

Study on the Impact of Entrepreneurship on Enterprise Performance in the Manufacturing Industry

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Abstract

Purpose: The study aims to explore the impact of entrepreneurship on the performance of manufacturing enterprises in China, focusing on specific traits of entrepreneurship such as innovation, risk-taking, and competitiveness. Additionally, it examines the relationship between entrepreneurship and regional economic growth, with an emphasis on how entrepreneurship drives enterprise performance, particularly in economically underdeveloped regions.

Approach/Methodology/Design: The research uses empirical analysis based on sample data from listed manufacturing companies on China's Shanghai and Shenzhen A-share markets. It employs regression models to assess the impact of entrepreneurship on enterprise performance. Indicators such as R&D investment, market share, and firm size serve as proxies for entrepreneurship traits, while principal component analysis is used to calculate scores for both entrepreneurship and enterprise performance. Control variables include regional economy and leadership structure. Sub-regional analysis is conducted to compare the impact of entrepreneurship across different economic regions.

Findings: The results show that entrepreneurship, innovation spirit, risk-taking spirit, and competitive spirit all have significant positive impacts on enterprise performance. Additionally, in different economic regions, entrepreneurship generally has a positive impact on enterprise performance, with a greater effect observed in areas with lower economic development.

Practical Implications: The study provides valuable insights for enterprises and policymakers. It suggests that enterprises can enhance their competitiveness by fostering entrepreneurial traits, increasing R&D investment, and efficiently managing financial leverage. Furthermore, governments should support entrepreneurship in underdeveloped regions through training and policy measures to stimulate regional economic growth.

Originality/value: This study constructs a unique evaluation system for entrepreneurship from a micro perspective and verifies its positive impact on enterprise performance. This study innovatively explores the differential impact of entrepreneurship across various economic regions, providing new perspectives for future research on the relationship between regional economies and entrepreneurship.

1. Introduction

In the context of China's shift from "high-speed growth" to "high-quality development," enterprises are facing increasingly complex and severe challenges due to intensified market competition, technological advancement, and consumption upgrades. In such an environment, enterprise performance is crucial for the long-term development of businesses. Entrepreneurs, as leaders and decision-makers of companies, bear the responsibility and mission of achieving and sustaining enterprise performance. The famous Japanese scholar Hisao Kanamori clearly pointed out that without entrepreneurs, there would be no revival and rapid growth of Japan's economy. The innovation, entrepreneurship, and reform spirit embodied by entrepreneurs are powerful forces that drive humanity out of stagnation (Q. Sun, 1988). President Xi Jinping also emphasized: "The vitality of the market comes from people, especially from entrepreneurs and entrepreneurial spirit". Entrepreneurial spirit plays a crucial role in the innovation and development of enterprises, and an increasing number of companies are recognizing and valuing the role of entrepreneurship in achieving outstanding performance (Z. Liu & Nie, 2021).

Compared with previous studies, the contributions are: firstly, the evaluation index system of entrepreneurship is constructed from a micro perspective to examine the impact of its specific traits on enterprise performance. On the basis of verifying the correlation between manufacturing entrepreneurship and enterprise performance, the robustness of this relationship is also verified. Secondly, the degree of influence of manufacturing entrepreneurship on enterprise performance in different regions is explored from the regional level.

2. Literature Review and Research Hypotheses

Entrepreneurship is a trait and attitude possessed by entrepreneurs and business people that emphasizes innovation, risk-taking and the ability to pursue opportunities, and encourages initiative in creating and developing new business opportunities. Entrepreneurship, which can be both individual and group, is not only applicable to entrepreneurs, but also has important implications for leaders and employees within an organization, contributing to the promotion of organizational competitiveness.

Scholars have studied the connotation and dimensions of entrepreneurship. For example, (Mao & Wang, 2015), (C. Liu, 2019), (Jiang & Zhang, 2020), (Xia, 2020), (Fan & Zhang, 2020), (Quan, 2020), (Yin, 2020), and (Qi, 2020) consider entrepreneurship as a state of mind, while other scholars, such as (Wang, 2013) and (Guo, 2014), (X. Xie & Chang, 2017) believe that entrepreneurship is a trait, while (Wu, 2015) and (H. Sun, Zhang, & Cui, 2015) believe that entrepreneurship is an important element. The details are summarized in Table 1.

