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Crisis shocks, executive confidence and strategic change: a study based on US Entity List sanctions

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This article examines the influence of crisis shocks on Chinese enterprises' strategic change caused by US Entity List sanctions. We integrate behavioural, prospect and threat rigidity theories to construct an inverted U-shaped relationship model of crisis shocks and strategic change. We then conduct a fixed effects regression using 2016–2022 panel data of A-share listed firms in the computer and communication industries, which are those industries most severely affected by US Entity List sanctions. In addition, we quantify executive confidence via textual analysis techniques and examine the moderating effect of executive confidence on the relationship between crisis shocks and strategic change. The results show that the impact of crisis shocks caused by US Entity List sanctions on strategic change has an inverted U shape; this result implies that moderate crisis shocks promote strategic change but that crisis shocks above a certain level inhibit strategic change. Executive confidence positively moderates the relationship between crisis shocks and strategic change. Further analysis reveals that the impact of crisis shocks on strategic change becomes more significant over time. This study's findings not only enhance the research on crisis shock and strategic change in the context of US Entity List sanctions but also offer practical strategies for Chinese enterprises to effectively manage the crisis shocks caused by US Entity List sanctions.

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Introduction

At present, a new wave of technological revolution, propelled by cutting-edge core technologies, is rapidly unfolding. In the face of this technological wave and window of opportunity, China's high-tech enterprises have implemented strategic change and grasped the opportunity to realize a leap forwards in terms of innovation capacity (Xie et al. 2024; Huang et al. 2023). However, to maintain its technological advantage, the US has suppressed the growth of China's high-tech enterprises in recent years (Liu and Liu 2024). Since 2018, the US has continually tightened its export controls, blacklisting over 800 Chinese enterprises with advanced high-tech technologies on its Entity List, restricting the strategic change of Chinese high-tech enterprises (Li et al. 2024). US Entity List sanctions refer to the US government's policy of imposing extremely stringent licensing requirements on export, re-export, or transfer domestically any items subject to US export control regulations to entities (organizations and individuals) designated on the Entity List (Li et al. 2024; Zhou et al. 2020). US Entity List sanctions have substantially disrupted the US supply of key core components and technologies to Chinese high-tech enterprises (Cheng, 2021), causing them to face crises of supply chain "breakage" and technology "cut-off" (He et al. 2024; Li et al. 2024), which has led to major challenges for Chinese enterprises in realizing strategic change in terms of innovation capability (Xu and Zhong 2024). In this context, what impact have US Entity List sanctions had on the strategic change of Chinese enterprises? Have these sanctions hindered the strategic change of Chinese enterprises, and what strategies should they adopt in response to this crisis? These questions have received extensive attention from both academia and industry.

However, theories offer contradictory explanations regarding the impact of the crisis shock caused by the US Entity List sanctions on the strategic changes of Chinese enterprises. In the context of the crisis shock brought by the US Entity List sanctions, behavioural theory and prospect theory suggest that when enterprises face crisis shocks, they stimulate themselves to conduct problem searches and promote change (Gavetti et al. 2012; Cyert and March 1963), and enterprises tend to balance potential losses through risk-seeking behaviours such as strategic change (Greve and Zhang 2022; Miller and Chen 2004; Gooding et al. 1996; Bowman, 1982; Kahneman and Tversky 1979). Threat rigidity theory argues that when facing crisis shocks, enterprises tend to strictly follow familiar or established behavioural patterns to restrict information processing and constrict control, resulting in rigidity and hindering strategic change (Li et al. 2024; Iyer and Miller 2008; Shimizu 2007; Dorsman and Buckley 2001; Staw et al. 1981). The literature considers a simple linear relationship between crisis and enterprise strategic change as either increasing or decreasing, ignoring the complex implications of the three theories that may work together.

Furthermore, prior studies suggest that organizational responses to environmental change are strongly influenced by executives' interpretations of environmental change (Ashill and Jobber 2010; Chattopadhyay et al. 2007). An enterprise's response to crisis shocks depends on how executives attend to and interpret the crisis shocks and how executives translate this perception into effective strategic actions (Grözinger et al. 2022; Maula et al. 2012). Executive confidence is a critical factor influencing enterprise response during a crisis (Li et al. 2024; Kaplan et al. 2013). Therefore, executive confidence may be an important boundary condition under which crisis shocks affect enterprise strategic change. However, the literature has not adequately discussed the significant impact of executive confidence, an important executive perception, on enterprise strategic change under crisis shocks.

To address these research gaps, we further examine the relationship between crisis shocks and enterprise strategic change and discuss the impact of executive confidence. First, by integrating behavioural, prospect, and threat rigidity theories, we propose an inverted U-shaped model of the relationship between crisis shocks and enterprise strategic change. We conduct a fixed-effects regression using the 2016–2022 panel data of A-share listed firms in the computer and communication industries, which are most heavily affected by US Entity List sanctions, to analyse the impact of crisis shocks on the strategic change of Chinese enterprises. Second, we use a textual analysis to construct the executive confidence variable and examine the role of executive confidence in crisis shocks and enterprise strategic change. The findings indicate that there is an inverted U-shaped relationship between crisis shocks and enterprise strategic change and that executive confidence has a positive moderating effect on the relationship between crisis shocks and enterprise strategic change.

The possible theoretical contributions of this paper are as follows. First, this study discusses enterprise response to strategic change in the context of a particular crisis, such as US Entity List sanctions, which not only expands the research context of the crisis but also enriches the study of the antecedents of strategic change in enterprises. Second, this study integrates behavioural, prospect and threat rigidity theories to analyse the inverted U-shaped relationship between crisis shocks and strategic change; reconciles the seeming contradictions among these theories in the crisis context; and reveals the complex causal relationship between crisis shocks and enterprise strategic change. Third, this study introduces executive confidence as a significant, cognitive moderating variable and finds that executive confidence plays an important moderating role in the relationship between crisis shocks and strategic change. This study bridges the gaps of the previous crisis research, which emphasize the role of factors such as resource inputs and organizational culture in coping with crisis shocks but give insufficient attention to the role of executive confidence and extends the boundary condition study of the relationship between crisis shocks and enterprise strategic change.

