reinforce the negative impact of the COVID-19 pandemic on the mental health of entrepreneurs through a tracking survey of 303 entrepreneurs in start-ups. The above studies mainly analyze the factors affecting the mental health of entrepreneurs under the background of the COVID-19 pandemic. Despite of some progress achieved, the following research gaps still remain.

First, from the perspective of research object, the researches regarding the impact of the COVID-19 pandemic on entrepreneurs’ psychology focus more on SMEs (Chhatwani et al., 2022; Sornsenee et al., 2022; Lathabhavan, 2022a), and less on entrepreneurs of EFs. Moreover, EFs play a crucial role in job creation, radical innovation, and long-term growth (OECD, 2020), yet since at a fragile stage in their life cycle, they may be more vulnerable to the COVID-19 pandemic (Benedetti-Fasil et al., 2022), and its founders are more likely to experience psychological problems. Therefore, this paper takes the entrepreneur of EFs as the research object to explore the COVID-19 pandemic’s influential mechanism on the entrepreneur anxiety (EA), hoping it can provide the theoretical enlightenment for alleviating the entrepreneur psychological anxiety, and promoting the healthy development of EFs and economic recovery.

Second, from the perspective of research content, previous studies on entrepreneurs and EFs mostly emphasize on exploring their coping strategies under the influence of COVID-19 pandemic (Kuckertz et al., 2020; Jhajharia and Sharma, 2021; Dragan et al., 2022; Mota et al., 2022), but neglect to explore the influence of COVID-19 pandemic on entrepreneur’s emotion. Entrepreneurs as pivotal decision makers for their businesses, their mental health and well-being play a critical role in their decisions, motivations, and actions (Stephan, 2018). In view of this, this paper bends its attention on entrepreneurs' emotions to explore the influential mechanism of the COVID-19 pandemic on it. Specifically, the psychological effects of the COVID-19 pandemic on individuals contain a wide range of worries, fears, and anxieties (Ahorsu et al., 2020; Wang et al., 2021; Moral et al., 2022; Lathabhavan, 2022b). Among them, anxiety is the most common negative mood with the COVID-19 pandemic. Anxiety is an emotional state of tension, restlessness, and worry caused by a threatening environment (Spielberger et al., 1976), and it can trigger and induce the corresponding behavior (Arnold, 1960), which in turn influences entrepreneurial decision-making and behavior (Stephan, 2018). Respecting this, this paper focuses on EA, and further discusses the influencing mechanism of the COVID-19 pandemic event's strength on EA, thereby providing a theoretical basis for solving the psychological problems of entrepreneurs and promoting the healthy development of EFs.

Third, from the perspective of influential mechanism, existing researches have ignored the mutual impact of internal performance decline pressure and external environmental threats on EA. Performance is critical to a company's long-term development, yet owing that EFs are still very young, they often have little revenue, operating deficits, and low chances of survival (Damodaran, 2009), tending to face more uncertainty. The COVID-19 pandemic has a tremendous, irregular, and sudden theoretical model of cognitive appraisal proposed from the perspective of pressure.

KEYWORDS
COVID-19 pandemic, entrepreneur anxiety, entrepreneur threat perception, entrepreneur performance pressure, entrepreneurial firms
external impact on EFs and their operations (Liu et al., 2021), which leads to a drastic decline in sales, profits, and market share, finally resulting in a performance decline (Li et al., 2022). Different EFs are somewhat differently affected by the COVID-19 pandemic, so the expected firm performance decline of their entrepreneurs will be different, and the COVID-19 pandemic on their performance pressure (PP) will be different. Entrepreneurs perceive the pressure brought by the decline of enterprise performance, which is referred to as “entrepreneur performance pressure (EPP).” There may be differences in threat perception (TP) under different levels of PP, which probably have dissimilar effects on the entrepreneur’s emotion. Based on this, this paper introduces EPP, as a moderator to further explore the boundary condition of the influence of COVID-19 pandemic event’s strength on EA through entrepreneur threat perception (ETP).

In order to fill the research gaps mentioned above, this paper takes the COVID-19 pandemic event’s strength as the antecedent variable affecting the EA. On this basis, according to the cognitive appraisal theory proposed by Skinner and Brewer (2002), TP is regarded as the result of people’s cognition to external stimuli, and the antecedent of negative emotions such as anxiety as well. In this paper, ETP is introduced as a mediator variable of the COVID-19 pandemic event’s strength and EPP as a moderator variable to explore the influential mechanism of the COVID-19 pandemic on EA. Compared with the existing research, the potential research contributions of this paper are as follows.

First and foremost, it is different from the researches based on the conservation of resource theory (Torres et al., 2021; Xu and Jia, 2022; Lathabhavan, 2022a), stressor-detachment model (Backman et al., 2021), stress event theory and job demand-resource model (Torres et al., 2021), to explore the impact of COVID-19 pandemic on entrepreneurial psychology. In this paper, the cognitive appraisal theory and the event system theory are introduced into the existing research, and the COVID-19 pandemic is measured from three dimensions including novelty, disruption and criticality. By virtue of measuring entrepreneurs’ perceptions about the novelty, disruption and criticality of the COVID-19 pandemic from the perspective of events’ attributes, this paper examines the effect of the COVID-19 pandemic event’s strength on EA and its mechanism. Meanwhile, it offers new insight to reveal the impact of the COVID-19 pandemic on entrepreneurs’ psychology, and a new theoretical perspective to understand and solve the mental health problems of entrepreneurs.

Secondly, this paper expands the research objects of the cognitive appraisal theory and the event system theory. Current event systems theory is mostly used to analyze the impact of the COVID-19 pandemic on employees (Lin et al., 2021; Yin and Ni, 2021), while cognitive appraisal theory is used to study individual emotions or behaviors, attaching more importance to consumers (Watson and Spence, 2007), tourists (Hosany, 2012), and employees (Shagirbasha and Sivakumaran, 2021), yet less on entrepreneurs. Taking the entrepreneurs of EFs as the research object, this paper explores the influential mechanism of the COVID-19 pandemic on entrepreneurs’ emotion, concerning about the psychological state of entrepreneurs under the COVID-19 pandemic, which expands research objects and the scope of these two theories. It is also the first time to integrate the cognitive appraisal theory and event system theory together, which enhances the explanatory potency of the two theories in the study of events’ influence on individuals. Besides, it also broadens the scope of application of these two theories in the fields of crisis situations and entrepreneur research, and enriches the research outputs of it in the fields of the COVID-19 pandemic and entrepreneur research.

Thirdly, this paper introduces ETP as the mediator variable of the COVID-19 pandemic affecting EA, and EPP as the moderator variable. Furthermore, the boundary condition of the COVID-19 pandemic event’s strength affecting EA through ETP gets explored and clarified. Most previous studies have regarded TP as an antecedent variable of anxiety mood (Cypryanska and Nezlek, 2020; Paredes et al., 2021), and performance as a result variable (Mota et al., 2022) or a moderator variable (Xu and Jia, 2022). Based on the cognitive appraisal theory and the impact of the COVID-19 pandemic, this paper considers the COVID-19 pandemic as an independent variable of anxiety, and takes the mediating effect of ETP into account. In addition, considering that entrepreneurs have different threat perception and anxiety under different performance pressures, this paper takes EPP as a moderator variable. By introducing ETP and EPP as mediator and moderator variables, and incorporating pressure and TP into the same research model, extends the previous model that only considers the moderating role of past performance, proposed by Xu and Jia (2022), and the model proposed by Cypryanska and Nezlek (2020), which only considers the mediating role of TP. The results of this study will help provide a new theoretical analysis insight for the related research on how the COVID-19 pandemic affects entrepreneurs’ psychology, and further deepen researchers to understand the mechanism of EA under the COVID-19 pandemic, providing inspirations for reducing EA.

The structure of this paper is arranged as follows. The first section is an introduction, the second section is the theoretical analysis and research hypothesis, the third section is the research design, the fourth section is the empirical results, the fifth section is the discussion, and the sixth section is the conclusions.

