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Can Female Executives Enhance Organizational Resilience? Evidence from China during the COVID-19 Pandemic

Hangsheng Yang [1,2], Min Tang [1,*] and Ju Huang [1]

[1] School of Management Science, Chengdu University of Technology, Chengdu 610059, China; 18883630563@163.com (H.Y.); hhhj35917@163.com (J.H.)
[2] School of Business Administration, Southwestern University of Finance and Economics, Chengdu 611130, China
* Correspondence: tangm@cdut.edu.cn

Abstract: Organizational resilience is the potential ability of a system to endure adversity, sustain its existing structure, and recover quickly after a shock. However, we know little about the factors that influence organizational resilience in the context of specific emergent situations. The COVID-19 pandemic has provided a new opportunity for research on the influencing factors in organizational resilience. In this study, we explore the impact of female participation in executive teams on organizational resilience on the basis of female executives' utility, upper echelons theory, and organizational resilience. We use 1755 listed Chinese A-share companies in Shanghai and Shenzhen as our study sample and test them by using OLS models with robust standard errors and Cox risk proportion models. The results suggest that companies with a higher proportion of female executives before the shock will experience fewer losses and will take a shorter amount of time to recover from the attack. By revealing the impact of female executives on organizational resilience, this paper fills the gap in the relevant literature and further explores the practical value and managerial implications.

Keywords: female executives; organizational resilience; survival analysis

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1. Introduction

Sudden changes and unprecedented events often surprise organizations: natural disasters interrupt the supply chain, financial crises paralyze the market, terrorist attacks hit the public and cause panic, and industrial and medical accidents have a significant impact on the ecological environment and social development [1]. At the beginning of 2020, coronavirus disease 2019 (COVID-19) brought the global economy to an unprecedented crisis [2]. The survival and development of business organizations were severely tested, and companies in many industries were on the verge of bankruptcy [3]. In fact, with the frequent occurrence of unconventional emergencies such as the September 11 attacks in the United States, a volatile, uncertain, complex, and ambiguous environment has become the new normal for organizational production and operation activities [4]. In this "new normal", sustaining the vitality of an enterprise is an important issue in organizational management.

Case studies and empirical evidence have shown that some organizations are better at responding to unexpected, sudden, or extreme events than other organizations in the same environment [5]. They can identify and react faster to early signs of crisis [6,7]; avoid, withstand, and buffer the impact of adverse events; recover and bounce back quickly from adversity; and develop more unusual ways of doing business for future growth [8,9]. These abilities describe the concept of organizational resilience. In the existing literature, most scholars have constructed the theoretical framework of organizational resilience from a qualitative perspective [10,11] and explored the formation mechanism of organizational resilience through case studies [3,12], which have produced rich theoretical results. At the same time, organizational resilience is a function of an organization's understanding of form, crucial weak links, and its adaptability to symbiosis with the

environment, which is triggered and driven by complex influencing factors. From an internal perspective, organizational culture [13] and employee perception [14] are essential factors in organizational resilience. Based on the external perspective of an organization, network resources [15] and social support [16] are considered to play a significant role in organizational resilience. However, we still know little about the influencing factors of organizational resilience limited by the scarcity of specific emergent situations.

The COVID-19 pandemic has provided a new opportunity for research on the influencing factors in organizational resilience. A recent study looked at the performance of women leaders around the world in response to the COVID-19 outbreak. The study points out that when the COVID-19 pandemic began impacting our societies in 2020, female leaders, although few in number, were featured for their skillful navigation of an unknown and invisible threat [17]. Many scholars and media outlets have appealed to this view, arguing that countries led by women are systematically more effective in responding to epidemics, and that women perform better than male leaders [18,19]. However, the applicability of this finding to businesses is unclear. In fact, as women continue to gain ground in business, the focus on female corporate leaders in business and academia continues to rise. For example, women leaders are emerging in business practice in companies like Facebook, where they can engage and steer across industries, driving broader diversity and inclusion and helping organizations address complex and changing challenges better. The existing literature on research into women leaders in business also notes that female executives are more likely to stimulate team creativity [20], focus on risk avoidance and corporate social responsibility [21], understand productivity signals from employees and facilitate job matching [22], value employees and adapt to environmental changes [23], and exhibit characteristics such as high mental resilience and less overconfidence [24,25]. These cognitive traits may help companies identify and interpret potential signals of disruption and deal with immediate problems in a critically insightful, creative way, thus helping them achieve crisis reversal [26]. Furthermore, female executives are engaged in promoting corporate sustainability, not only by responding to stress signals promptly but also by being driven by personal values [27]. In addition, the upper echelons theory suggests that the demographic characteristics of the executive team can have a significant impact on corporate production and business decisions [28]. Scholars have demonstrated that female executives can significantly improve firm performance [29] and maintain a sustainable competitive advantage [30].

However, while the vital value of women executives in businesses has been highlighted and widely recognized [31,32], there is still a gap in how women executives impact organizational performance in the face of systemic shocks such as the COVID-19 pandemic. At the same time, identifying and controlling the prerequisites for organizational resilience is also necessary for effectively cultivating high levels of resilience. Clarifying the role of women executives during the COVID-19 crisis can provide solutions for organizations to achieve sound operations and steady development in an uncertain environment from a leadership perspective. In this study, we use empirical research in the context of pandemics to bridge difficult and essential gaps in the existing research. We integrate the literature on female executives, upper echelons theory, and organizational resilience to explore how the proportion of female executive participation affects firms' organizational resilience in the face of systemic shocks. We expected that firms with greater female executive participation will have experienced smaller stock price losses under a shock from the COVID-19 pandemic, and their stock prices will be more likely to have recovered more quickly to pre-pandemic levels. We used 1755 listed companies in Shanghai and Shenzhen A-shares as our research sample and tested them by using OLS models with robust standard errors and Cox risk proportion models, and the regression results confirmed our hypotheses. After a series of robustness tests, our conclusions still hold.