Theoretical foundations

Problemistic search is a central point of behavioural theory (Cyert and March 1963). When enterprise performance is below the aspirational level, the enterprise searches for its current activities for symptoms of the problem (Audia and Greve 2021; Chen and Miller 2007; Miller and Chen 2004). Argote and Greve (2007) and Li et al. (2019) further reported that as the performance gap widens, enterprises are increasingly inclined to make positive strategic changes. Kahneman and Tversky (1979) introduced prospect theory, which demonstrates through a body of evidence that people's actual decisions do not necessarily follow rational calculations. Most people are risk averse when faced with gains but risk seeking when faced with losses (Burgess et al. 2023; Rieger and Wang 2006; Wakker 2003). Enterprises facing adversity prefer risky strategic change behaviour rather than nonrisky behaviour (Massis 2016). Threat rigidity theory, proposed by Staw et al. (1981), suggests that restricted information processing, restricted control, and resource conservation can cause enterprises to become rigid in the face of imminent threats, which inhibits strategic change (Halinski et al. 2024; Jeong et al. 2023; Staw et al. 1981).

In summary, in the face of crisis shocks, on the basis of behavioural and prospect theories, enterprises may tend towards problemistic search and risk taking for strategic change (Massis 2016; Argote and Greve 2007; Li et al. 2019; Kahneman and Tversky 1979; Cyert and March 1963), whereas on the basis of

threat rigidity theory, enterprises tend towards risk avoidance and reject strategic change (Jeong et al. 2023; Staw et al. 1981). The three theories have posited inconsistent views on the relationship between crisis shocks and strategic change.

In our view, these inconsistencies are mainly because these studies do not integrate behavioural, prospect and threat rigidity theories into a unified analytical framework and do not sufficiently consider the fact that the impacts of different levels of crisis shocks on enterprise strategic change may differ. In fact, behavioural theory proposes that problemistic search follows the rule of proximity, which tends to find solutions within the internal organization where the problem is identified; solutions that involve small changes to current practices are preferred (Bromiley et al. 2001), and decision makers' responses are incremental and short term (Audia and Greve 2021; Bromiley 1991). Therefore, this theory is more applicable to small crisis shocks (Argote and Greve 2007; Greve 2003). Prospect theory assumes that decision-makers seek risk when faced with losses that exceed the desired reference point. However, prospect theory is based on conclusions drawn from tests of generalized losses and gains conducted in the laboratory and does not include the exploration of decision makers' behaviour in extreme situations (Chattopadhyay et al. 2007; Henrich 1998). Therefore, prospect theory applies mainly to medium crises. It cannot explain well the reactions of decision-makers when facing severe crisis shocks in the actual decision-making process (Pan 2019). Threat rigidity theory can compensate for the shortcomings of prospect theory by considering the extreme psychological stress response of decision-makers when facing shocks (Gooding et al. 1996), which exacerbates the rigidity of practices when decision-makers feel that they are losing control over the situation, causing their enterprises to be rigid in the face of crisis shocks (König et al. 2021). Crisis shocks at this point tend to be significant and far beyond enterprise tolerance and decision-maker capacity.

Behavioural, prospect and threat rigidity theories have different applications in crises. Behavioural theory is suitable for explaining enterprise reactions when crisis shocks are small, prospect theory is suitable for explaining enterprise reactions when crisis shocks are moderate, and threat rigidity theory is suitable for explaining enterprise reactions when crisis shocks are large enough to affect enterprise survival. Crisis shocks and enterprise strategic change may not have a simple linear relationship but an inverted U-shaped nonlinear relationship. Thus, in the context of US Entity List sanctions, we integrate the above theories, construct an inverted U-shaped model of the impact of crisis shocks on enterprise strategic change, and introduce executive confidence as an important boundary condition for empirical analysis.

Research hypotheses

The US Entity List is among the most restrictive tools in US export control system (Li and Zhang 2021). The US Entity List constrains the supply of key core technologies and products to Chinese enterprises, disrupts the innovation paths that Chinese enterprises have long maintained, and plunges Chinese enterprises into an unprecedented crisis (Li et al. 2024; Chen et al. 2023). With respect to the impact caused by crisis shocks due to US Entity List sanctions, some scholars believe that these sanctions promote strategic changes among Chinese enterprises (Cai et al. 2023; Yang and Zheng 2022), whereas others believe that they act as disincentives (Chen et al. 2023; Wan et al. 2022). By integrating behavioural, prospect and threat rigidity theories, we argue that the impact of US Entity List sanctions on Chinese enterprises' strategic change is not a simple linear relationship between promotion and inhibition. Under those crisis shocks caused by US Entity List sanctions, the motivation for strategic

change neither increases nor decreases without limits; rather, as the crisis shocks increase in degree, the strategic change in Chinese enterprises tends to increase and then decrease. A U-shaped relationship might obtain between crisis shocks caused by US Entity List sanctions and Chinese enterprise strategic change.

Enterprises that are less affected by crisis shocks due to US entity list sanctions may, as suggested by the behavioural theory of the enterprise, stimulate problem-seeking (Bromiley et al. 2001; Audia et al. 2000) and respond to the crisis through relatively mild strategic changes such as technological transformation or increased advertising and operational expenditures (Teng and Li 2024). Since it is difficult for general strategic changes to recoup the substantial losses caused by the "broken chain" crisis (Yu et al. 2022), enterprises that have been impacted by crisis shocks due to US Entity List sanctions might choose risk seeking rather than avoidance, as described in prospect theory (Li et al. 2023; Massis, 2016). Enterprises may increase their levels of high-risk R&D and capital investment as well as fixed asset renewal and implement strategic changes that are more radical to obtain high returns to hedge against large losses (Hu et al. 2024; Xue et al. 2023). For enterprises that have been severely impacted by crisis shocks due to US Entity List sanctions that completely exceed enterprise capacity, risky strategic changes do not lead to substantial improvements and may respond rigidly, as described by threat rigidity theory (Jeong et al. 2023; Cai and Shefrin 2018). At this time, to survive, the enterprise chooses risk aversion (Shou et al. 2023; McKinley et al. 2014) instead of strategic change adoption. On the basis of this discussion, this paper proposes the following hypothesis:

Hypothesis 1 *The impact of crisis shocks on strategic change has an inverted U shape. Moderate crisis shocks promote strategic change, but when crisis shocks exceed a certain level, they inhibit strategic change.*

As described in Hypothesis 1, moderate crisis shocks from US Entity List sanctions promote strategic change but inhibit such change when crisis shocks exceed a certain level. We argue that this inverted U-shaped relationship is not homogeneous and that differences in executive confidence levels in enterprises subjected to crisis shocks due to US Entity List sanctions lead to different degrees of strategic change. Executive confidence refers to an executive's belief in his or her ability to accomplish tasks, influence events, or achieve goals (Chakravarty and Hegde 2019; Huelsbeck et al. 2011). The following five mechanisms strengthen the inverted U-shaped relationship between crisis shocks and strategic change: cognitive, economic, regulatory, resource, and emotional (Heavey et al. 2022). That is, when enterprises face crises, executives with strong confidence have emotions that are more positive and can better manage the crisis event than can executives with weak confidence (Fisher et al. 2013; Peng et al. 2024); the former can interpret the information and make decisions accordingly (Mormile et al. 2023). When their mental toughness is greater, executives know how to alleviate pressure to realize goals (Ronay et al. 2019) and focus more attention on the positive results introduced by the crisis; such executives are willing to take greater risks (Barbosa et al. 2019) and prefer more aggressive strategies (Burkhard et al. 2023; Cain et al. 2015); thus, such enterprises are more inclined towards strategic change under the impact of a crisis.

Therefore, when enterprises are impacted by US Entity List sanctions, compared with executives with weak confidence, executives with strong confidence exploit the opportunities for change introduced by the crisis, actively interpret information about crises, seek opportunities, promote enterprise risk taking, mobilize resources from all parties to promote strategic change, and strengthen the role of crisis shocks in promoting strategic change on the left side of the inflection point of the inverted

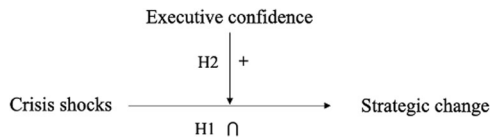


Fig. 1 Conceptual framework of the study. This figure illustrates the hypothesised inverted U-shaped pattern between crisis shocks and strategic change in the conceptual framework, with executive confidence exerting a positive moderating effect on this relationship.

U-shaped curve. Moreover, executives with strong confidence actively broaden information channels, relieve their own anxiety and pressure, face the crisis optimistically, and weaken the inhibitory effect of the crisis on strategic change on the right side of the inflection point of the inverted U-shaped curve. Hence, compared with enterprises with weak executive confidence, enterprises with strong executive confidence are more likely to change their strategies when faced with the impacts of crises due to US Entity List sanctions. On the basis of this discussion, the following hypothesis is proposed:

Hypothesis 2 Executive confidence plays a positive moderating role in the relationship between crisis shocks and strategic change.

The conceptual framework of the study is shown in Fig. 1. According to it, the impact of crisis shocks on strategic change has an inverted U-shaped relationship, meaning that moderate crisis shocks promote strategic change, but when crisis shocks exceed a certain level, they inhibit strategic change. Executives' confidence positively moderates the inverted U-shaped relationship between crisis shocks and strategic change.

Research design

Data. The US Entity List targets Chinese high-tech industries, particularly the computer and communication industries. Given this industry concentration for most of the listed firms affected by these sanctions, we select A-share listed firms in this industry as our data analysis sample. Since 2018, the US has imposed large-scale Entity List sanctions on the Chinese computer and communications industries. Given that the magnitude of crisis shocks involves a comparison of relevant data before and after the crisis (as detailed in the measurement of crisis shocks below), we selected a sample from 2016 to 2022. From the sample, we exclude abnormal operations firms, such as special treatment (ST) and *ST firms; those that have been issued nonstandard audit opinions; and those with serious issues of missing data. We finally obtain 615 firm-year observations. The research data are drawn from the China Stock Market & Accounting Research (CSMAR) and Chinese Research Data Services (CNRDS) databases. To control for the influence of extreme values, continuous variables are winsorized at the 1% level.

Main variables

Explained variable. The explained variable is strategic change ($Change_{i,t+1}$). Drawing upon the studies of Zhu et al. (2018), Tang et al. (2011) and Finkelstein and Hambrick, (1990), this study uses six key investment indicators—advertising, research, fixed asset renewal, management expense investment, capital intensity, and financial leverage—to portray the degree of strategic change. First, these six key indicators are standardized by subtracting their average value in the same industry in the same year and dividing it by their standard deviation. Second, the absolute value of the standardized values is taken to obtain the degree of deviation of each enterprise from the industry average in each strategic dimension. Finally, the average value of the six standardized strategic indicators is taken to obtain the degree of strategic change. After the crisis shock, a certain amount of time

passes in terms of strategic change. Therefore, this study takes the strategic change delayed by one period as the explained variable.

Explanatory variable. The explanatory variable is crisis shocks ($Crisis_{i,t}$). Revenue changes can directly reflect the magnitude of crisis shocks due to US Entity List sanctions (Osievsky et al., 2020). Drawing on the research of Osievsky et al. (2020), this paper measures the severity of the crisis shocks in year t by the decline in the sum of revenues from year t and $t+1$ relative to the sum of revenues from years $t-1$ and $t-2$. A higher value of this variable indicates a greater decline in the enterprise's revenue as a result of the US Entity List sanctions, thereby indicating a more pronounced crisis shock for the enterprise.