Theoretical analysis and research hypothesis

Event system theory and cognitive appraisal theory

The impact of the COVID-19 pandemic is complicated. Whereas event system theory can incorporate context into theorization and provide profound methods to quantify the influence of events (Johns, 2017), it can facilitate to understand the complex impact of the COVID-19 pandemic. Event system
The COVID-19 pandemic event’s strength and EA

EA is rooted in the cyclical pursuit of entrepreneurial goals by individuals, mainly lying in persistent worry, suspicion and uneasiness about uncertain outcomes (Thompson et al., 2020). Besides, it derives mostly from a negative perception of environmental stimuli that threatens survival (Cacciotti and Hayton, 2015). In the context of the COVID-19 pandemic, the economic downturn and fluctuations in the external environment triggers threats to entrepreneurs (Torres et al., 2021). Apart from it, the uncertainty of the COVID-19 pandemic makes it easier for entrepreneurs to worry and fret about the future. Due to the initial insufficient funding and resources, those EFs who bear more economic pressure are more prone to being anxious.

The COVID-19 pandemic has issued in adverse and unforeseen problems for entrepreneurs (Meurer et al., 2022). Based on the event system theory, the impact of COVID-19 pandemic on entrepreneurs can be measured from three aspects: novelty, disruption and criticality. The novelty of the COVID-19 pandemic reflects the sudden and unexpected nature of the outbreak, and entrepreneurs do not have a well-established procedure and process to guide their actions. Under the circumstances, it is indispensable for them to explore and exploit new opportunities, or learn new skills, yet which will be difficult for them (Nummela et al., 2020), thus aggravating EA. The disruption reflects the changing degree in the routine entrepreneurial activities, chiefly involving the economic shock of the epidemic and the uncertainty of the external environment. Since the outbreak of the COVID-19 epidemic, the demand and supply chain of many enterprises have been affected (Bartik et al., 2020), and the ways of working and working environment have also changed (Costa et al., 2022). Online office at home is more widespread (Cuerdo-Vilches et al., 2021), which will limit the operation of a range of business, and even incur the closure of business (Torres et al., 2021), posing an economic threat. What is worse, economic threats can cause greater individual

theory highlights the impact of events on organizations and individuals in the light of the spatial, temporal and strength attributes (Morgeson et al., 2015). As for the COVID-19 public health emergency, the time, space and strength of the outbreak will exert distinct influence over organizations and individuals. Event’s strength can be measured in terms of its novelty, disruption, and criticality (Morgeson et al., 2015). Novelty reflects the extent to which an event differs from current and past behavior, characteristics, and events, representing a new or unexpected phenomenon (Morgeson, 2005). Disruption reflects the extent to which an event changes organizations and individuals (Morgeson, 2005). Event’s criticality reflects an event’s importance, necessity and priority for organizations and individuals (Morgeson and DeRue, 2006). Specifically, the novelty of the COVID-19 pandemic measures the unexpected and unusual degree for entrepreneurs. In terms of disruption, the COVID-19 pandemic has a significant impact on the catering industry (Byrd et al., 2021), the tourism industry (Jang et al., 2021; Kim et al., 2021), and people’s physical and mental health (Shah et al., 2022), and so on, which has changed production activities and brought changes in the external environment, representing the changing and influencing extent of the pandemic on entrepreneurs. As to criticality, the criticality of COVID-19 pandemic event measures the extent to which the COVID-19 pandemic is “important, necessary or prior” for entrepreneurs. This paper measures it from the strength of novelty, disruption and criticality, to explore the impact of the COVID-19 pandemic on the emotions of entrepreneurs.

The cognitive appraisal theory holds that emotions arise from an individual’s evaluation and cognitive process of a stimulus event (Smith and Ellsworth, 1985; Frijda, 1987; Roseman et al., 1990; Tomaka et al., 1997; Oatley and Johnson-Laird, 2014). Specifically, once a stimulus event is perceived, the individual will automatically make an evaluation of “whether it is good or bad for me,” which in turn generates an emotion associated with the stimulus event (Frijda et al., 1989; Lazarus, 1991). Therefore, the process of cognitive appraisal is the decisive factor of emotion production. Arnold (1960) contends that emotion is a tendency to access to something good or fond, or to stay away from something bad or sick, and that any evaluation of things or events is tinged with emotion or mood. After that, researchers have expanded and supplemented the cognitive appraisal theory by combining different scenarios. For example, Lazarus (1991) further extends Arnold (1960)’s emotional evaluation to a kind of evaluation including information screening, motivation, physiological changes and reactions, and other components, and re-appraisal process. Roseman (1996) extends the dimensions of the emotion evaluation model by estimating the situation state, motivation state, control potential, problem source, etc. Skinner and Brewer (2002) proposes a theoretical model of cognitive appraisal, arguing that emotions stems mainly from the appraisal and cognitive processes of threats and challenges, which means challenge appraisal is related to positive emotions while threat appraisal is involved with negative emotions. TP is not only the result of people’s cognition to external stimuli, but also the antecedent of negative emotions such as anxiety. Skinner and Brewer (2002) puts forward the cognitive appraisal theory model, which is a theoretical basis for our study. As to entrepreneurs, the COVID-19 pandemic is a kind of negative external stimulus event. The uncertainty and economic shock caused by the COVID-19 pandemic will bring about entrepreneurs pressure like external threats and the performance decline, which would lead to anxiety and other negative emotions to them. Based on the model proposed by Skinner and Brewer (2002), this paper takes EFs as the research object, the external stimuli of the COVID-19 epidemic as the independent variable, and EA as the dependent variable, ETP as mediating variable, EPP as moderator variable to explore the influential mechanism of the COVID-19 pandemic on EA.
anxiety (Mamun et al., 2020). For EFs, working online may lead to higher financial costs, financial hardship and anxiety due to limited resources and funds. In addition, as the COVID-19 is highly contagious (Satici et al., 2021), which will further increase entrepreneur pressure and EA. The criticality of the COVID-19 pandemic reflects the extent to which it affects the long-term development of entrepreneurs. As for entrepreneurs, the COVID-19 pandemic not only disrupts their normal daily lives, but also endangers their situation and working modes (Nummela et al., 2020). Since the outbreak of the COVID-19 pandemic, it is predictable that the economic losses caused by the COVID-19 pandemic will be severe, ubiquitous and long-lasting (Torres et al., 2021). It will continue to affect the production and life in the future. The uncertainty of its duration will also incur pressure and uncertainty to entrepreneurs, which will render them to feel anxious. To sum up, the strength of the COVID-19 pandemic will increase EA, and then the following hypothesis is put forward.

**Hypothesis 1:** the COVID-19 pandemic event's strength will positively affect EA.

The mediating role of ETP

ETP is the entrepreneur's evaluation and cognition in terms of external threats. Threat evaluation reflects an individual's judgment that an external threat endangers their well-being, as well as an individual's confidence degree and ability to cope with threats. The COVID-19 pandemic, as a public health emergency, has an impact on entrepreneurs' subjective perceptions (Hernandez-Sanchez et al., 2020). First and foremost, due to the sudden and unexpected nature of the COVID-19 pandemic, entrepreneurs do not have a well-established procedure and process to deal with the sudden changes, and their normal production activities and lives are seriously affected, rendering them aware of threats. The infectiousness and severity of the COVID-19 itself may also increase risk perception among entrepreneurs. In addition, due to the high infectiousness and severity of the COVID-19, epidemic prevention measures need to be taken. When entrepreneurs think that these measures entail to be necessarily and quickly implemented, TP may be exacerbated (Tomaka et al., 1997). The COVID-19 pandemic also causes entrepreneurs unable to start businesses, resulting in lower sales and low profits (Li et al., 2022), which causes economic stress and TP. The criticality of the COVID-19 pandemic is a reflection of the extent to which it affects the long-term development of entrepreneurs and it threatens the achievement of their goals. The long-term impact of the COVID-19 pandemic crisis will remain unknown in the future (Korsgaard et al., 2020), so entrepreneurs do not know when the epidemic will end and how long it will last. These uncertainties will put pressure on entrepreneurs (Xu et al., 2021), which increases ETP.

The cognitive appraisal theory suggests that TP increases anxiety (Skinner and Brewer, 2002). Individual emotions are also closely related to their cognitive appraisal of the environment (Smith and Ellsworth, 1985). Anxiety occurs when an entrepreneur perceives a potential change and assesses that it threatens the achievement of personal goals, standards, or values (Thompson et al., 2020). The COVID-19 pandemic, as a negative external stimulus, will threaten the achievement of entrepreneurs' personal goals, and then make them anxious. It is also widely accepted in existing studies that TP of the COVID-19 pandemic will induce psychological anxiety (Cyprianska and Nezlek, 2020; Paredes et al., 2021; Zhang et al., 2022), which in turn generates EA. Based on this, this paper argues that the COVID-19 pandemic will make entrepreneurs perceive external threats, and the greater the degree of external threats perceived by them, the more likely they are to become anxious. Afterwards, the paper proposes the following hypothesis.