This study is expected to contribute to the existing literature in two aspects: (1) To the best of our knowledge, we are among the first to link female executives to the literature on organizational resilience, answering the practical question of how female executives

affect firm performance in the face of systemic shocks. These findings contribute to a better understanding of the differences in firms' responses and performance during specific unconventional contingencies, thereby promoting the sustainable development of enterprises. (2) We expand the research perspective of the upper echelons theory. Previous research has pointed out that cognitive ability, perceived competence, and values of the top management team determine the strategic decision-making process and firm value [28]. However, previous works in the literature have mainly argued for firm performance and firm innovation, and studies on crisis in specific scenarios have focused on the impact of CEOs' personal characteristics [33]. This study focuses on the impact of female executives' participation ratios on organizational resilience from the demographic characteristics of executive teams. These new insights are important to enrich the application value and expand the research perspective of upper echelons theory.

The remainder of this study is arranged as follows: The second section reviews the relevant theories and presents the hypotheses. The third section introduces the research methods and variable settings. The empirical results and analysis are implemented in the fourth section. Finally, the fifth section discusses the results and concludes the study.

2. Theoretical Analysis and Research Hypothesis

The term "resilience" originated in materials science, where it refers to the unique properties of certain types of wood that enable them to adapt to sudden and violent loads without breaking; that is, it is the ability to resist external impacts without breaking [34]. With the development of systems theory, the concept of resilience became closely associated with ecology [35]. Ecological resilience reflects the adaptive behavior of ecosystems to adjust themselves actively to changes in the environment and to re-establish an equilibrium with the existing environment [36]. Resilience has gained recognition and has shown a flourishing trend in different disciplines, such as engineering resilience, which is the ability of engineering structures to withstand earthquakes, floods, or accidental disturbances [37]; psychological resilience, which is the ability of individuals to adapt and adjust to sudden adversity [38]; and regional resilience, or the ability of a region to maintain its ability to recover from external shocks [39].

The turbulence and increased competition in the business environment have propelled the study of resilience into the field of management. In the 1980s, research pioneered the integration of the concept of resilience into business and management, defining organizational resilience as the effectiveness of an organization's learning through initial adjustments and improvements [40]. Organizational resilience is viewed as a purpose and outcome of effort, indicating that the organization maintains its effectiveness in response to continuous and rapid changes in the environment and meets the needs of its customers [41].

In the past few years, organizational-level resilience has received extensive attention [42] and has gradually become the center of discussion in the field of management scholarship and practice. Previous studies have confirmed that organizational resilience is a multidimensional, cross-level, and complex concept [43,44]. Organizational management scholars have described and interpreted the concept of organizational resilience from different perspectives and approaches. It can be based on the "capability view", as the implicit ability of an organization to anticipate, prevent, and adjust to environmental trials [33]; on the "trait view", as the collection of attributes of defensiveness, growth, and anticipation [45]; and on a 'process view' based on the core ideas of coordinated response and sustained environmental interactions and sustained operations in a crisis with resources and capabilities [46]. The "capability" perspective to define and evaluate organizational resilience is widely accepted by scholars [47]. Previous research identified organizational resilience as the potential ability of a system to endure despite adversity and to maintain its existing structure and recover quickly after a shock [48]. It encompasses the multiple aspects of organizational anticipation, avoidance, and adaptation to environmental shocks [7]. To understand the concept of resilience in depth, existing research defined resilience as two dimensions: (1) the ability of a system to withstand major disruptions, and (2) the ability

of a system to recover [49]. These two dimensions have been applied in empirical studies on organizational resilience and correspond to two fundamental attributes in resilient systems: stability and flexibility [33,35]. Stability enables an organization to maintain its core attributes, including its function and structure, in the face of external environmental disturbances [50], whereas flexibility allows organizations to absorb, adapt, and adjust to environmental changes and to recover and develop [7].

Nowadays, enterprises are in the unpredictable VUCA era, where a haze of fear, turmoil, and uncertainty looms over their survival and growth, and they need to develop the ability to adapt, innovate, and be flexible to withstand sudden unconventional crises and return to normality as soon as possible. Realistically, some firms were hit hard by the COVID-19 pandemic, whereas others recovered quickly and continued to grow. To explain this heterogeneity, the literature on organizational resilience has explored the impact of individual executive characteristics, such as CEO greed and CEO narcissism [33,51]. Upper echelons theory states that both individual executive and executive team demographic characteristics influence firm survival and growth [28]. Hence, we focus our research on the gender differences dimension of executive teams. Female executives are better able to promote effective team communication and harmony and can bring new ideas and perspectives from a female perspective to the decision-making process [20]. In this study, we refer to previous studies that consider stability and flexibility as core attributes for organizations to remain resilient [35]. Moreover, we assess organizational resilience in terms of the volatility and recovery of a firm's stock, as the market valuation of a firm reflects the latest information about the firm [33,51]. We expect firms with high female executive participation to perform better than firms with low female executive participation in response to unexpected shocks such as the COVID-19 pandemic.