Table 1 Entrepreneurship Measurement Studies

The Connotation of Entrepreneurship	Scholars	Specific Measurement
Spirit	(Mao & Wang, 2015)	Innovative, Pioneering and Adventurous
	(C. Liu, 2019)	Innovative, Adventurous, Proactive
	(Jiang & Zhang, 2020)	Innovative Spirit, Entrepreneurial Spirit
	(Xia, 2020)	Innovative Spirit, Risk-taking Spirit, Contractual Spirit
	(Fan & Zhang, 2020)	Innovative and Adventurous
	(Quan, 2020)	Innovative Spirit, Adventurous Spirit, Enterprising Spirit
	(Yin, 2020)	Innovative Spirit, Risk-taking Spirit, Focus on Quality Spirit
Trait	(Qi, 2020)	Innovative Spirit, Adventurous Spirit, Responsible Spirit
	(Wang, 2013)	Innovative, Risk-Taking, Pioneering
	(Guo, 2014)	Innovative, Risk-Taking, Competitive
Elements	(X. Xie & Chang, 2017)	Innovative, Competitive, Managerial Skills, Sense of Adventure
	(Wu, 2015)	Collective Innovation, Risk-Taking, Integrity
	(H. Sun et al., 2015)	Organizational Innovation, Strategic Innovation, Flexible Innovation, Operational Innovation

Based on previous research findings, entrepreneurship is recognized as a mental state, and it is measured across three dimensions: innovation spirit, risk-taking spirit, and competitive spirit.

At the same time, domestic scholars have extensively studied the relationship between entrepreneurship and enterprise performance. The specific details can be found in Table 2.

Table 2 Study on the relationship between entrepreneurship and enterprise performance

Scholars	Research Content	Main Points
(H. Sun et al., 2015)	The relationship between entrepreneurial innovation and enterprise financial performance	Entrepreneurship is an important factor of production; entrepreneurship has a significant effect on the enterprise's financial performance
(Yu, He, & Liu, 2015)	Relationship between entrepreneurship and new product innovation performance	Entrepreneurship with innovative change contributes to new product innovation performance
(Fan & Zhang, 2020; Jiang & Zhang, 2020; X. Xie & Chang, 2017)	The relationship between entrepreneurship and enterprise performance	Entrepreneurship characterized by innovation, competitiveness, sense of adventure, and risk-taking is important in helping to improve enterprise performance
(Z. Xie & Zhang, 2019)	Relationship between entrepreneurship, business environment and real economic development	Cultivating entrepreneurship plays a significant role in promoting the development of the real economy
(Zhang, Geng, & Zhang, 2021)	The relationship between entrepreneurship, enterprise performance and regional economic growth	An entrepreneurial firm prefers to improve its performance through “soft power”

These studies all emphasize the importance of entrepreneurship to enterprise performance. Entrepreneurial spirit, characterized by innovation, competitiveness, a sense of adventure, and risk-taking, can enhance a company’s financial performance, new product innovation, core competitiveness, and crisis management capabilities. Additionally, it plays a significant role in driving the development of the real economy.

Therefore, the following hypotheses are proposed:

H1: There is a positive relationship between entrepreneurship and enterprise performance in the manufacturing industry.

H1a: There is a positive relationship between entrepreneur's innovative spirit and enterprise performance.

H1b: There is a positive relationship between entrepreneur's risk-taking spirit and enterprise performance.

H1c: there is a positive relationship between entrepreneur's competitive spirit and enterprise performance.

Entrepreneurs with positive entrepreneurship tend to be more creative and adventurous and are able to take the initiative in exploring new business opportunities and creating new markets, which can help to drive business growth and increase the competitiveness of enterprises. Thus, the impact of entrepreneurship on enterprise performance is generally positive in different economic regions.

However, there are differences in the extent to which the dynamics of entrepreneurship are influenced by the level of the economy (Zhang et al., 2021). The extent of the impact of entrepreneurship may be more pronounced in regions with relatively underdeveloped economies. This is because in a difficult economic environment, entrepreneurs face more challenges and competition, and they need to be more proactive in responding to changes and finding new business opportunities to sustain and enhance the survival and development of their businesses. Therefore, entrepreneurship has a relatively greater role in driving enterprise performance in such regions. On the other hand, the impact of entrepreneurship may be relatively less in regions with better economies. This is because in a booming economy, entrepreneurs may face fewer difficulties and competition, and it is relatively easier for enterprises to survive and grow. In this case, entrepreneurship is still important, but its impact is relatively weak.

Therefore, the following hypothesis is proposed:

H2: Entrepreneurship generally plays a positive role in enterprise performance, but the effect of entrepreneurship in driving enterprise performance is more significant in relatively economically underdeveloped regions and stronger than in relatively economically developed regions.

3. Research Methodology

3.1 Sample Selection and Data Sources

The industry selected for the study is the manufacturing industry in China. The reasons for choosing this industry are as follows: (1) manufacturing industry is a direct reflection of the productivity level of a country, and China's manufacturing industry has been maintaining good development and playing an important role in the national economy; (2) the current industry concentration and globalization level of China's manufacturing industry is relatively low. According to the data of listed companies, China's high-end manufacturing industry still has a large growth potential; (3) Facing the pressure of a deteriorating external environment, China has become more reliant on independent research and development in terms of technological upgrading. However, based on the observation of funding expenditures and growth rates, there is still considerable room for technological advancement in China's manufacturing industry.