**Hypothesis 2:** ETP plays a significant mediating role between the COVID-19 pandemic event's strength and EA.

The moderating role of EPP

The outbreak of the COVID-19 have led to supply chain disruption, raw material shortage, lower output and lower demand in many enterprises (Bartik et al., 2020; Sarker et al., 2022). It makes the enterprises operation threatened and even face the risk of temporary closure (Torres et al., 2021), bringing much uncertainty to enterprises' business continuity (Zutshi et al., 2021). In this context, a large number of EFs have experienced varying degrees performance decline (Turner and Akinremi, 2020), which also puts entrepreneurs into varying degrees of PP. First of all, after the outbreak of the COVID-19 pandemic, for most enterprises, no matter how much resources they have invested before, the expected income they can get will fall to a lower level, bringing about greater losses for better-performing companies and a worse mood for entrepreneurs (Xu and Jia, 2022). Compared with the same period of previous years, the greater the gap between the expected performance year on year is, the greater the potential loss that entrepreneurs will face. The pressure increases as the performance declines. Anxiety occurs when entrepreneurs perceive and assess that the COVID-19 pandemic threatens the achievement of personal goals, standards, or values (Thompson et al., 2020). Compared with those entrepreneurs with low PP, the COVID-19 pandemic makes those entrepreneurs with high PP more negative mood, bearing greater losses. Therefore, after the COVID-19 pandemic, the latter are more likely to have high anxiety. In addition, the larger the expected performance decline is, the greater EPP will be. Whereas in high-stress status, anxiety is easier to be increased (Messagno and Mullane-Grant, 2010; Ellis and Ward, 2022). Therefore, those entrepreneurs with high PP...
Entrepreneur Threat Perception (ETP) and COVID-19 Pandemic

Entrepreneur Anxiety (EA) and Entrepreneur Performance Pressure (EPP)

Entrepreneurs with high EPP are more vulnerable to the negative impact of COVID-19 pandemic and have more anxiety accordingly.

The impact of the COVID-19 pandemic on ETP may be different with distinct EPP. From the perspective of resource, enterprise resources remain a necessary condition for enterprise operation and an important source for enterprises to obtain competitive advantage (Vartanova et al., 2021), which shows a significant positive effect on enterprise performance (Beleska-Spasova et al., 2012). If entrepreneurs’ expected performance this year is less than that of the same period in previous years, then they will deem that the enterprise resources are relatively insufficient. Those entrepreneurs with high PP confront a more serious deficiency of resources, threatening the enterprises’ operation, or even their survival, and then strengthening ETP. After the outbreak of the COVID-19 pandemic, it is more difficult for companies to obtain credit (Zhang and Fang, 2022), which exacerbates the problem of resource scarcity in enterprises (Garcia-Vidal et al., 2020). As for those entrepreneurs with high PP, it definitely makes things worse. In other words, the COVID-19 pandemic makes the lack of resources well-marked for entrepreneurs with high PP, which in turn will enhance their TP. From the perspective of the causes of PP, the individual’s evaluation on it depends on its cause, such as heavy workload, arduous task requirements, etc., rendering individuals to regard PP as a threat (Mitchell et al., 2019). As for the entrepreneur with high PP, the severe performance decline means that there remain serious problems in the enterprises’ operation, which makes them evaluate PP as a threat and enhance their TP. The COVID-19 pandemic has exacerbated the firm performance decline (Shen et al., 2020), further increasing EPP, so that entrepreneurs with high PP are more inclined to evaluate PP as a threat, and to enhance their TP brought by the COVID-19 pandemic.

PP will also affect the energy and mentality of entrepreneurs to deal with emergencies, and their ability to respond varies under different PP levels. Existing researches show that entrepreneurs’ capability and performance are positively and significantly correlated (Aujiarchapman et al., 2020; Qu et al., 2022), as those entrepreneurs with better opportunity recognition (Alim et al., 2022) and entrepreneurial ability (Xia et al., 2020) tend to have higher performance. The level of enterprise performance can reflect the capability of entrepreneurs to some extent. EFPs with high performance in the past represent that they have stronger capability. Entrepreneurs with high PP expect performance to decline, indicating their sense of crisis. When the outbreak occurs, crisis-conscious entrepreneurs can more quickly perceive the threat of economic shocks and external uncertainties, and then analyze the current situation so as to quickly take measures to deal with the negative impact of emergencies. For entrepreneurs with high PP, in the face of the external threats posed by the COVID-19 pandemic, they are more likely to see them as a challenge based on perceived threats, so as to respond faster and improve their resilience. According to the cognitive appraisal theory (Skinner and Brewer, 2002), when individuals treat external threats as a challenge, they are more likely to generate a positive emotion, which can ease EA to some extent. To sum up, entrepreneurs with high PP will be able to rapidly take measures to tackle the crisis under the COVID-19 pandemic, thus soothing the anxiety caused by TP.

Based on the above analysis, this paper proposes the following hypotheses.

Hypothesis 3a: EPP positively moderates the relationship between the COVID-19 pandemic event's strength and EA.

Hypothesis 3b: EPP positively moderates the relationship between the COVID-19 pandemic event's strength and ETP.

Hypothesis 3c: EPP negatively moderates the relationship between ETP and EA.

Based on the above hypotheses, the research model is shown in Figure 1.

![Research Model](image-url)
Research design

Sample

In view of the fact that it is difficult to measure the entrepreneurs’ psychological activities and anxiety with objective statistical data, this study uses a subjective questionnaire method to obtain analytical data. The survey is from June 2020 to September 2020 and the objects are those entrepreneurs of EFs from the science and technology parks in Guangdong Province, China. Because the simple random sampling works well in finding a generalized result that can be applied to the entire population (Rahman et al., 2002), this paper also chooses it to obtain the questionnaire survey data. The operation companies of the science and technology parks are entrusted to randomly distribute questionnaires to entrepreneurs of EFs in the parks. The survey has collected 206 questionnaires, excluding the enterprises that have been established for more than 8 years, there are 168 analysis samples of EFs. The sample enterprises mainly derive from the industries of information transmission, software and information technology services, scientific research and technology services. All of them are EFs within 8 years old with less than 300 employees and business income less than RMB 20 million, which shows that most of the sample enterprises are SMEs. And most of them have no overseas business, which fits the characteristics of EFs and has a good representative. The basic information of the sample enterprises is shown in Table 1.

Measurement

The scales applied in this paper originates from the mature scales. This study adopts the back translation method to translate and back translate the items in the original scales and revised them with the actual situation. All scales adopt Likert 5-point Scale, ranging from “1 = totally disagree” to “5 = totally agree.”

1. The COVID-19 pandemic event's strength. Based on the measurement scale developed by Morgeson et al. (2015), Morgeson (2005), and Morgeson and DeRue (2006), and revised in combination with the COVID-19 pandemic, it contains three dimensions: novelty, criticality and disruption with a total of 11 items. Novelty contains “there is a clear, known way for our company to respond to the COVID-19 pandemic event” and other three items. Criticality contains “the COVID-19 pandemic event is critical for the long-term success of our company’s innovation and development” and other two items. Disruption includes “the COVID-19 pandemic event disrupts our company’s value creation and acquisition ability to get its work done” and other three items. The items of novelty are the reverse scoring question.

2. ETP. Referring to the measurement scale of Lebel (2016), ETP includes “the COVID-19 pandemic event causes the economic downturn that would negatively impact our organization” and other four items.

3. EPP. Referring to Chen (2008) and Xu and Jia (2022), PP is measured by whether the actual performance is expected to be lower than the same period of the previous years. This paper makes use of the virtual variable (0–1) to measure EPP. If the actual performance of the enterprise is lower than the same period of the previous years, the entrepreneur will have a high PP. The assignment is 1. Otherwise, the assignment is 0.