Moderator variable. The moderator variable is executive confidence ($Confidence_{i,t}$). In this paper, we use the Python technique to obtain executive confidence by analysing the text of the Management Discussion and Analysis (MD&A) sections in the annual reports of listed firms. Psychological studies have shown that language can reflect people's perceptions, preferences, and personalities (Lind and Mehlum 2010) and that researchers can capture people's traits by analysing the types and frequencies of words used in the language of experimental subjects (Pennebaker et al. 2001). In the MD&A sections, executives communicate their assessments of business conditions and confidence in achieving their goals to investors linguistically (Hu et al. 2021). Studies have utilized positive and negative linguistic information in MD&As to portray managerial traits, which proves the reliability of this approach to a certain extent (Jiang and Feng 2014; Davis and Tama-Sweet 2012; Li 2010). Therefore, drawing on Xie and Lin, (2015), we translate the English sentiment dictionary proposed by Loughran and McDonald, (2011) into a Chinese dictionary, expand and refine it within the Chinese context, and ultimately utilize the number of positive and negative words matched in the CNRDS database to measure the level of executive confidence. Positive words include "profit", "positive", "growth", "opportunity", etc., whereas negative terms include "loss", "negativity", "decline", "hardship", etc. Executive confidence = (positive words-negative words)/all words. Higher values indicate that executives are more confident in responding to US Entity List sanctions. Loughran and McDonald's English Sentiment Dictionary and the translated and refined Chinese dictionary used are displayed in Appendix A.

Control variables. To control for the effects of the internal and external factors of the enterprise on the relationship between the explanatory and the explained variables, this paper incorporates the enterprise-level (Aberg and Torchia 2020; Schumpeter 2013; Sorensen and Stuart 2000; Bloodgood 2006), industry-level (Ferreira and Kittsteiner 2011) and macrolevel (Kumar et al. 2023) factors that have been shown to be important determinants of strategic change in previous literature as control variables: enterprise age (Age), enterprise size (lnStaff), solvency (LVE), net operating margin (ROS), board power (Board), degree of competition in the industry (IndComp), and regional macroeconomic conditions (lnGDP). We use the number of years since the establishment of the enterprise to measure enterprise age (Age); the number of employees employed by the enterprise, which takes the logarithm (lnStaff) to measure enterprise size; the assets-to-liabilities ratio, which measures enterprise solvency (LVE); the net operating margin (ROS), which is the net profit divided by the operating revenue, to measure the profitability of the enterprise; the number of individuals on the board of directors, which measures board power (Board); the industry top-4 enterprises' ratio of main business revenue to industrywide main business

revenue multiplied by 100, which reflects the degree of competition in the industry (IndComp); and the regional gross domestic product (lnGDP), which measures the impact of regional macroeconomic conditions on enterprises. To minimize the differences among the variables, we take GDP in logarithmic form.

To prevent endogeneity problems caused by omitted variables, this study controls for individual, year and industry effects on the basis of the inclusion of control variables. Individual, year and sub-industry fixed effects are included in the model to control for the effects of unobserved individual enterprise characteristics, time-varying factors and industry characteristics, respectively, on enterprise strategic change.

Model construction. On the basis of the research hypotheses of this paper, we set up the following model for testing:

$$\text{Change}_{i,t+1} = \alpha + \beta_1 \text{Crisis}_{i,t} + \beta_2 \text{Crisis}_{i,t}^2 + \beta_3 \text{CV}_{i,t} + \gamma_{i,t} + \mu_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$\begin{aligned} \text{Change}_{i,t+1} = & \alpha + \beta_1 \text{Crisis}_{i,t} + \beta_2 \text{Crisis}_{i,t}^2 \\ & + \beta_3 \text{Confidence}_{i,t} \times \text{Crisis}_{i,t} + \beta_4 \text{Confidence}_{i,t} \times \text{Crisis}_{i,t}^2 \\ & + \beta_5 \text{Confidence}_{i,t} + \beta_6 \text{CV}_{i,t} + \gamma_{i,t} + \mu_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (2)$$

In the model, strategic change ($\text{Change}_{i,t+1}$) is the explained variable. Crisis shocks ($\text{Crisis}_{i,t}$) is the explanatory variable. Executive confidence ($\text{Confidence}_{i,t}$) is the moderator variable. $\text{CV}_{i,t}$ represents the control variables. Considering the possible heteroskedasticity of the panel data, this study adopts a fixed effects model to solve the heteroskedasticity problem. $\gamma_{i,t}$, $\mu_{i,t}$ and $\theta_{i,t}$ represent individual, year and sub-industry fixed effects, respectively, and $\varepsilon_{i,t}$ is the random error term. The descriptive statistics of the above variables are shown in Table 1.

Empirical results and analysis

Descriptive statistics. Table 1 reports the descriptive statistics of the relevant variables. As shown in Table 1, the average value of Change is 0.573, and the standard deviation is 0.235. The average value of Crisis is 0.253, and the standard deviation is 0.319. These findings show that the degrees of strategic change and crisis shocks among the sample enterprises are both high and different, which is important for further empirical research. Appendix B reports the results of the correlation coefficient analysis of the study variables. The correlation coefficients among the variables are low. In addition, we perform variance inflation factor (VIF) analysis on the variables, the results of which show that the maximum VIF value among the variables is 3.39 and that the VIF values of all the variables are much lower than 10, which indicates that the model does not consider multicollinearity issues (Aiken et al. 1991) and is thus suitable for further regression analysis.

Table 1 Variables and descriptive statistics.

Variable	Obs.	Mean	SD	Min.	Max.
Change	615	0.573	0.235	0.201	1.980
Crisis	615	0.253	0.319	-0.735	1.688
Confidence	615	0.033	0.016	-0.021	0.088
Age	615	20.226	5.339	10.329	40.362
lnStaff	615	8.153	1.299	4.554	12.058
LEV	615	0.396	0.170	0.044	0.780
ROS	615	0.061	0.136	-1.007	0.472
Board	615	8.132	1.591	4.000	13.000
IndComp	615	0.020	0.007	0.007	0.097
lnGDP	615	11.047	0.576	9.018	11.731

Table 2 Main and moderating effects between crisis shocks and strategic change.