Female participation in executive teams and organizational stability. Stability enables an organization to maintain its core attributes, including its function and structure, in the face of external environmental disturbances [50]. In this study, organizational stability is reflected in the degree of corporate share price loss under a pandemic shock, with a smaller degree of corporate share price loss indicating better stability. We expect that firms with a higher proportion of female executive participation will have a smaller degree of share price loss. First, female participation in executive teams helps companies identify and interpret potential crisis signals and enhances the organization's ability to interpret and deal with complex environments. Research has shown that female participation in executive teams can help organizations use more complementary approaches and ideas to understand the external environment [52]. In the face of a crisis, female executives make full use of their professional experience, mindset, and emotional preferences developed in their previous work to think critically about recognizing and dealing with crisis signals, thus helping the company maintain effective operations or even achieve crisis reversal [26]. It has also been shown that crisis situations lead to a significant increase in the appointment of female executives, which highlights the important role of female executives in coping with crises [53]. Second, female participation in the executive team helps an organization establish good reciprocal relationships (employees, partners, and other stakeholders). On the one hand, during the organizational development process, female executives are more caring, understand the needs of employees, promote effective communication and harmony among team members [54], and contribute to the formation of a cohesive organizational culture, which is a core element for organizations to maintain normal operations under unexpected shocks such as the COVID-19 pandemic [55]. On the other hand, female executives pay more attention to the fulfillment of corporate social responsibility than male executives [31], which further deepens the interdependence between a firm and its different stakeholders. Such interdependence facilitates the linking and sharing of the firm's resource network in a crisis. When a crisis comes, the reciprocal relationship established by female executives makes the firm more securely embedded in the social and natural environment; hence, employees and stakeholders will not abandon the firm and will even ride out the storm with the firm [56]. As a result, the core functions of the firm are maintained, and

the firm's losses are reduced. Finally, studies have shown that female executives are more risk averse and therefore more prepared for and take action to deal with possible conflicts, which may send more positive signals to the market or investors [26], leading to smaller losses. We hypothesize:

Hypothesis 1 (H1). *The higher the proportion of female executives involved in a firm, the lower the degree of loss of its share price after a shock.*

Female participation in executive teams and organizational flexibility. Flexibility allows organizations to absorb, adapt, adjust to environmental changes, and be better able to recover and grow [7]. In this study, organizational flexibility is reflected in the time it takes for a firm's stock price to recover to pre-shock levels, with faster recovery indicating better flexibility. We expect that firms with a higher proportion of female executive participation will recover their share prices to pre-crisis levels more quickly. First, a good reciprocal relationship not only helps firms maintain stability, but also fosters greater flexibility after a shock. In a company with a good organizational climate, the company and employees are not only a community of interest but also a community of destiny; employees are more willing to adjust their working hours and even risk returning to work [55]. For example, when other airlines were in crisis during the September 11 attacks, Southwest's "employee-friendly" policy made a huge difference, as many employees were able to process their grief and return to work quickly. In the shortest possible time after 9/11, Southwest Airlines was able to resume operations [56]. Reciprocal relationships with supply partners may facilitate the development of trust between companies and suppliers to work together toward recovery [7]. Second, according to resource dependency theory, organizations, including enterprises, are open systems; hence, constant access to resources from the external environment is a natural choice. Female executives are adept at making connections with the external environment and acquiring needed resources. These skills greatly facilitate recovery from shocks as adequate resources and the ability to rearrange, transform, and adapt these resources to an uncertain and post-change environment are key elements of flexibility [51]. Finally, female participation in executive teams facilitates the use of gender-specific strengths in thinking and problem solving, providing innovative perspectives, new approaches to problem solving, and more complete information for decision making in business management [32,57]. The resulting knowledge diversity can help firms to cultivate the ability to navigate uncertain and complex environments [58]. Moreover, it can stimulate creativity and innovation in shock environments, thereby facilitating the development of new solutions [35] and enabling faster recovery. We hypothesize:

Hypothesis 2 (H2). *The greater the proportion of female executives involved in a firm, the shorter the time it takes for its stock price to recover to pre-shock levels after a shock.*

3. Research Design

3.1. Sample Selection and Data Sources

This study uses A-share companies listed on the Shanghai Stock Exchange and Shenzhen Stock Exchange as the research sample. B-share companies are excluded because they only publish financial data and do not provide access to data on other variables. Based on the initial sample, the sample was screened according to the following principles: (1) companies listed after 2019 were excluded; (2) companies listed in the financial industry were excluded; (3) companies listed in ST, ST*, and PT were excluded; and (4) listed companies with missing values for the main variables were excluded. Considering that the pandemic has affected all aspects of the economy and society, all companies regardless of industry were included in our sample, resulting in a sample of 1755 listed companies. At 2:00 a.m. on 23 January 2020 (the Chinese stock market closes at 3:00 p.m.), the city of Wuhan announced the temporary closure of its exit routes from 10:00 a.m. Wuhan become a "closed" city,

indicating the full outbreak of COVID-19. Therefore, we used 23 January 2020 as the start date of the systemic shock.

Executive personality characteristics, stock prices, and other financial data used in this study were obtained from the China Stock Market and Accounting Research Database. In the process of data collation, we supplemented and checked the original data through the RESSET database and annual reports of listed companies to ensure the reliability and authenticity of the data.

3.2. Variable Measurement

Explanatory variable: female executive participation (Fep). In previous studies, this variable has usually been measured in two ways [59]. One is by constructing a dummy variable that takes the value of 1 when the firm has female executives and 0 otherwise, and the other is by calculating the participation ratio of female executives (the number of female executives divided by the total number of executives) to measure the participation of women in the firm's executive team. Given that most of the 1755 companies selected in this study have one or more female executives, we chose the second approach. In addition, on the basis of the information about managers disclosed in the annual reports of companies, this study adopts the definition of executives given by [60]. They define the executive team as the senior managers and the chairman of the board of directors disclosed in the annual reports of listed companies, specifically including the chief financial officer (chief accountant), deputy general manager (vice president), general manager (president), secretary of the board of directors, and chairman of the board.