4. EA. Referring to the scale of Lambert et al. (2014), anxiety is measured by three items: anxious, nervous, and worried. These three items are used to measure EA.

| Variables                      | Categories                                               | Frequency | Percentage (%) |
|-------------------------------|----------------------------------------------------------|-----------|----------------|
| Number of employees           | Less than 20 employees                                   | 124       | 73.8           |
|                               | 20–299 employees                                         | 43        | 25.6           |
|                               | 300–999 employees                                        | 1         | 0.6            |
| Revenue of the previous year  | Revenue less than RMB 3 million                          | 115       | 68.5           |
|                               | Revenue RMB 3–20 million                                 | 48        | 28.6           |
|                               | Revenue RMB 20–40 million                                | 4         | 2.4            |
|                               | Revenue of more than RMB 40 million                      | 1         | 0.6            |
| Industry attributes           | Information transmission, software and information technology services | 74        | 44.0           |
|                               | Scientific research and technology services              | 38        | 22.6           |
|                               | Manufacturing                                            | 10        | 6.0            |
|                               | Leasing and business services                            | 12        | 7.1            |
|                               | Culture, sports and entertainment                        | 11        | 6.5            |
|                               | Wholesale and retail                                     | 8         | 4.8            |
|                               | Other industries                                         | 15        | 9.0            |
| Whether there is overseas business | Export                                                   | 11        | 6.5            |
|                               | No export                                                | 157       | 93.5           |

TABLE 1 Characteristics of sample enterprises.
In addition, the study also takes the age of enterprises, number of employees, business income, industry attribute, and presence of overseas business as control variables. See Table 2 for the specific items of each scale.

Data analysis tools and techniques

This paper makes use of SPSS 22.0 and AMOS 25.0 for data analysis. First, SPSS 22.0 is used for exploratory factor analysis and reliability analysis, and then AMOS 25.0 is for confirmatory factor analysis. On this basis, SPSS 22.0 is applied for descriptive statistics and correlation analysis, model 4 in the PROCESS for SPSS is for mediating effect test, and model 59 in the PROCESS for SPSS is utilized for the total effect moderation model test.

Testing of reliability and validity

The Cronbach’s α of each variable and the combined reliability are shown in Table 2. The Cronbach’s α of novelty, criticality and disruption of the COVID-19 pandemic event are 0.924, 0.872 and 0.883 respectively, and the combined reliability are 0.926, 0.877 and 0.886 respectively, indicating that the scale has good internal consistency and reliability. The Cronbach’s α of ETP is 0.823 and the combined reliability is 0.827, which suggests the scale has good internal consistency and reliability. The Cronbach’s α of EA is 0.941, and the combined reliability is 0.942, which evinces that the scale has good internal consistency and reliability.

In terms of validity, exploratory factor analysis (EFA) is used to test the aggregation validity of each scale, and the results are shown in Table 2. The KMO value of EFA for the COVID-19 pandemic event’s strength is 0.871, which manifest that the scale is suitable for EFA. Then the maximum variance method is rotated. The results reflect that the items could be clustered into three dimensions: novelty, criticality and disruption. The total variance of the cumulative explanation is 78.768%, which indicates that the scale has good validity. The KMO value of EFA for the ETP is 0.768, showing that it is suitable for EFA. Then the maximum variance method is rotated. One factor is extracted from the result, and the total variance of cumulative explanation is 59.525%, which evinces that the scale has good aggregation validity. The KMO value of EFA for the EA is 0.753, meaning that it is suitable for EFA. Then the maximum variance method is rotated. One factor is extracted from the result, and the total variance of cumulative explanation is 89.563%, which reveals that the scale has good convergent validity.

On the basis of EFA, confirmatory factor analysis (CFA) is used to test the discriminant validity of the scales. The results are shown in Table 3. The fitting degree of the five-factor model (χ²/df = 1.873 < 3, RMRR = 0.050, RMSEA = 0.072 < 0.08, CFI > 0.9, TLI > 0.9, IFI > 0.9, PCFI >0.5) is better than that of the single-factor model and other competitive models, which shows that there is a good distinction between event’s novelty, criticality and disruption, ETP and EA.

Common method bias test

The questionnaire items are filled by entrepreneurs, so there may be common variance in the process of data collection. This paper firstly utilizes Harman’s one-factor method to test the common method bias, and all items are put together to perform factor analysis. As the results show, factor 1 occupies 24.553% of the variance, less than 40% and less than half of the total variance of 72.978%, indicating that there was no serious common method bias in this paper. At the same time, the common method factor is introduced into the CFA, and the fitting index after controlling the common method factor is shown in Table 3. The results show that the common method factor (RMSEA = 0.072, CFI = 0.947, IFI = 0.947) is added to the five-factor model (RMSEA = 0.069, CFI = 0.958, IFI = 0.958), and the improvement of model fit index is very small, evincing that the problem of common variance among the variables is not salient.

Empirical results

Descriptive statistics and correlation analysis

The results of descriptive statistics and correlation analysis are shown in Table 4. The results reflect that the COVID-19 pandemic is positively correlated with ETP (r = 0.629, p < 0.001) and EA (r = 0.387, p < 0.001). Meanwhile, there is a positive correlation between ETP and EA (r = 0.539, p < 0.001), which is significant at the 0.001 level respectively, initially supporting the research hypothesis of this paper. In addition, the AVE square root of the latent variables is larger than the correlation coefficient between the variables, which shows that the core variables has higher discriminant validity. In order to further test the hypothesis proposed in this paper, the following regression analysis is introduced.

Hypothesis test

Hierarchical regression is applied firstly in this paper to analyze the direct effect of the COVID-19 pandemic on EA and the mediating effect of ETP. Then the total effect moderation model proposed by Edwards and Lambert (2007) is used to test the moderating effect of EPP, and the results are shown in Table 5. The empirical test result of the relationship between the COVID-19 pandemic and EA is shown in M2. The result shows that the COVID-19 pandemic has a significantly positive effect on EA (β = 0.682, p < 0.001). The hypothesis I is supported.
| Variable                                      | Dimension | Item                                                                 | EFA factor loading | CFA factor loading | Total variance explained | CR  | Cronbach’s α |
|----------------------------------------------|-----------|----------------------------------------------------------------------|-------------------|--------------------|--------------------------|-----|--------------|
| COVID-19 pandemic event’s strength            | Novelty   | There is a clear, known way for our company to respond to the COVID-19 pandemic event® | 0.898             | 0.904              | 30.222%                  | 0.926| 0.924        |
|                                              |           | There is an understandable sequence of steps that can be followed in responding for our company to the COVID-19 pandemic event® | 0.920             | 0.937              |                          |     |              |
|                                              |           | Our company can rely on established procedures and practices in responding to the COVID-19 pandemic event® | 0.887             | 0.830              |                          |     |              |
|                                              |           | The COVID-19 pandemic event occurred”| 0.842             | 0.803              |                          |     |              |
|                                              | Criticality| The COVID-19 pandemic event is critical for the long-term success of our company’s innovation and development | 0.689             | 0.779              | 58.444%                  | 0.877| 0.872        |
|                                              |           | The COVID-19 pandemic event is of a priority to our company's innovation and development | 0.850             | 0.835              |                          |     |              |
|                                              |           | COVID-19 pandemic is an important event for our company's innovation and development | 0.775             | 0.900              |                          |     |              |
|                                              | Disruption| The COVID-19 pandemic event disrupts our company's value creation and acquisition ability to get its work done | 0.766             | 0.793              | 78.768                   | 0.886| 0.883        |
|                                              |           | The COVID-19 pandemic event causes our company to stop and think about how to respond | 0.803             | 0.813              |                          |     |              |
|                                              |           | The COVID-19 pandemic event alters our company’s normal way of responding | 0.856             | 0.861              |                          |     |              |
|                                              |           | The COVID-19 pandemic event requires our company to change the way it does its work | 0.827             | 0.779              |                          |     |              |

(Continued)
| Variable | Dimension | Item                                                                 | EFA factor loading | CFA factor loading | Total variance explained | CR    | Cronbach’s α |
|----------|-----------|----------------------------------------------------------------------|-------------------|--------------------|--------------------------|-------|--------------|
| ETP (KMO = 0.768) |          | The COVID-19 pandemic event causes the economic downturn that would negatively impact our organization | 0.822             | 0.772              | 59.525%                  | 0.827 | 0.823        |
|          |          | Affected by COVID-19 event, our organization would lose (part) sales or revenue | 0.765             | 0.783              |                          |       |              |
|          |          | Affected by COVID-19 event, there would be layoffs at our organization | 0.694             | 0.541              |                          |       |              |
|          |          | Affected by COVID-19 event, our organization would lose business to a competitor | 0.731             | 0.579              |                          |       |              |
|          |          | The COVID-19 pandemic event causes an industry downturn that would negatively impact our organization | 0.837             | 0.798              |                          |       |              |
| EA (KMO = 0.753) |          | Anxious                                                              | 0.933             | 0.910              | 89.563%                  | 0.942 | 0.941        |
|          |          | Nervous                                                               | 0.962             | 0.964              |                          |       |              |
|          |          | Worried                                                               | 0.944             | 0.882              |                          |       |              |