Variable	(1) Change	(2) Change
Crisis	0.113** (0.047)	0.181** (0.086)
Crisis ²	-0.068* (0.039)	-0.333*** (0.113)
Confidence×Crisis		-1.757 (2.414)
Confidence×Crisis ²		5.821** (2.680)
Confidence		0.199 (0.677)
Controls	Yes	Yes
Constant	-0.007 (1.183)	0.165 (1.225)
Observations	606	603
R-squared	0.062	0.077
Ind fix	Yes	Yes
Year fix	Yes	Yes
ID fix	Yes	Yes

Standard errors in parentheses are clustered at the individual level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Baseline results. To reduce the problems of heteroskedasticity and autocorrelation in the panel data, we regress the base model via a fixed effects model and individually cluster robust standard errors. Table 2 reports the results of testing the hypotheses of this paper. The relationship between crisis shocks and strategic change is shown in Column (1) of Table 2, with a significant positive correlation between the primary term of crisis shocks and strategic change ($\beta_1 = 0.113$, $P < 0.05$) and a significant negative correlation between the square term of crisis shocks and strategic change ($\beta_2 = -0.068$, $P < 0.1$). The impact of the crisis shock caused by US Entity List sanctions on strategic change is not linear; rather, it has an inverted U shape. Furthermore, this study applies the three-step method proposed by Lind and Mehlum (2010) to test the inverted U-shaped relationship. First, β_2 must be significant and negative. In Model (1) of Table 2, the regression coefficient β_2 of Crisis^2 is -0.068, which is significant at the 10% level and satisfies condition one. Second, the slope of the left (right) endpoint of the curve should be positive (negative) to ensure that the parabola opens downwards. The slope of curve $\beta_1 + 2\beta_2 \times \text{Crisis}_{\min}$ is positive when the crisis takes the minimum value of Crisis_{\min} , and the slope of curve $\beta_1 + 2\beta_2 \times \text{Crisis}_{\max}$ is negative when the crisis takes the maximum value of Crisis_{\max} . According to the descriptive statistics in Table 1 and the data in Column (1) of Table 2, $\beta_1 + 2\beta_2 \times \text{Crisis}_{\min} = 0.212$ and $\beta_1 + 2\beta_2 \times \text{Crisis}_{\max} = -0.117$, which satisfy condition two. Third, the turning point (axis of symmetry) should be in the range of the values of the explanatory variable to prevent the graph from containing only a part of the curve monotonically increasing or decreasing. The turning point of the curve is the value when the slope of the curve is 0, and $\text{Crisis}^* = -\beta_1/2\beta_2$. After calculation, $\text{Crisis}^* = 0.830$, which is within the range of the value of Crisis and satisfies the third condition. In summary, the hypothesis that crisis shocks have an inverted U-shaped effect on strategic change passes the test; thus, Hypothesis 1 is supported. The results indicate that when crisis shocks are within a certain level, enterprises attempt to change the unfavourable situation through strategic change, and crisis shocks promote such change.

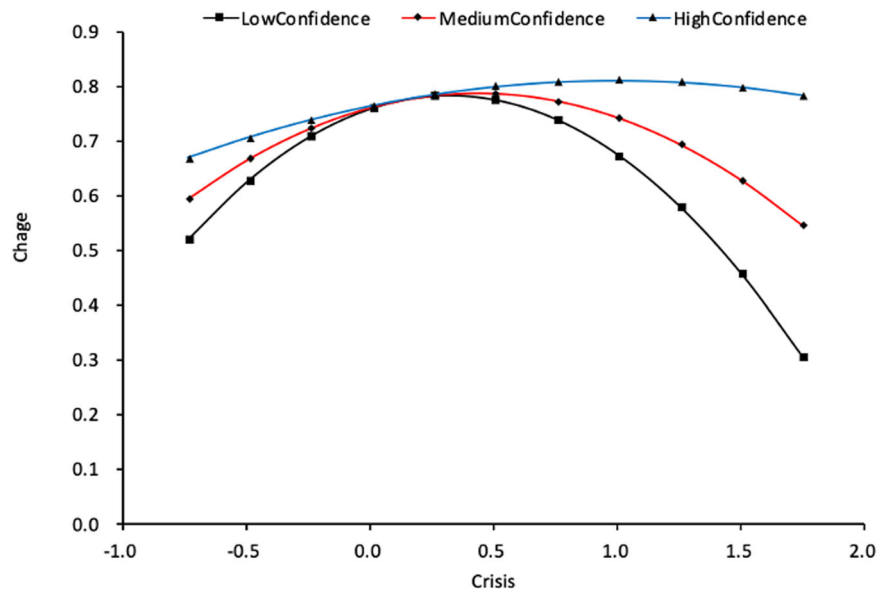


Fig. 2 Moderating effect. This figure demonstrates the moderating effect of low, medium, and high levels of executive confidence on crisis shocks and strategic change. Stronger executive confidence strengthens the facilitating effect of crisis shocks on strategic change.

However, when crisis shocks exceed a certain level, enterprises may become rigid because of the great pressure they face and adopt conservative risk-averse behaviour, so crisis shocks may inhibit strategic change.

Moderating effect analysis. The moderating effect of executive confidence on crisis shocks and strategic change is shown in Column (2) of Table 2. The coefficient of the interaction term between executive confidence and $Crisis^2$ is significantly positive ($\beta = 5.821$, $P < 0.05$). Executive confidence strengthens the inverted U-shaped relationship between crisis shocks and strategic change; thus, Hypothesis 2 is supported. These findings suggest that strong executive confidence, when faced with crisis shocks caused by US Entity List sanctions, helps strengthen the facilitating impact of crisis shocks on strategic change and weakens their inhibiting impact on strategic change. To illustrate the moderating effect of executive confidence more clearly and carefully, this study uses two methods of graphical presentation and data analysis on the basis of the regression results.

On the basis of the regression findings of Model (2), we draw graphs to illustrate the distinct patterns of crisis shocks and strategic change at varying levels of executive confidence: low, medium, and high. As shown in Fig. 2, compared with lower levels of executive confidence, the inverted U-shaped curve of crisis shocks and strategic change is flatter, the inflection point of the curve is shifted to the right, and the overall level of the curve is higher when executive confidence is at a higher level. This finding implies that enterprises with greater executive confidence have a greater degree of strategic change under the same crisis shock than do enterprises with weaker executive confidence.