Explained variable: organizational resilience. Previous studies have shown that organizational resilience is characterized by potential, multiple dimensions, and path dependence [61], which determine that organizational resilience is difficult to directly observe and measure. Scholars have mainly addressed the challenge of measuring organizational resilience through indirect methods. Some scholars have argued that whether an organization is resilient depends on its ability to maintain a certain level of performance or achieve a better level of performance in a constantly changing environment [62]. Thus, organizational resilience can be indirectly reflected by observing a firm's aggregate performance over time. For example, some studies combined measures of firm financial performance with volatility data to develop a measure called VOLARE, which is specified as the standard deviation of a firm's long-term return on equity relative to its industry peers [63]. Ortiz-de-Mandojana and Bansal [7] conducted a 15-year-long study using stock return volatility and cumulative net sales growth to measure organizational resilience. They showed that firms that adapt to environmental disruptions will experience weaker financial volatility, thereby exhibiting high growth and high survival rates. Another measure examines organizational performance under specific unconventional and unexpected shocks, inferring organizational resilience from the results of the organization's response to external shocks. Previous works in the literature [33,51] have used the 2008 financial crisis as a research context to measure organizational resilience in terms of the severity of organizational loss and organizational recovery time after environmental shocks [33]. This approach effectively answers the question of "resilience to what", remedies the challenge of multidimensional organizational resilience constructs, and is suitable for studying the drivers of organizational resilience in specific event contexts [64], which is consistent with the research content of this study. Therefore, we refer to existing research [33,35] to consider stability and flexibility as core attributes of organizational resilience. We also use the severity of a firm's share price loss during the COVID-19 pandemic to measure organizational stability, and the time for a firm's share price to recover to pre-shock levels after a crisis to measure organizational flexibility.

Stability: This variable reflects the severity of loss in the share price of the firm after the shock of the COVID-19 outbreak. The absolute percentage of the closing price before (i.e., the closing price on 22 January) and after (i.e., the lowest closing price between 23 January and 22 July) the COVID-19 shock date of 23 January 2020 is used as a measure.

A higher value of this indicator means a greater degree of share price loss and a lower stability of the firm during the outbreak. The six-month observation window was chosen because the Chinese government announced on 29 April that the prevention and control of the epidemic had entered a normalized phase, giving companies enough time to reflect and adjust during the window. This six-month observation window also reduces the likelihood that a company's share price decline will be driven by other events.

Flexibility: This variable reflects the time for the firm's share price to recover to the pre-shock level during the COVID-19 outbreak. It is measured by the probability of the firm's recovery during the observation period. Since 23 January 2020 is considered the shock date of the COVID-19 crisis, we take the closing price on 22 January 2020 as the firm's pre-shock performance level. We then calculate the number of days (denoted as t) it took for the firm's stock price to recover to the pre-shock level, with the observation period spanning from 23 January to 22 July. Firms whose stock prices did not recover to the pre-shock level at the end of the observation window are considered right-censored. We use survival analysis to solve the right-censored problem, and when duration is used as an input, the results of survival analysis will determine the probability that the firm recovers at time t.

Control variables. Drawing from the existing views [35,65,66], we control for pre-shock firm characteristics. Eleven control variables related to organizational resilience were selected: age (Age, the logarithm of the number of years in the enterprise as of 2019), profitability (Profit, the earnings before interest and taxes divided by the book value of total assets), board independence (Board, the number of independent directors divided by the total number of board of directors), intangible assets (Intangible, the net intangible assets divided by the book value of total assets), operational efficiency (Operation, the sales revenue divided by the book value of total assets), fixed assets (Fixed, the net value of fixed assets divided by the book value of total assets), financial leverage (Finan, the total liabilities divided by the total assets), executive team size (Teamsum, the total number of corporate top management), property rights (State, if the enterprise is a state-owned enterprise, the value is 1, otherwise the value is 0), pre-crisis stock price (Price, the enterprise closing price on 22 January 2020), and industry dummy variables (Industry, according to the SFC's 2012 Industry Classification Guidelines for Listed Companies). All control variables, except for the industry dummy variable, are taken to have 2019 values to capture pre-shock firm characteristics.

4. Empirical Analysis Results

In this section, we first present the descriptive statistical analysis of the variables and the correlation coefficient matrix. Next, we report the results of the OLS model with robust standard errors and survival analysis (Cox risk proportional model). Finally, we perform a risk proportionality test and a series of robustness tests.

4.1. Descriptive Statistics and Correlation Coefficient Matrix

Table 1 shows the descriptive statistical results of the main variables. The sample descriptive results show that the mean value of the severity of corporate share price loss is 0.207 and the maximum value is 0.633, which are consistent with the findings of [65]. The mean value of female executives' participation ratio is 0.190, which indicates that female executives are still a minority group in Chinese firms and the executive team is overwhelmingly dominated by men. The results of descriptive statistics for other variables are generally consistent with existing studies.

Table 2 shows the Pearson correlation coefficient between the variables. As shown in Table 2, the participation percentage of female executives is negatively correlated with the severity of corporate share price loss, with a correlation coefficient of −0.028; that is, the higher the participation percentage of female executives, the more stable the firm is under crisis shock. However, the correlation coefficients are not statistically significant at the statistical level; thus, further research is needed. Firm age, intangible assets, fixed

assets, executive team size, and the nature of ownership are significantly and negatively correlated with the severity of firm share price loss. These results indicate that older age, more intangible assets, more fixed assets, larger executive team size, and state-owned enterprises have less loss after crisis shocks. Board independence is significantly and positively correlated with the severity of the firm's share price loss, indicating that firms with more independent directors suffer greater losses. The correlation coefficients between all variables in the correlation coefficient matrix in Table 2 are less than 0.5, which intuitively shows that no significant multicollinearity problem exists between the variables and no variables are redundant. We further performed the variance inflation factor (VIF) test for all variables, and the range of VIF values was from 1.01 (board) to 1.23 (profit) with a mean value of 1.10. All VIF values were less than 5; thus, no substantial multicollinearity exists.