*Refers to the reverse question.*
TABLE 3  Confirmatory factor analysis results.

| variables                  | $\chi^2$  | df   | $\chi^2$/df | RMR   | RMSEA | CFI   | TLI   | IFI   | PCFI |
|----------------------------|-----------|------|-------------|-------|-------|-------|-------|-------|------|
| 5-factor model             | 265.969   | 142  | 1.873       | 0.050 | 0.072 | 0.947 | 0.936 | 0.947 | 0.786 |
| 5-factor model + common method factor | 221.531   | 123  | 1.801       | 0.050 | 0.069 | 0.958 | 0.941 | 0.958 | 0.689 |
| 4-factor model             | 468.305   | 146  | 3.208       | 0.097 | 0.115 | 0.861 | 0.838 | 0.863 | 0.735 |
| 3-factor model             | 830.472   | 148  | 5.611       | 0.103 | 0.166 | 0.706 | 0.661 | 0.709 | 0.611 |
| 2-factor model             | 1004.999  | 150  | 6.700       | 0.120 | 0.216 | 0.489 | 0.425 | 0.493 | 0.434 |
| 1-factor model             | 1339.904  | 152  | 8.815       | 0.120 | 0.216 | 0.489 | 0.425 | 0.493 | 0.434 |

5-factor model: novelty, criticality, disruption, threat, Anxiety. 4-factor model: novelty, criticality, disruption, threat + Anxiety. 3-factor model: novelty + criticality + disruption, threat + Anxiety. 2-factor model: novelty + criticality + disruption + threat + Anxiety.

TABLE 4  Means, standard deviations and correlations coefficients.

| Variables                        | 1       | 2       | 3       | 4       |
|----------------------------------|---------|---------|---------|---------|
| 1 COVID-19 pandemic              | 0.841   |         |         |         |
| 2 Entrepreneur Performance Pressure | 0.367** |         |         |         |
| 3 Entrepreneur Threat Perception | 0.629***| 0.257***|         | 0.703   |
| 4 Entrepreneur Anxiety           | 0.387***| 0.157*  |         | 0.539***|
| Mean                             | 3.024   | 0.792   | 3.226   | 3.635   |
| SD                               | 0.460   | 0.407   | 0.738   | 0.802   |

The bold part in the table is the AVE square root of each latent variable. ***p<0.001; *p<0.050.

TABLE 5  Regression results of COVID-19 pandemic on EA.

| Variables                        | M1     | M2     | M3     | M4     | M5     | M6     |
|----------------------------------|--------|--------|--------|--------|--------|--------|
| Constant                         | 3.734  | 1.707  | 0.376  | 0.495  | 1.506  | 1.876  |
| Enterprise age                   | −0.005 | −0.026 | 0.017  | 0.017  | −0.035 | −0.026 |
| Number of employees              | −0.015 | −0.087 | −0.096 | −0.095 | −0.036 | −0.029 |
| Revenue of the previous year     | −0.031 | 0.057  | −0.036 | −0.036 | 0.076  | 0.046  |
| Dummy variable, Manufacturing    | −0.430 | −0.152 | −0.157 | −0.151 | −0.068 | −0.135 |
| Dummy variable, overseas         | 0.104  | −0.014 | 0.018  | 0.008  | −0.023 | −0.026 |
| COVID-19 pandemic                | 0.682***| 0.983***| 0.926***| 0.158  | −0.293 |
| ETP                              |        |        |        |        | 0.534***| 0.829***|
| EPP                              | −0.166 |        |        |        | −0.621***|        |
| COVID-19 pandemic × EPP          | 0.074  |        |        |        |        | 0.663* |
| ETP × EPP                        |        |        |        |        | −0.417* |        |
| $R^2$                            | 0.134  | 0.398  | 0.636  | 0.636  | 0.550  | 0.569  |
| $R^3$                            | 0.018  | 0.159  | 0.404  | 0.405  | 0.302  | 0.324  |
| $F$                              | 0.591  | 5.063***| 18.181***| 13.521***| 9.907***| 7.517***|

The coefficient is a non-standardized regression coefficient. ***p<0.001; *p<0.050.

Therefore, $ETP$ plays a significantly mediating role between the COVID-19 pandemic and $EA$, and the hypothesis 2 is supported.

M2, M3 and M5 are used to test the mediating effect of $ETP$. The results show that the COVID-19 pandemic has a significantly positive effect on $ETP$ ($\beta=0.983$, $p<0.001$), and $ETP$ also has a significantly positive effect on $EA$ ($\beta=0.534$, $p<0.001$). The regression coefficient of the COVID-19 pandemic on $EA$ became smaller, and the significance changes from being significant to non-significant. Furthermore, bootstrap test results suggest that the mediating effect of $ETP$ is 0.524 with 95% confidence interval [0.293, 0.769] and does not contain zero.

The results of moderating effect analysis of $EPP$ can be found in M4 and M6. The results show that the interaction between $EPP$ and the COVID-19 pandemic positively affects $EA$ ($\beta=0.663$, $p<0.05$). That is, the greater $EPP$ is, the stronger the positive impact of the COVID-19 pandemic on $EA$ will be, and the hypothesis 3a is supported. The interaction item between $EPP$ and the COVID-19 pandemic has no significant effect on $ETP$. 

Frontiers in Psychology
so the hypothesis 3b is not supported. The interaction item between EPP and ETP negatively affects EA ($\beta = -0.417$, $p < 0.05$). That is, the stronger EPP is, the weaker the positive effect of ETP on EA will be, and the hypothesis 3c is supported.

In order to present the moderating effect of EPP much clearer, a simple slope diagram is applied to plot the moderating effects of EPP on the relationship between the COVID-19 pandemic and EA, ETP and EA respectively, as shown in Figure 2, 3. According to Figure 2, it can be seen that under high EPP, the COVID-19 pandemic will increase EA, while it is negatively related to EA with low EPP. The reason may lie in that when the company has no performance decline (low PP), while its competitors’ performance decline, the company has advantage under the circumstances, and thus reducing anxiety. By virtue of Figure 3, it reveals that under high PP, the positive influence of ETP on EA is weak, while under low PP, the positive effect of the ETP on EA is more conspicuous.

**Discussion**

**Results discussion**

From the perspective of the COVID-19 pandemic event’s strength, based on the cognitive appraisal theory and the event system theory, this paper performs an in-depth and far-reaching study of the COVID-19 pandemic’s influence on entrepreneurs. According to the empirical analysis to the 168 entrepreneurs of EFs from the science and technology parks in Guangdong Province, China, the following results are obtained.

First, the COVID-19 pandemic event’s strength has a positive effect on EA. Given the novelty of the COVID-19, with the sudden outbreak of it, entrepreneurs are lack of a well-established procedure and process to cope with the sudden changes, resulting in uncertainty about their future goals. From the perspective of the disruption, the COVID-19 pandemic has an impact on all industries and sectors, which leads to declines in sales, market share and profits, and exacerbates the financial burden and
uncertainty of entrepreneurs, and thus intensifying the anxiety of entrepreneurs. From the perspective of the criticality, the long-term impact of the COVID-19 pandemic will remain unknown in the future (Korsgaard et al., 2020), bringing uncertainty to entrepreneurs and threatening the realization of their goals and long-term development, further increasing their anxiety. Similar to the existing findings that "the COVID-19 pandemic have a negative impact on the entrepreneurs’ psychology of SMEs" (Lathabhavan, 2022a; Sornsenee et al., 2022). This article finds that the COVID-19 pandemic causes EA of EFs. However, the existing research puts high premium on entrepreneurs to explore the COVID-19 pandemic’s negative impact, but ignores the events' attributes, that is, from the intrinsic characteristics of the event to explore the COVID-19 pandemic's impact on entrepreneurs' psychological mechanism. Considering the intrinsic characteristics of the COVID-19 pandemic including the novelty, the disruption and the criticality, will help to strengthen the explanation of how the COVID-19 pandemic affects entrepreneurs. More importantly, from a micro-perspective, this study examines the impact of the COVID-19 pandemic on entrepreneurs and extends the application of event system theory in the field of entrepreneurs' emotions.