Furthermore, this study elucidates the moderating effect of executive confidence through a detailed data analysis. Drawing upon the method proposed by Haans et al. (2016) to test the moderating effect of the U-shaped relationship, we further test the moderating effect of executive confidence from the following three aspects: curve shape, curve inflection point, and overall level of the curve. First, according to Model (2) in Table 2, $\beta_4 = 5.821 > 0$. Therefore, the inverted U-shaped curve of crisis shocks and strategic change becomes flatter when executive confidence is stronger. Second, according to Model (2) in Table 2, $\beta_1\beta_4 - \beta_2\beta_3 = 0.469 > 0$. Therefore, the inflection points of

the inverted U-shaped curve of crisis shocks and strategic change shift to the right when executive confidence is stronger. Finally, according to Model (2) in Table 2, $\beta_4 = 5.821$, $\beta_3^2 - 4\beta_4\beta_5 = -1.546$, and the inverted U-shaped curve of crisis shocks and strategic change shifts upwards when executive confidence is stronger. The results indicate that stronger executive confidence strengthens the facilitating effect of crisis shocks on strategic change and weakens the inhibiting effect of crisis shocks on strategic change. When facing the same crisis shock, enterprises with greater executive confidence experience greater strategic change. Executive confidence positively moderates the relationship between crisis shocks and strategic change.

Endogeneity tests. This work mitigates the problem of omitted variables by including individual, year, and sub-industry fixed effects as well as enterprise-, industry-, and macrolevel control variables in the model, which ensures the validity of the regression results to a large extent. However, the results may suffer from variable measurement bias, omitted variable bias, and reverse causality. To further improve the reliability of this study, endogeneity tests are conducted on crisis shocks and strategic change.

Instrumental variable (IV) test. To address variable measurement bias, omitted variable bias, and reverse causation, we use IV two-stage least squares (IV-2SLS) regression to mitigate these endogeneity problems. Drawing on the practices of existing studies (Zhou et al. 2020; Kim et al. 2014), this work uses the region-industry-year average of crisis shocks as the IV for crisis shocks. Crisis shocks in the same region, industry and year affect the degree of crisis shocks to the enterprise and satisfy the IV correlation requirement. However, this situation does not directly affect the strategic change decision of an enterprise, satisfying the exogeneity requirement. Table 3 reports the IV-2SLS estimation results based on the IVs. In the first-stage regression, IV and Crisis are significantly positively correlated ($\beta = 0.894$, $P < 0.01$), as are IV^2 and $Crisis^2$ ($\beta = 1.188$, $P < 0.01$), indicating that the IVs are strongly correlated with the primary and square terms of crisis shocks, which satisfies the correlation condition. In addition, the value of the Kleibergen-Paap rk Lagrange multiplier (LM) is 23.35, which rejects the hypotheses of insufficient identification of

Table 3 IV test and reverse causality test.

Variable	(1) Crisis	(2) Crisis ²	(3) Change	(4) Crisis ²
Crisis			0.240** (0.106)	
Crisis ²			-0.185* (0.108)	
IV	0.894*** (0.151)	-0.105 (0.112)		
IV ²	-0.049 (0.201)	1.188*** (0.193)		
Change				-0.313 (0.239)
Controls	Yes	Yes	Yes	Yes
Constant	-3.985 (2.208)	-1.270 (1.660)	-0.922 (1.357)	25.369** (12.443)
Observations	596	596	596	270
R-squared	0.154	0.121	0.835	0.163
Ind fix	Yes	Yes	Yes	Yes
Year fix	Yes	Yes	Yes	Yes
ID fix	Yes	Yes	Yes	Yes
Kleibergen–Paap rk LM	23.35***			-
Cragg–Donald Wald F statistic	36.78			-

Standard errors in parentheses are clustered at the individual level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

IVs at the 1% level. The value of the Cragg–Donald Wald F statistic is 36.78, which is greater than the critical value of Stock–Yogo’s weak IV identification test at the 10% significance level of 7.03, rejecting the original hypotheses of weak IVs. This test confirms the reasonableness of the IVs selected in this paper. In the second-stage regression in Column (3), Crisis and Change are significantly positively correlated ($\beta=0.240$, $P < 0.05$), and Crisis² and Change are significantly negatively correlated ($\beta=-0.185$, $P < 0.1$), which suggests that the impact of crisis shocks on strategic change has an inverted U shape. This result indicates that moderate crisis shocks promote strategic change, but crisis shocks inhibit strategic change when they exceed a certain level; thus, Hypothesis 1 passes the IV test.

Reverse causality test. To test whether reverse causality exists between crisis shocks and strategic change, i.e., that enterprise strategic change may lead to an enterprise crisis, we take strategic change as the explanatory variable and crisis shocks with a two-period lag as the explained variable (Crisis²) and add the control variables to the basic model to conduct the regression. As shown in Column (4) of Table 3, the regression coefficients of strategic change and crisis shocks with a two-period lag are not significant, which means that no reverse causality exists between crisis shocks and strategic change.

Robustness tests

Replacing the measure of crisis shocks. The previous measure of crisis shocks in terms of a revenue decline highlights the direct impact of US Entity List sanctions on Chinese enterprises. However, the US Entity List sanctions affect not only revenues but also the overall financial position of the enterprise. For this reason, referring to Ohlson’s (1980) approach for measuring the financial distress of an enterprise, we construct a crisis shock indicator (CrisisN) using six indicators—including the logarithm of total assets, current ratio, working capital ratio, and ratio of net cash flow from operations to total liabilities—and then conduct a

Table 4 Robustness test.