Table 1. Descriptive statistic results.

Variables	N	Min	Mean	P25	P50	P75	Max	Sd
Fep	1755	0.000	0.190	0.000	0.170	0.310	1.000	0.191
Stability	1755	0.006	0.207	0.151	0.186	0.244	0.633	0.085
Age	1755	1.386	2.859	2.639	2.890	3.045	4.111	0.295
Profit	1755	−0.787	0.071	0.049	0.076	0.112	0.556	0.094
Board	1755	0.250	0.379	0.333	0.364	0.429	0.800	0.054
Intangible	1755	0.000	0.046	0.020	0.035	0.057	0.654	0.050
Operation	1755	0.060	0.618	0.389	0.535	0.740	11.350	0.457
Fixed	1755	0.001	0.191	0.088	0.170	0.270	0.834	0.133
Finan	1755	0.034	0.391	0.245	0.387	0.522	0.976	0.181
Teamsum	1755	1.000	5.848	4.000	6.000	7.000	20.000	2.285
State	1755	0.000	0.179	0.000	0.000	0.000	1.000	0.383
Ifre	1755	0.000	0.924	1.000	1.000	1.000	1.000	0.266

Table 2. Pearson correlation coefficient matrix.

Variables	Fep	Stability	Price	Age	Profit	Board	Intangible	Operation	Fixed	Finan	Teamsum	State
Fep	1											
Stability	−0.028	1										
Price	0.015	0.170 ***	1									
Age	0.047 **	−0.076 ***	−0.100 ***	1								
Profit	−0.027	−0.015	0.249 ***	0.029	1							
Board	0.060 **	0.043 *	0.014	−0.002	0.018	1						
Intangible	−0.033	−0.059 **	−0.076 ***	0.027	−0.009	−0.012	1					
Operation	−0.015	−0.023	0.058 **	−0.002	0.133 ***	−0.016	−0.105 ***	1				
Fixed	−0.076 ***	−0.056 **	−0.098 ***	0.025	0.153 ***	−0.006	0.046 *	−0.023	1			
Finan	−0.084 ***	0.028	−0.119 ***	−0.023	−0.257 ***	0.015	0.091 ***	0.143 ***	0.037	1		
Teamsum	−0.108 ***	−0.048 **	0.017	0.061 **	0.069 ***	−0.083 ***	0.068 ***	0.028	−0.001	0.116 ***	1	
State	−0.136 ***	−0.094 ***	−0.082 ***	0.097 ***	−0.013	−0.035	0.096 ***	−0.015	0.082 ***	0.199 ***	0.131 ***	1

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

4.2. Regression Results of Severity of Loss

Given that the sample data were cross-sectional, we used an OLS model with robust standard errors to test hypothesis 1. First, we ran the model with only control variables, and the regression results are shown in Model 1 (Table 3). We found that older firms suffer smaller losses after shocks compared with younger firms, and this result is consistent with previous findings [61]. One possible explanation is that older firms have historically experienced more external shocks, and path-dependent qualities of resilience determine that firms that have experienced more external shocks are better able to withstand unexpected events over time [35]. In addition, firms with more intangible assets, more efficient business operations, and larger executive teams experience smaller losses, and state-owned firms experience smaller losses compared with non-state-owned firms.

Model 2 in Table 3 adds the core explanatory variable of female executive participation. As shown in Table 3, the participation percentage of female executives is significantly negatively related to the severity of the firm's share price loss ($\beta = -0.021$), which is significant at the 5% level. This result indicates that firms with a higher participation

percentage of female executives suffer fewer losses compared with firms with less female executive participation. Thus, H1 has been verified.

Table 3. Severity of loss: OLS regression.

Variables	Model 1	Model 2
Fep		−0.021 **
		(0.010)
Age	−0.013 *	−0.012 *
	(0.007)	(0.007)
Profit	−0.024	−0.025
	(0.026)	(0.026)
Board	0.051	0.054
	(0.036)	(0.036)
Intangible	−0.076 **	−0.077 **
	(0.037)	(0.037)
Operation	−0.008 **	−0.008 **
	(0.004)	(0.004)
Fixed	−0.017	−0.018
	(0.015)	(0.015)
Finan	0.033 ***	0.032 ***
	(0.012)	(0.012)
Price	0.001 ***	0.001 ***
	(0.000)	(0.000)
Teamsum	−0.001 *	−0.002 *
	(0.001)	(0.001)
State	−0.018 ***	−0.019 ***
	(0.004)	(0.005)
Constant	0.226 ***	0.228 ***
	(0.025)	(0.025)
Industry	Included	Included
N	1755	1755
F	6.736 ***	6.463 ***
R^2	0.051	0.053

Note: N = 1775, robust standard error in parentheses. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

4.3. Regression Results of Recovery Time

To estimate the effect of female executive participation ratios on firm recovery time, we used Cox proportional risk models. In each survival model, we report regression coefficients instead of risk ratios, which are calculated through exponential coefficients. The risk ratio can be interpreted as the change in a firm's recovery rate over the observation period when the corresponding variable is increased by one unit. A larger regression coefficient for a variable means that the firm is more likely to recover after a shock. Survival analysis is appropriate for our data because it can handle right-censored data well. Specifically, our observation period is between 23 January and 22 July 2020. During our observation period, 134 firms had stock prices that did not recover to pre-shock levels, and these firms had recovery times in the range (182, +), which we address with right censoring. We specify standard errors with robustness to address the heteroskedasticity of the sample data. Figure 1 shows the cumulative risk function; that is, the sum of the risk rates. Overall, the slope of this curve decreases over time, which implies that the firm is less likely to recover over time.