Second, ETP plays a significant mediating role between the COVID-19 pandemic and EA. Based on the cognitive appraisal theory, this study puts the COVID-19 pandemic on individuals into a process of "external stimulus--cognitive appraisal--emotional response," and the mediating role of ETP between the COVID-19 pandemic and EA is analyzed and verified. This conclusion shows that the EA mainly comes from the cognitive appraisal process brought from the external threat of stimulus events. When individuals perceive the COVID-19 pandemic threat is greater, they will show a higher level of psychological anxiety. Most previous studies have regarded TP as an antecedent variable of anxiety (Cypryanska and Nezlek, 2020; Paredes et al., 2021). On this basis, in view of the impact of the COVID-19 pandemic, this paper takes the COVID-19 pandemic as the antecedent variable of ETP, and regards ETP as a mediator variable based on the cognitive appraisal theory. Previous studies explore the impact of COVID-19 pandemic on individual anxiety from the perspective of job insecurity (Lin et al., 2021) and efficacy (Zhang et al., 2022), while this study provides a new theoretical insight and mechanism for the research of the COVID-19 pandemic and individual emotion through the verification of TP mechanism, that is, to understand the influential mechanism of the COVID-19 pandemic on anxiety from the perspective of TP, which enriches the research results of the influential mechanism of the COVID-19 pandemic on entrepreneur's emotion.

Third, EPP positively moderates the relationship between the COVID-19 pandemic event's strength and EA, and it negatively moderates the relationship between ETP and EA. However, the moderating effect on the relationship between the COVID-19 pandemic event's strength and ETP is not significant. The results illuminate that EPP has a significant positive moderating effect between the COVID-19 pandemic event's strength and EA. For entrepreneurs with high PP, under the influence of the COVID-19 pandemic, the gap between the expected performance this year and that of the same period in the previous years is larger. Furthermore, they will face more potential losses, which in turn brings about higher levels of anxiety. Besides, there is no significant moderating effect between the COVID-19 pandemic and ETP, and that is because the level of internal performance pressure may not change the objective threat incurred by external crisis. Entrepreneurial stress stems from external uncertainty (Rauch et al., 2018), which in turn threatens individuals. For entrepreneurs, however high nor low PP it is, it cannot change the uncertainty caused by the COVID-19 pandemic. In addition, other variables may also modulate the relationship between the COVID-19 pandemic and TP, such as the entrepreneurs' characteristics and risk perception. Entrepreneurs with different risk perceptions tend to have different TP. Eventually, there is a significant negative moderating effect of EPP on ETP and EA. High-pressure entrepreneurs are inclined to appear stronger crisis awareness, opportunity recognition, and crisis coping, often regarding threats as external challenges, which can alleviate the anxiety caused by external threats to some extent. On the basis of Xu and Jia's (2022) model of PP moderating COVID-19 pandemic and entrepreneur' psychological well-being, this study further investigates the effect boundary of both the COVID-19 pandemic on ETP and EPP on EA, broadening the model proposed by Xu and Jia (2022) and revealing the influential mechanism of PP on EA under the COVID-19 pandemic as well. What is more, the study finds that individual pressure can affect their cognitive appraisal, which broadens the theoretical model of cognitive appraisal proposed by Skinner and Brewer (2002) from the perspective of pressure. It means that future research should take the pressure influential mechanism into consideration in the process of exploring "external stimulus--cognitive appraisal--emotional response."

Theoretical implications

Based on the above research findings, this paper has the following theoretical implications.

First, this paper explores the impact of the COVID-19 pandemic event's strength on entrepreneurial anxiety. Similar to the existing findings that "the COVID-19 pandemic has a negative impact on the entrepreneurs' psychology of SMEs" (Sornsenee et al., 2022; Lathabhavan, 2022a). This paper finds that the COVID-19 pandemic causes EA of EFs. However, the existing research puts high premium on entrepreneurs to explore the COVID-19 pandemic's negative impact, but ignores the events' attributes. That is, from the intrinsic characteristics of the event to explore the influential mechanism of the COVID-19 pandemic impacting entrepreneurs' psychology. Considering the intrinsic characteristics of the COVID-19 pandemic including the novelty, the disruption and the criticality, this study will help to strengthen the explanation of how the COVID-19 pandemic affects...
entrepreneurs. More importantly, from a micro-perspective, this study examines the impact of the COVID-19 pandemic on entrepreneurs and extends the application of event system theory in the field of entrepreneurs’ emotions.

Second, this paper introduces TP as a mediating variable of the COVID-19 pandemic event’s strength affecting entrepreneurs’ anxiety. Most previous studies have regarded TP as an antecedent variable of anxiety (Cypryanska and Nezlek, 2020; Paredes et al., 2021). On this basis, in view of the impact of the COVID-19 pandemic, this paper takes the COVID-19 pandemic as the antecedent variable of ETP, and regards ETP as a mediator variable based on the cognitive appraisal theory. Previous studies explore the impact of COVID-19 pandemic on individual anxiety from the perspective of job insecurity (Lin et al., 2021) and efficacy (Zhang et al., 2022), while this study provides a new theoretical insight and mechanism for the research of the COVID-19 pandemic and individual emotion through the verification of TP mechanism. That is, to understand the influential mechanism of the COVID-19 pandemic on anxiety from the perspective of TP, which enriches the research results of the influential mechanism of the COVID-19 pandemic on entrepreneur’s emotion.

Finally, on the basis of Xu and Jia’s (2022) model of PP moderating COVID-19 pandemic and entrepreneur psychological well-being, this study further investigates the effect boundary of both the COVID-19 pandemic on ETP and ETP on EA, broadening the model proposed by Xu and Jia (2022) and revealing the influential mechanism of PP on EA under the COVID-19 pandemic as well. What is more, the study finds that individual pressure can affect their cognitive appraisal, which broadens the theoretical model of cognitive appraisal proposed by Skinner and Brewer (2002) from the perspective of pressure. It means that future research should take the pressure influential mechanism into consideration in the process of exploring “external stimulus--cognitive appraisal--emotional response.”

Practical implications

Based on the above research findings, this paper puts forward the following practical implications.

First, in view of the adverse impact of the COVID-19 pandemic, the science and technology parks should develop contingency plans for major crises such as the COVID-19 pandemic. The science and technology parks should promote the digital transformation of EFs in order to reduce the restrictions on business operations caused by the pandemic and enhance entrepreneurs’ confidence in coping with major crisis. Through the above measures, entrepreneurs’ perception of the intensity of major crisis events such as the COVID-19 epidemic can be reduced, thus soothing entrepreneurs’ psychological anxiety. In addition, enterprises should establish clear and executable working procedures and guidelines during the pandemic to decrease the threat and negative impact of COVID-19 pandemic to entrepreneurs and EFs, helping them quickly return to normal operations.

Second, given that EPP is positively moderating the relationship between the COVID-19 pandemic event’s strength and EA, entrepreneurs should fully understand the negative impact of the COVID-19 pandemic and other major crises, and appropriately adjust their firm performance targets to reduce PP caused by high targets. In addition, the science and technology parks should constantly enhance the entrepreneurs’ crisis awareness and the ability of identifying and responding to crisis, and of recognizing and grabbing opportunities. The last but not least, to organize concentrated capacity training to deepen entrepreneurs’ understanding of major crises such as the COVID-19 pandemic and instruct them how to identify and exploit opportunities under major crises, which will facilitate them to cope with sudden major crises better in the future as well.

Third, in view of the mediating role of TP between the COVID-19 pandemic and EA, in order to alleviate EA and maintain entrepreneurs a good psychological state, it is better to minimize the external ETP. Entrepreneurs should spare no efforts to obtaining information for a correct understanding of the crisis, thus reducing the threat of information asymmetry and uncertainty. At the same time they need to treat pandemic threat in a correct way. By viewing perceived external crises as external challenges, they can better improve their emotional state, and thus face crises and challenges bravely and identify opportunities positively, ultimately promoting the long-term growth of EFs.