Variable	(1) Change	(2) Change	(3) Change
CrisisN	0.086* (0.051)		
CrisisN ²	-0.494** (0.214)		
Crisis		0.104* (0.058)	0.155* (0.089)
Crisis ²		-0.093 (0.060)	-0.324** (0.127)
ConfidenceS×Crisis		-0.212* (0.117)	
ConfidenceS×Crisis ²		0.159** (0.074)	
ConfidenceS		0.040 (0.028)	
ConfidenceW×Crisis			-0.122 (0.321)
ConfidenceW×Crisis ²			0.683* (0.384)
ConfidenceW			-0.007 (0.090)
Controls	Yes	Yes	Yes
Constant	0.897 (1.475)	0.130 (1.238)	0.128 (1.209)
Observations	551	587	605
R-squared	0.078	0.062	0.075
Ind fix	Yes	Yes	Yes
Year fix	Yes	Yes	Yes
ID fix	Yes	Yes	Yes

Standard errors in parentheses are clustered at the individual level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

robustness test on the relationship between crisis shocks and strategic change in the enterprise. The regression results are shown in Column (1) of Table 4. The relationship between the primary term of crisis shocks and strategic change ($\beta=0.086$, $P < 0.1$) is significantly positive, and the relationship between the interaction of the square term of crisis shocks and strategic change ($\beta=-0.494$, $P < 0.05$) is significantly negative. This finding indicates that the effect of crisis shocks on strategic change has an inverted U shape, and Hypothesis 1 passes the robustness test.

Replacing measures of executive confidence. In this work, two methods are used to test the moderating effect of executive confidence on the relationship between crisis shocks and strategic change. First, executive confidence (ConfidenceS) is measured by using the number of shares of equity incentives held by executives. Drawing on Malmendier and Tate (2005), Malmendier and Tate (2005), Malmendier and Tate (2008), we use the number of shares of equity incentives held by executives to measure executive confidence. When executives hold a greater number of equity incentive shares, they are more optimistic about the future of the company and less willing to sell their shares, which indicates stronger executive confidence. The regression results are shown in Column (2) of Table 4. The coefficient of the interaction term between executive confidence and the square of the crisis shocks ($\beta=0.159$, $P < 0.05$) is significantly positive, which indicates that executive confidence positively moderates the relationship between crisis shocks and strategic change; thus, Hypothesis 2 passes the robustness test. Second, we change the denominator in the previous formula for calculating executive confidence by replacing the number of words in all of the text with the number of emotionally positive words plus the number of emotionally

Table 5 Further analysis.			
Variable	(1) Change	(2) Change1	(3) Change2
Crisis	0.059* (0.034)	0.085** (0.038)	0.169*** (0.053)
Controls	Yes	Yes	Yes
Constant	0.213 (1.230)	-1.753 (5.084)	-10.286 (7.288)
Observations	606	409	271
R-squared	0.056	0.065	0.136
Ind fix	Yes	Yes	Yes
Year fix	Yes	Yes	Yes
ID fix	Yes	Yes	Yes

Standard errors in parentheses are clustered at the company level. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

negative words to conduct a robustness test of executive confidence. Executive confidence (ConfidenceW)= (positive words-negative words)/(positive words+negative words). The regression results are shown in Column (3) of Table 4. The coefficient of the interaction term between executive confidence and squared crisis shocks ($\beta=0.683$, $P < 0.1$) is significantly positive, indicating that executive confidence strengthens the inverted U-shaped relationship between crisis shocks and strategic change; thus, Hypothesis 2 again passes the robustness test.

Further analysis

We further discuss the long-term impact of crisis shocks caused by US Entity List sanctions on the strategic change of Chinese enterprises. The previous regression model considers the fact that there is a certain lag in strategic change after the occurrence of crisis shocks; therefore, the model lags strategic change by one period as the explained variable (Change). On this basis, we continue to lag strategic change by two periods (Change1) and three periods (Change2) to discuss the long-term impact of crisis shocks. The regression results, as shown in Table 5, reveal that the effects of crisis shocks (Crisis) on lagged strategic change (Change, Change1, and Change2) ($\beta=0.059$, $P < 0.1$; $\beta=0.085$, $P < 0.05$; $\beta=0.169$, $P < 0.01$) are positive and significant. Moreover, over time, the coefficient of the impact of crisis shocks on strategic change increases and becomes more significant. This finding indicates an obvious long-term promotion effect of crisis shocks on strategic change. The rationale behind this phenomenon is that as time progresses, organizations are afforded more chances to analyse and adapt to the crisis and can mobilize a greater array of resources to cope with the crisis, thus facilitating strategic change.

Discussion and implications

Discussion. We examined the relationship between crisis shocks and strategic change. The literature—on the basis of behavioural, prospect, and threat rigidity theories—has revealed that crisis shocks exhibit either a facilitating (Greve 2003; Chen and Miller 2007; Audia et al. 2000; Burgess et al. 2023; Tapas and Pillai 2022) or an inhibiting (Mazzei et al. 2024; Halinski et al. 2024; Jeong et al. 2023) linear relationship with strategic change. However, upon a thorough examination of these three theories, we discovered a possibly more complex relationship between crisis shocks and strategic change. In fact, each of the three theories has its own applicability and is suitable for explaining the impact of different magnitudes of crisis shocks on strategic change, ranging from relatively minor to large and existential threats to the enterprise(Argote and Greve, 2007; Chattopadhyay et al. 2007;

König et al. 2021). Therefore, we integrated these three theories to analyse the impact of crisis shocks on strategic change. The results reveal an inverted U-shaped relationship between crisis shocks and strategic change. This finding challenges the existing view of a linear relationship between the two and contributes to a more precise depiction of their complex relationship. The finding also strongly echoes Shimizu’s, (2007) argument that a single theory cannot fully capture the complexity of reality and that integrating multiple theories provides reasonable explanations and predictions. Our findings provide a more precise theoretical perspective for understanding strategic change decisions made by enterprises in complex crisis situations.

Furthermore, this study introduces executive confidence into the crisis context and finds that executive confidence plays a positive moderating role in the relationship between crisis shocks and strategic change. This finding strongly supports the research that shows that executive confidence can have a positive effect on enterprise behaviour (Peng et al. 2024; Villanueva-Flores et al. 2023; Li 2024). Moreover, this finding reveals that executive confidence is not only an important driving force for strategic change but also a crucial psychological resource for mitigating the negative effects of crises. This study not only deepens the understanding of the mechanism of executive confidence but also provides important theoretical support for how enterprises can promote strategic change by enhancing executive confidence in extreme crisis situations.