Table 4 reports the main results of the survival analysis. Model 1 incorporates only control variables. We found that firms with better profitability and higher stock values before the crisis were less likely to recover, and non-state-owned firms were more likely to recover after the crisis compared with state-owned firms. In Model 2, the participation ratio of female executives was significantly and positively related to the probability of firm recovery ($\beta = 0.265$), which implies that firms with a higher proportion of female executive participation were more likely to recover after a crisis. Specifically, for each one standard

deviation increase in the proportion of female executive participation, the firm's probability of recovery from a shock will increase by 30.4% [exp(coefficient) − 1 × 100%]. Thus, H2 has been verified. In Model 3, we extended the Cox risk proportion model. In our sample, state-owned enterprises and non-state-owned enterprises may exhibit heterogeneity, which may affect the regression results. Assuming that individuals in the same group are homogeneous and individuals in different groups are heterogeneous, which is called "shared frailty" [65], we introduced the Cox proportional risk frailty model and added the nature of property rights as a heterogeneity variable in our survival analysis model. The results of model 3 are generally consistent with those of model 2, and H2 still holds.

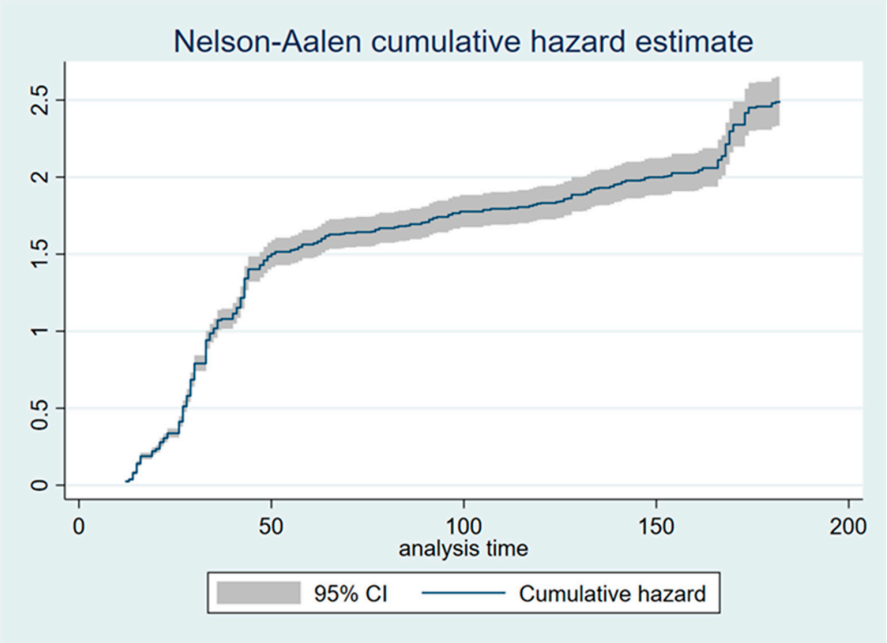


Figure 1. Nelson–Aalen cumulative hazard estimate.

Table 4. Time to recovery: Cox proportional risk model.

Variables	Model 1	Model 2	Model 3
Fep		0.265 **	0.271 **
		(0.126)	(0.132)
Age	0.132	0.124	0.12
	(0.081)	(0.081)	(0.083)
Profit	−0.974 ***	−0.942 ***	−0.947 ***
	(0.319)	(0.323)	(0.315)
Board	−0.301	−0.352	−0.346
	(0.413)	(0.414)	(0.459)
Intangible	0.271	0.285	0.264
	(0.494)	(0.492)	(0.498)
Operation	0.032	0.033	0.035
	(0.042)	(0.042)	(0.058)
Fixed	−0.189	−0.175	−0.187
	(0.196)	(0.197)	(0.206)
Finan	−0.195	−0.167	−0.178
	(0.141)	(0.141)	(0.152)
Price	0.008 ***	0.008 ***	0.008 ***
	(0.001)	(0.001)	(0.001)
Teamsum	−0.001	0.001	0.001
	(0.012)	(0.012)	(0.011)
State	−0.290 ***	−0.278 ***	
	(0.067)	(0.068)	
Industry	Included	Included	Included
No. of firms	1755	1755	1755
No. of firms recovered	1621	1621	1621
Wald χ^2	90.185 ***	87.513 ***	87.008 ***

Note: N = 1775, robust standard error in parentheses. ** $p < 0.05$; *** $p < 0.01$.

4.4. Survival Analysis—Testing the Proportional Risk Hypothesis

A key assumption of the Cox proportional risk model is that the effect of explanatory variables on recovery time is constant over time. If the proportionality assumption holds, then the relationship between the explanatory variables and the recovery time is not a function of time. We used two approaches for proportional risk testing. First, we used the estat phtest command in Stata to perform the Schoenfeld residuals-based proportional risk hypothesis test, which has the null hypothesis that the variables included in the Cox regression model satisfy the PH assumption. The test results showed that the *p*-value for the entire model ($p = 0.7322$) and the core explanatory variable female executive participation ($p = 0.2375$) is greater than 0.05. Moreover, the null hypothesis cannot be rejected, indicating that our model satisfies the proportional risk hypothesis. Second, we included the time-varying effect of the core explanatory variable female executive participation and constructed an interaction between the core explanatory variable female executive participation and time. The results of the regression indicate that the interaction is not significant, suggesting that the effect of the explanatory variable on recovery time does not change over time. Therefore, the proportional risk hypothesis holds for our results.