Limitations and future research

Although the research findings of this paper have some theoretical and practical implications, but there are still some limitations. First and foremost, as it is not quite easy for entrepreneurs to carry out the longitudinal questionnaire survey, this paper uses cross-sectional data to study the impact of the COVID-19 pandemic on EA, changes in core variables are difficult to be measured. Therefore, future research should adopt longitudinal follow-up study to further test the cause and effect of research conclusions. Secondly, based on the cognitive appraisal theory and the event system theory, this paper explores the influential mechanism of the COVID-19 pandemic event’s strength affecting the EA through ETP, and introduce EPP as a moderator to explore the effecting boundary of the COVID-19 pandemic on EA, obtaining some meaningful conclusions indeed. However, the relationship between the COVID-19 pandemic and EA is not only influenced by EPP and EPT, but also by other individual characteristics such as entrepreneur personality. Therefore, the impact of different individual characteristics on the relationship between the COVID-19 pandemic and entrepreneurs’ negative emotions should be taken into account in the future studies, further exploring the “black box” of negative events on entrepreneurs’ negative emotions. In the end, this paper uses event’s strength
to measure the impact of the COVID-19 pandemic. Nevertheless, event systems theory also focuses on explaining the effects of events on organizations and individuals from temporal and spatial attributes (Morgeson et al., 2015), and subsequent research can expand the event measurement dimension, from the time and space attributes to measure the COVID-19 pandemic, further delving into its impact on entrepreneurs.

**Conclusion**

This study investigates the mediating effect of ETP and the moderating effect of EPP by exploring the influential mechanism of the COVID-19 pandemic influencing EA. Through the empirical study, this paper finds that the COVID-19 pandemic significantly and positively affects EA, and it will facilitate ETP, then indirectly affecting EA. In other words, ETP plays a mediating role between COVID-19 pandemic and EA. In addition, this study also finds that the positive effect of COVID-19 pandemic on EA is enhanced by EPP, while the positive effect of ETP on EA is weakened by EPP. This study will be favorable for researchers and managers to further understand the potential relationship and mechanism between the COVID-19 pandemic and EA from the event system theory and cognitive appraisal theory. In a nutshell, the findings will enrich the research results in the field of the COVID-19 pandemic and entrepreneurs’ emotion, providing theoretical reference for timely intervention of entrepreneurs’ mental health under sudden crisis, which will facilitate the healthy development of entrepreneurial firms, the stability of social employment and the economic recovery.

**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.

**References**

Ahorsu, D. K., Lin, C. Y., Imani, V., Saffari, M., Griffiths, M. D., and Paipour, A. H. (2020). The fear of COVID-19 scale: development and initial validation. *Int. J. Ment. Health Ad*. 20, 1537–1545. doi: 10.1007/s11469-020-00270-8

Ahorsu, D. K., Moon, M. J., and Imani, V. (2022). To explain and to predict: analysis of opportunity recognition on the entrepreneur’s mental health during the COVID-19 pandemic and the potential relationship and mechanism between the COVID-19 pandemic and EA from the event system theory and cognitive appraisal theory. In a nutshell, the findings will enrich the research results in the field of the COVID-19 pandemic and entrepreneurs’ emotion, providing theoretical reference for timely intervention of entrepreneurs’ mental health under sudden crisis, which will facilitate the healthy development of entrepreneurial firms, the stability of social employment and the economic recovery.

**Ethics statement**

Ethical review and approval were not required for the study on human participants in accordance with the local legislation and institutional requirements. The participants have provided their written informed consent to participate in this study.

**Author contributions**

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

**Funding**

This research is supported by the National Natural Science Foundation of China (71802062), the Science and Technology Planning Project of Guangdong (2020B1010010013 and 2018A070712042), the “13th five year plan” for the Development of Philosophy and Social Sciences in Guangzhou (2020GZGJ161).

**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.

**Publisher’s note**

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.
Lathabavan, R. (2022b). Fear of COVID-19, psychological distress, well-being and life satisfaction: a comparative study on first and second waves of COVID-19 among college students in India. Curr. Psychol. 1–8. doi: 10.1007/s12144-022-03207-7

Lazarus, R. S. (1991). Progress on a cognitive-motivational-relational theory of emotion. Am. Psychol. 46, 819–834. doi: 10.1037/0003-066X.46.8.819

Lebel, R. D. (2016). Overcoming the fear factor: how perceptions of supervisor openness lead employees to speak up when fearing external threat. Organ. Behav. Hum. Decis. 135, 10–21. doi: 10.1016/j.obhdp.2016.05.001

Li, Y. J., Chen, H. C., Wei, L. L., and Wei, L. Q. (2022). COVID-19 pandemic and SMEs performance decline: the mediating role of management innovation and organizational resilience. Front. Public Health 10.1038/sj.2022.44742. doi: 10.3838/fpubh.2022.44742

Lin, W. P., Shao, Y. D., Li, G. Q., Guo, Y. R., and Zhan, X. J. (2021). The psychological implications of COVID-19 on employee job insecurity and its consequences: the mitigating role of organization adaptive practices. J. Appl. Psychol. 106, 317–329. doi: 10.1037/ap0000896

Liu, B. J., Lu, L., Zhang, H., and Liu, C. J. (2021). Strategic choices for social responsibility of startups in China. Front. Psychol. 12:719454. doi: 10.3389/fpsyg.2021.719454

Mamun, M. A., Akter, S., Hossain, I., Faisal, M. T. H., Rahman, M. A., Arfin, A., et al. (2020). Financial threat, hardship and distress predict depression, anxiety and stress among the unemployed youths: a bangladeshi multi-city study. J. Affect. Disorders. 276, 1149–1158. doi: 10.1016/j.jad.2020.06.075

Mickibbin, W., and Fernando, R. (2021). The global macroeconomic impacts of COVID-19: seven scenarios. Asian Econ. Policy 10, 1–38. doi: 10.11225/aep_008796

Mesagno, C., and Mullen-Grant, T. (2010). A comparison of different pre-performance routines as possible choking interventions. J. Appl. Sport Psychol. 22, 343–360. doi: 10.1037/a0019780

Meurer, M. M., Waldkirch, M., Schou, P. K., Rucher, E. L., and Burmeister-Lamp, K. (2022). Digital affordances: how entrepreneurs access support in online communities during the COVID-19 pandemic. Small Bus. Econ. 58, 657–666. doi: 10.1007/s11187-021-00540-2

Mitchell, M. S., Greenbaum, R. L., Vogel, R. M., Mawritz, M. B., and Keating, D. J. (2019). Can you handle the pressure? The effect of performance pressure on stress appraisals, self-regulation, and behavior. Acad. Manag. J. 62, 531–552. doi: 10.5465/amj.2016.0646

Moral, J. H., Rahaman, M. S., Imran, M. S., and Rahman, M. M. (2022). Mental health of hawkers during COVID-19: a marginal community in Bangladesh. J. Enterp. Communities. 10.1108/ICE-01-2022-0006

Morgeson, F. P. (2005). The external leadership of self-managing teams: intervening in the context of novel and disruptive events. J. Appl. Psychol. 90, 497–508. doi: 10.1037/0021-9010.90.3.497

Morgeson, F. P., and DeRue, D. S. (2006). Event criticality, urgency, and duration: understanding how events disrupt teams and influence team leader intervention. Leadership Quart. 17, 271–287. doi: 10.1016/j.leaqua.2006.02.006

Morgeson, F. P., Mitchell, T. R., and Liu, D. (2015). Event system theory: an event-oriented approach to the organizational sciences. Acad. Manage. Rev. 40, 515–537. doi: 10.5465/amr.2012.0999

Mota, R. D., Bueno, A., Gonella, J. D. L., Ganga, G. M. D., Godinho, M., and Ganga, G. M. D. (2020). When all doors close: implications of COVID-19 for cosmopolitan entrepreneurs. Int. J. Destin. Mark. Manage. Decis. J. 10.1008/jdmm-09-2021-0998

Mustafa, F., Khursheed, A., Fatima, M., and Rao, M. R. (2021). Exploring the impact of COVID-19 pandemic on women entrepreneurs in Pakistan. Int. J. Gen. Entrep. 13, 187–203. doi: 10.1080/10413200.2010.491780

Nammala, N., Paavilainen-Marttmyki, E., Harikakkla-Lahinen, R., and Rattj, I. (2020). When all doors close: implications of COVID-19 for cosmopolitan entrepreneurs. Int. Small Bus. J. 38, 711–717. doi: 10.1108/1426242205945127

Oatley, K., and Johnson-Laird, P. N. (2014). Cognitive approaches to emotions. Trends Cogn. Sci. 18, 134–140. doi: 10.1016/j.tics.2013.12.004

OECD (2020). Startups in the time of COVID-19: Facing the challenges, seizing the opportunities. Retrieved from https://www.oecd.org/coronavirus/policy-responses/start-ups-in-the-time-of-covid-19-facing-the-challenges-seizing-the-opportunities-87219267/. [Accessed May 13, 2020]