Theoretical contributions. This study makes the following theoretical contributions. First, prior research has focused on the impact of crises such as disruptive business model to technology shocks, financial crises, natural disasters, and other enterprise crises (Tripsas and Gavetti 2017; Dewald and Bowen 2010; Makkonen et al. 2014; Quarantelli 1988), whereas few studies have examined the impact of crisis shocks caused by international government sanctions on enterprises. This study explores the inverted U-shaped effect of US Entity List sanctions' shocks on Chinese enterprises' strategic change, expanding the related studies on crises. Second, existing studies grounded individually in behavioural, prospect, and threat rigidity theories assume a unidirectional linear relationship between crisis shocks and strategic change—either promoting or inhibiting such change (Greve and Zhang, 2022; Miller and Chen 2004; Iyer and Miller 2008). We integrate three theories to reveal the nonlinear relationship between crisis shocks and strategic changes in enterprises, reconciling the seeming contradictions among behavioural, prospect, and threat rigidity theories. Third, the research has highlighted the significant role of factors such as slack resources, organizational culture, and risk experience in coping with crisis shocks (Woo et al. 2024; Agusti et al. 2022; Deverell and Olsson 2010; Osiyevskyy and Dewald 2015), whereas the role of executive confidence has been insufficiently discussed. This study examines the influence of the cognitive variable of executive confidence and reveals its positive moderating effect on the relationship between crisis shocks and enterprise strategic changes. This finding not only reveals that executive confidence is a critical boundary condition for the impact of crisis shocks on enterprise strategic change but also helps to overcome the deficiency of the crisis literature in understanding executive confidence.

Practical implications. For Chinese enterprises, executives need to dialectically view the impacts of crisis shocks. While recognizing the potential negative effects that crisis shocks may bring, executives should also see the potential driving force for strategic change within enterprises. Furthermore, executives should

recognize the opportunities for domestic substitution arising from the impact of US Entity List sanctions as well as the trend of strengthened technological collaboration and industry-academia-research cooperation among Chinese enterprises following the sanctions, leading to continual technological breakthroughs. Therefore, Chinese enterprises should fully leverage the strategic change opportunities introduced by the US Entity List sanctions; strengthen internal and external cooperation and technological research; reconstruct the supply, value, and innovation chains; continually enhance their confidence in responding to the crisis; and actively undertake strategic changes to cope with the crisis. Take Huawei as an example. Since 2018, this well-known Chinese telecommunications company has suffered multiple rounds of sanctions under the US Entity List, which have been a heavy blow. In the context of crisis shocks, based on its extensive cooperation network and deep technological accumulation, Huawei has continually expanded internal and external cooperation and R&D investment, enhancing its confidence and ability to cope with sanctions. Consequently, Huawei has actively undertaken strategic changes to respond to the US Entity List sanctions crisis by increasing R&D investment in the semiconductor and telecommunications equipment sectors, enhancing advertising investment in its smartphone business, launching the HarmonyOS ecosystem, and entering the smart auto industry.

For the Chinese government, it is imperative to maximize the positive effects of crisis shocks on Chinese enterprises while minimizing their negative consequences as much as possible. In response to the crisis shocks posed by US Entity List sanctions, the Chinese government urgently needs to establish an efficient cross-departmental collaboration framework. This framework aims to integrate the advantageous resources of government departments, industry organizations, scientific research institutions, and all sectors of society, forming a powerful force of resource and technology collaboration to fully support Chinese enterprises affected by US Entity List sanctions. Furthermore, the government can leverage various measures—including fiscal subsidies, tax incentives, special funds, and policy support—to assist Chinese enterprises in establishing a tightly cooperative network system involving the government, industry, academia, and research. By encouraging leading enterprises to take on the role of “chain leaders”, the government can guide sanctioned enterprises in reshaping their supply chains, value chains, and innovation chains. These initiatives will help boost the confidence and capabilities of Chinese enterprise executives in dealing with US Entity List sanctions, reduce their anxiety, thereby facilitating strategic change among Chinese enterprises and overcoming the adverse impacts that arise from the crisis shocks of US Entity List sanctions.

Limitations and future research prospects. This study has several limitations that can inspire future research. First, we collect data only from 2016 to 2022, which is not a long enough time span. As time progresses, the impact of crisis shocks on strategic change can be examined over a longer period. Second, this study examines only the impact of executive confidence on crisis shocks and strategic change. In fact, other unobservable internal and external factors, such as enterprise reputation and government concern, may affect the relationship between crisis shocks and strategic change. This topic could be further investigated in future research to gain a more comprehensive understanding of the mechanisms through which crisis shocks affect strategic change. Third, this work analyses the impact of crisis shocks on strategic change by measuring strategic change from the perspective of overall enterprise resource allocation. Future research could explore the impact of crisis shocks from the perspective of strategic change at specific business and product levels.

Conclusions

Within the context of US Entity List sanctions, we integrate behavioural, prospect and threat rigidity theories to study the relationship between crisis shocks and the strategic change of Chinese enterprises. We utilize textual analysis to measure executive confidence to further discuss its moderating role in the above relationship. The regression results based on fixed effects show that the impact of crisis shocks caused by US Entity List sanctions on strategic change has an inverted U-shape, which indicates that moderate crisis shocks promote strategic change but that crisis shocks exceeding a certain level inhibit such change. Executive confidence positively moderates the relationship between crisis shocks and strategic change. Further analysis reveals that crisis shocks promote strategic change more significantly as time progresses. These findings remain robust after endogeneity and robustness tests. Our research further reveals the complex causal relationships between crisis shocks and enterprise strategic change and highlights the important, positive role of executive confidence in moderating the two.

Data availability

The data used in this study can be requested from the corresponding author.

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Author contributions

ZL: conceptualization, theoretical analysis, funding acquisition, project administration, supervision. QL: methodology, visualization, writing-review and editing, writing-original draft. YZ: data curation and editing.

Competing interests

The authors declare no competing interests.

Ethics approval

Ethical approval was not required as the study did not involve human participants.

Informed consent

Informed consent was not required as the study did not involve human participants.

Additional information

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