4.5. Robustness Test

We conducted separate robustness tests for the results of severity of loss and recovery time. For severity of loss, we performed three robustness tests. First, we extended the observation period to 8, 10, and 12 months, and we observed the change in firm share prices from 23 January 2020 to 22 September 2021 and 22 November 2021. The results of the regression analysis were generally consistent with our estimates (Table 5, Model 1 reports the results of the test with an observation period of 8 months). Second, we took manufacturing firms as an independent subsample for testing. On the one hand, the supply chain and resumption of work and production of manufacturing firms were drastically impacted by the pandemic, and exploring their organizational resilience is typical. On the other hand, the manufacturing industry itself was the majority of our sample, specifically 1292 firms in total. The regression results showed that the proportion of female executive participation is significantly negatively related to the degree of loss of corporate share prices. The regression results for the control variables are largely consistent with the previous results (see Table 5, Model 2). Finally, we varied the values of all control variables, and we included the average of the 2018 and 2019 control variables in our model to capture stable pre-shock firm characteristics. Our results are unchanged (see Table 5, Model 3).

Table 5. Robustness test results for severity of loss.

Variables	Model 1	Model 2	Model 3
Fep	−0.021 *	−0.024 **	−0.020 *
	(0.011)	(0.012)	(0.001)
Age	−0.011	−0.001 **	−0.012 *
	(0.007)	(0.000)	(0.007)
Profit	−0.021	0.006	−0.024
	(0.028)	(0.030)	(0.028)
Board	0.047	0.064	0.053
	(0.037)	(0.042)	(0.036)
Intangible	−0.079 **	−0.143 **	−0.078 **
	(0.037)	(0.064)	(0.036)
Operation	−0.008 **	−0.018 **	−0.009 **
	(0.004)	(0.007)	(0.004)
Fixed	−0.018	−0.019	−0.019
	(0.016)	(0.020)	(0.015)
Finan	0.031 **	0.053 ***	0.033 ***
	(0.012)	(0.015)	(0.012)

Table 5. *Cont.*

Variables	Model 1	Model 2	Model 3
Price	0.001 ***	0.001 ***	0.001 ***
	(0.000)	(0.000)	(0.000)
Teamsum	−0.002 **	−0.002 **	−0.002 *
	(0.001)	(0.001)	(0.001)
State	−0.018 ***	−0.018 ***	−0.019 ***
	(0.005)	(0.006)	(0.005)
Constant	0.231 ***	0.209 ***	0.229 ***
	(0.026)	(0.021)	(0.025)
Industry	Included		Included
N	1755	1292	1755
F	6.890 ***	5.63 ***	6.376 ***
R^2	0.069	0.056	0.053

Note: N = 1775, robust standard error in parentheses. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

For recovery time, we conducted two robustness tests. First, we replaced the measure of the independent variable and used the 0 and 1 variables to measure female executive participation; that is, firms with female executives took the value 1, and otherwise 0. The results of the regression showed that female executive participation was positively associated with the probability of recovery (Table 6, Model 1). Second, we re-tested our hypotheses by using the Exponential, Weibull, Gompertz parametric risk model and obtained results that were generally consistent with those of the Cox proportional risk model (Table 6, Models 2, 3, and 4). Our results were robust.

Table 6. Robustness test results for recovery time.

Variables	Model 1	Model 2	Model 3	Model 4
Fep	0.113 **	0.299 **	0.323 **	0.258 **
	(0.054)	(0.148)	(0.164)	(0.124)
Age	0.005	0.154	0.168	0.129
	(0.005)	(0.098)	(0.107)	(0.083)
Profit	−0.956 ***	−0.996 ***	−1.1 ***	−0.843 ***
	(0.315)	(0.327)	(0.369)	(0.270)
Board	−0.324	−0.311	−0.325	−0.304
	(0.459)	(0.503)	(0.551)	(0.423)
Intangible	0.280	0.157	0.159	0.159
	(0.497)	(0.614)	(0.67)	(0.519)
Operation	0.033	0.052	0.058	0.041
	(0.058)	(0.048)	(0.053)	(0.040)
Fixed	−0.177	−0.368	−0.391	−0.315
	(0.207)	(0.028)	(0.249)	(0.195)
Finan	−0.172	−0.192	−0.21	−0.157
	(0.152)	(0.169)	(0.186)	(0.142)
Price	0.008 ***	0.006 ***	0.007 ***	0.006 ***
	(0.001)	(0.001)	(0.001)	(0.001)
Teamsum	−0.005	−0.003	−0.003	−0.001
	(0.012)	(0.014)	(0.015)	(0.011)
State	−0.276 ***	−0.31 ***	−0.333 ***	−0.275 ***
	(0.072)	(0.080)	(0.087)	(0.069)
Constant		−4.346 ***	−4.823 ***	−4.069 ***
		(0.370)	(0.405)	(0.314)
Ln_p			0.097 ***	
			(0.015)	
Gamma				−0.005 ***
				(0.000)
Industry	Included	Included	Included	Included
No. of firms	1755	1755	1755	1755
No. of firms recovered	1621	1621	1621	1621
Wald χ^2	93.558 ***	101.279 ***	96.811 ***	94.415 ***

Note: N = 1775, robust standard error is in parentheses. ** $p < 0.05$; *** $p < 0.01$.