Paredes, M. R., Apaolaza, V., Fernandez-Robin, C., Hartmann, P., and Vazquez-Martinez, D. (2021). The impact of the COVID-19 pandemic on subjective mental well-being: the interplay of perceived threat, future anxiety and resilience. Pers. Indiv. Differ. 170.110455. doi: 10.1016/j.paid.2020.110455

Qu, S. W., Li, T. H., and Zhang, M. (2022). Predictive factors of the entrepreneurial performance of undergraduates. Front. Psychol. 13:814759. doi: 10.3389/fpsyg.2022.814759

Rahman, M. M., Tabah, M. I., Salamzadeh, A., Abdul, S., and Rahaman, M. S. (2022). Sampling techniques (probability) for quantitative social science researchers.
a conceptual guidelines with examples. *SEEU Review* 17, 42–51. doi: 10.2478/seeu-2022-0023

Ramadan, V., Rahman, M. M., Salamzadeh, A., Rahaman, M. S., and Abati-Alli, H. (2022). Entrepreneurship education and graduates’ entrepreneurial intentions: does gender matter? A multi-group analysis using AMOS. *Technol. Forecast. Soc.* 180.121693. doi: 10.1016/j.techfore.2022.121693

Rauch, A., Fink, M., and Hatak, I. (2018). Stress processes: an essential ingredient in the entrepreneurial process. *Acad. Manage. Perspect.* 32, 340–357. doi: 10.5465/amp.2016.0184

Roseman, I. J. (1996). Appraisal determinants of emotions: constructing a more accurate and comprehensive theory. *Cogn. Emot.* 10, 241–278. doi: 10.1080/026999396380240

Roseman, I. J., Spindel, M. S., and Jose, P. E. (1990). Appraisals of emotion-eliciting events: testing a theory of discrete emotions. *J. Pers. Soc. Psychol.* 59, 899–915. doi: 10.1037/0022-3514.59.5.899

Sarker, M. R., Rahman, S. M. A., Islam, A. K. M. H., Bhuyan, M. F. F., Supra, S. E., Ali, K., et al. (2022). Impact of COVID-19 on small and medium-sized enterprises. *Glob. Bus. Rev.* 0972150922109349. doi: 10.1177/09721509221093489

Satci, B., Gocet-Tekin, E., Deniz, M. E., and Satci, S. A. (2021). Adaptation of the fear of COVID-19 scale: its association with psychological distress and life satisfaction in Turkey. *Int. J. Ment. Health Ad.* 48, 582–592. doi: 10.1007/s11469-020-00294-9

Shagirbasha, S., and Sivakumaran, B. (2021). Cognitive appraisal, emotional labor and organizational citizenship behavior: evidence from hotel industry. *J. Hosp. Tour. Manag.* 48, 582–592. doi: 10.1016/j.jhtm.2021.08.016

Shah, S. H. A., Haider, A., Jindong, J., Muntaz, A., and Rafiq, N. (2022). The impact of job stress and state anger on turnover intention among nurses during COVID-19: the mediating role of emotional exhaustion. *Front. Psychol.* 12:810378.

Shen, H., Fu, M. Y., Pan, H. Y., Yu, Z. F., and Chen, Y. Q. (2020). The impact of the COVID-19 pandemic on firm performance. *Emerg. Mark. Financ. Tr.* 56, 2213–2230. doi: 10.1080/1540496X.2020.1785863

Skinner, N., and Brewer, N. (2002). The dynamics of threat and challenge appraisals prior to stressful achievement events. *J. Pers. Soc. Psychol.* 83, 678–692. doi: 10.1037/0022-3514.83.3.678

Smith, C. A., and Ellisworth, P. C. (1985). Patterns of cognitive appraisal in emotion. *J. Pers. Soc. Psychol.* 48, 813–838. doi: 10.1037/0022-3514.48.4.813

Sornsenee, P., Kongtragulsh, A., Waltcharajirach, K., Chantanawat, R., Aungchayakul, A., Mangkhlaathit, K., et al. (2022). Factors associated with anxiety and depression among micro, small, and medium enterprise restaurant entrepreneurs due to Thailand’s COVID-19-related restrictions: a cross-sectional study. *Risk Manag. Healthcare. P.* 5, 1157–1165. doi: 10.2147/RMHP.539507

Spilberger, C. D., Anton, W. D., and Bedell, J. (1976). “Emotions and anxiety: new concepts, methods, and applications,” in *The nature and treatment of test anxiety*. eds. M. Zuckerman and C. D. Spilberger, (New Jersey: The Halsted Press) 317–345.

Stephan, U. (2018). Entrepreneurs’ mental health and well-being: a review and research agenda. *Acad. Manage. Perspect.* 32, 290–322. doi: 10.5465/amp.2017.0001

Thompson, N. A., van Gelderen, M., and Kepper, L. (2020). No need to worry? Anxiety and coping in the entrepreneurship process. *Front. Psychol.* 11:398. doi: 10.3389/fpsyg.2020.00398

Tomaka, J., Blascovich, J., Kibler, J., and Ernst, J. M. (1997). Cognitive and physiological antecedents of threat and challenge appraisal. *J. Pers. Soc. Psychol.* 73, 63–72. doi: 10.1037/0022-3514.73.1.63

Torres, O., Benzari, A., Fisch, C., Mukerjee, J., Swalhi, A., and Thurik, R. (2021). Risk of burnout in French entrepreneurs during the COVID-19 crisis. *Small Bus. Econ.* 58, 717–739. doi: 10.1007/s11187-021-00516-2

Turner, J., and Akinceme, T. (2020). The business effects of pandemics – A rapid literature review. Available at: https://persistent-url (Accessed 16 April 2020).

Vartanova, O., Kolomytseva, O., Bilyk, V., Budnikevich, I., Vasylenchenko, L., and Burtseva, T. (2021). Enterprise competitive positioning based on knowledge resources identification. *Entrep. Sustain. Iss.* 9, 529–541. doi: 10.9770/jesi.2021.9.1(33)

Wang, S. Y., Liu, Y., Du, Y. Y., and Wang, X. Y. (2021). Effect of the COVID-19 pandemic on consumers’ impulse buying: the moderating role of moderate thinking. *Int. J. Envi. Res. Pub. He.* 18:11116. doi: 10.3390/ijerph18211116

Watson, L., and Spence, M. T. (2007). Causes and consequences of emotions on consumer behaviour - a review and integrative cognitive appraisal theory. *Eur. J. Marketing* 41, 487–511. doi: 10.1108/0309056071073570

Xia, L. H., Luo, B. A., and Sun, Y. (2020). How can entrepreneurs achieve success in chaos? the effects of entrepreneurs’ effectuation on new venture performance in China. *Kybernetes* 49, 1407–1428. doi: 10.1108/K-01-2019-0035

Xu, X. Y., Huang, D., and Chen, Q. R. (2021). Stress and coping among micro-entrepreneurs of peer-to-peer accommodation. *Int. J. Hosp. Manag.* 97:103009. doi: 10.1016/j.ijhm.2021.103009

Xu, Z. D., and Jia, H. Q. (2022). The influence of COVID-19 on entrepreneurs’ psychological well-being. *Front. Psychol.* 12:823542. doi: 10.3389/fpsyg.2021.823542

Yin, J., and Ni, Y. (2021). COVID-19 event strength, psychological safety, and avoidance coping behaviors for employees in the tourism industry. *J. Hosp. Tour. Manag.* 47, 431–442. doi: 10.1016/j.jhtm.2021.04.017

Zhang, D. J., and Fang, Y. K. (2022). Are environmentally friendly firms more vulnerable during the COVID-19 pandemic? *J. Clean. Prod.* 355:131781. doi: 10.1016/j.jclepro.2022.131781

Zhang, W., Xiong, S. K., Zheng, Y. L. H., and Wu, J. N. (2022). Response efficacy and self-efficacy mediated the relationship between perceived threat and psychis anxiety among college students in the early stage of the COVID-19 pandemic. *Int. J. Env. Res. Pub. He.* 19:2832. doi: 10.3390/ijerph19052832

Zutshi, A., Mendy, J., Sharma, G. D., Thomas, A., and Sarker, T. (2021). From students to entrepreneurs: empirical trends and challenges to creativity: enhancing SMEs’ resilience in the context of COVID-19. *Sustainability-basel. 13:6542. doi: 10.3390/su13126542