5. Discussion and Conclusions

During the COVID-19 pandemic, some companies suffered a fatal blow, while others recovered quickly and "turned the corner". This difference defines organizational resilience across firms [55]. However, due to the scarcity of specific contingency situations and the difficulty of directly measuring organizational resilience, the existing literature provides few answers about the factors that influence organizational resilience. Prior research has tended to outline the significance of top managers in building organizational resilience based on qualitative descriptions on the one hand, and provided perception-based empirical data with ambiguity and subjectivity on the other hand, so the persuasiveness and vividness of the research are still in urgent need of improvement. To improve these deficiencies, we integrated the literature on female executives, upper echelons theory, and organizational resilience to explore the impact of female participation in executive teams on corporate organizational resilience in the context of the COVID-19 pandemic. Owing to the characteristics of potential, multiple dimensions, and path dependence of organizational resilience [61], we referred to the existing research [33,35] and indirectly measured organizational resilience from two dimensions: the degree of stock price loss and the recovery time of stock price under the COVID-19 pandemic. The empirical results show that the proportion of female executive participation is significantly negatively related to the degree of stock price loss and significantly positively related to stock price recovery time. Thus, the proportion of female executive participation significantly enhances the organizational resilience of firms. After controlling for other variables and conducting a series of robustness tests, the above findings still hold.

This finding is similar to previous research showing that female executives possess risk aversion and preventive motivations that guide them in building a sense of anticipation and preparedness for unknown risks [31,67,68], and that organizations with diverse leadership teams involving female executives tend to demonstrate superior environmental insight and adaptability [69]. At the same time, managers and their characteristics affect an organization's survival decisions and management direction, and the construction of female leadership has a unique effect on crisis management [53]. However, unlike the previous literature, our study is based on the context of the COVID-19 outbreak, which reflects a real-world environment where uncertainty is widespread and which is rife with complex variations, both routine and non-routine. At the same time, our findings further clarify the positive role of female executives on organizational resilience and reveal the urgency and value of female participation in management teams in crisis management. In conclusion, this study presents a direction to optimize the executive structure of firms, which may help firms to achieve stable growth and sustainable development.

5.1. Theoretical Contributions

In recent years, female executives have started to play a vital role in the rise and development of enterprises. However, the power of female executives has not been fully assessed [53]. By revealing the relationship between female executives and organizational resilience under survival challenges, this study responds to the call.

The theoretical contributions of this paper are as follows: (1) This paper expands the drivers of organizational resilience and adds to the literature on organizational resilience and performance. The joint research literature on agility and management indicates that maintaining an open attitude and proactive approach to diversified structural design can help flexibly coordinate resources and effectively solve disruption scenarios [70]. The dynamic configuration of the senior management team can help the organization build resilience and handle constant change. Our research confirms that the participation of women in senior management teams is an essential path to fostering organizational resilience, which drives the evolution of adaptability and long-term viability. (2) This paper explores the functions of female executives during the COVID-19 pandemic, enriching the literature on leadership and executive team heterogeneity. As we have pointed out, in multiple change scenarios, organizations deploy female executives to effectively capture

and analyze external signals and weigh the relative positions of change and constancy, thereby maintaining the steadiness and foundation to survive volatile markets. (3) This study explores the effectiveness of organizational resilience in managing environmental uncertainty, which creates space for improving organizational sustainability. Based on the specific background of the COVID-19 pandemic, this paper reflects the law of the highly VUCA-oriented real world. It warns organizations to continue to take timely actions and innovate in the appropriate direction.

5.2. Practical Implications

This research provides practical implications for organizational managers and policy makers: (1) Organizational resilience is a key capability for enterprises to cope with unexpected and unconventional events, and paying attention to the heterogeneity of executive teams helps enterprises reduce losses and recover quickly from crises. (2) Policymakers should improve the gender quota system for corporate executives, promote the establishment of laws on professional equality between men and women, appropriately promulgate policies and regulations on increasing the proportion of female executive participation, ensure gender diversity in corporate executive teams, and give full play to the important role of female executives in corporate business decision making. For example, Sweden explicitly stipulates that female directors in enterprises should account for at least 25% of board members, and Germany included in the Law on Gender Equality of Workers that enterprises should have at least 30% female executives or suffer penalties. These examples are important references for China's policy formulation. (3) Enterprises should fully recognize the practical value of selecting and recruiting women to participate in the executive team for the survival and development of enterprises and should formulate gender-diverse talent development strategies. On the other hand, women have the right and responsibility to step out of their comfort zone and enter the executive team through concerted efforts to break the "glass ceiling" and remove the "gender barrier" and "gender hierarchy" of women in the promotion of corporate talent. (4) Women should develop business awareness and management experience, grasp opportunities for advancement, actively participate in the decision-making process of corporate production and development, and contribute "women's wisdom" to the sustainable development of companies.

5.3. Limitations and Suggestions for Future Research

This study still has some limitations: (1) Although our study finds that female executives significantly enhance the organizational resilience of firms, we do not explore the mechanisms of action and boundary conditions, which may partially limit our understanding. The mechanisms of action can be further investigated in the future and studied in different specific types of shocks, for example, financial crises and natural disasters [35,71]. (2) We measured organizational resilience using stock price volatility because stock price is one of the best indicators to assess organizational resilience under a crisis [35]. Even critics of the efficient market hypothesis accept that stock prices reflect all relevant information about a firm [33]. Nonetheless, this measurement may limit the applicability of results. In the future, organizational resilience can be measured using other financial indicators and by extending the observation period to obtain the long-term financial performance of a firm. (3) We consider gender heterogeneity of the executive team a prerequisite for influencing organizational resilience. However, executive gender characteristics are only part of the theoretical perceptions of upper echelons theory, and the impact of other characteristics of the executive team (e.g., age, tenure, occupation, education level) on organizational resilience needs to be further explored.

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