The research data mainly comes from the listed companies in the manufacturing industry of Shanghai and Shenzhen A-shares in 2022 in the Oriental Wealth Choice database. In the process of sample selection, enterprises labeled as ST and *ST were excluded, and enterprises with missing data were eliminated, finally obtaining a data sample of 3,183 enterprises. Meanwhile, in order to overcome the existence of concentrated extreme values or outliers in the exported data that affect the results of the statistical analysis, the data were shrink-tailed at 2% and 98% quantile using the winsorize method.

3.2 Selection and Description of Variables

3.2.1 Dependent Variable

Enterprise performance(*ep*). In academia, there are two common methods for evaluating enterprise performance: the indicator system method and the single indicator method. Compared to the single indicator method, the indicator system method, while more complex in selecting and calculating indicators, can effectively avoid the lack of objectivity and randomness that may arise due to significant individual data differences in the single indicator evaluation process. Based on this, and with reference to the research results of (X. Xie & Chang, 2017), (Fan & Zhang, 2020), (Yin, 2020), and (Qi, 2020), and considering data availability, return on equity (*roe*) and year-over-year revenue growth rate (*gr*) were used as substitute indicators. Enterprise performance scores were then calculated through principal component analysis.

3.2.2 Independent Variable

Entrepreneurship(*eship*). Referring to the research results of (X. Xie & Chang, 2017), and (Qi, 2020), and considering data availability, this study selects the ratio of R&D investment (*rd*) and the proportion of R&D personnel (*prd*) as proxy indicators for innovation spirit. Operating leverage (*ol*) and debt ratio (*dr*) are used as proxy indicators for risk-taking spirit. Market share (*ms*) and company size (*size*) are selected as proxy indicators for competitive spirit. An evaluation index system for entrepreneurship is constructed, and principal component analysis is used to calculate the entrepreneurship score.

3.2.3 Control Variable

Based on the research results of (Z. Xie & Zhang, 2019), the following variables are set as control variables: regional economy (*gdp*), *province*, *region*, leadership structure (*dual*), asset expansion multiple (*expan*), and concentration of the top ten shareholders (*top10*).

Descriptions of the meanings and values of the various variables are provided in Table 3.

Table 3 Description of Variables and Their Values

Type	Variable Name	Variable Code	Variable Value Description
Dependent Variable	Enterprise Performance	<i>roe</i>	Return on Net Assets = Net Profit/Owners' Equity * 100%
		<i>gr</i>	Operating Revenue Year-Over-Year Growth Rate = (Current Period Operating Revenue - Previous Period Operating Revenue) / Previous Period Operating Revenue * 100%
Independent Variable	Entrepreneurship	<i>eship</i>	Calculated by PCA
	Innovation Spirit	<i>rd</i>	R&D Investment Ratio = Total R&D Expenditures / Operating Revenues
		<i>prd</i>	Percentage of R&D Personnel = R&D Personnel in The Enterprise/Total Number of People in the Enterprise
	Risk-Taking Spirit	<i>ol</i>	Operating Leverage = Rate of Change in Operating Income / Rate of Change in Net Income
		<i>dr</i>	Debt Ratio = Total Debt/Total Assets
	Competitive Spirit	<i>ms</i>	Market Share = Firm Revenue/Total Industry Revenue
		<i>size</i>	Firm size = total assets of the firm (taken in logarithms)
Control Variable	Regional Economy	<i>gdp</i>	Data from national statistical offices (taken in logarithms)
	Province	<i>province</i>	Provinces, municipalities and autonomous regions are sorted alphabetically by pinyin and assigned values 1-31 respectively
	Region	<i>region</i>	1-6 for Northeast, South China, East China, North China, Southwest, and Northwest
	Leadership Structure	<i>dual</i>	If the Chairman and the General Manager hold the same position, assign a value of 1; if they do not, assign a value of 0
	Asset Expansion Multiple	<i>expan</i>	Total Assets Year-on-Year Growth Rate
	Centralization of Top Ten Shareholders	<i>top10</i>	Shareholding Ratio of the Top Ten Shareholders

3.3 Construction of regression models

To verify H1, we refer to the study by (Yang & Yang, 2022) and construct Model (1) for verification. Here, β_0 represents the intercept, and β_1 represents the regression coefficient of entrepreneurship. X denotes the control variables, and β_2 represents the coefficients of the

control variables, while ε denotes the error term, with i representing the listed enterprises (the same below). If the regression coefficient β_1 in Model 1 is positive and the P -value is significant, H1 is supported.

$$ep_i = \beta_0 + \beta_1 eship_i + \beta_2 X_i + \varepsilon_i \quad (1)$$

To verify H1a, according to (Li, 2021), R&D investment not only affects the current performance of a firm, but also has a lagged effect. Enterprise R&D projects usually take a period of time to complete and may need to go through several stages, including research, development, testing and marketing. During this process, enterprises may need to invest a lot of resources and time, but the improvement in performance may not be reflected immediately until the project is completed. Based on this, model (2) is constructed for testing, where t denotes the year ($t=2021,2022$).

$$ep_i = \beta_0 + \beta_1 rd_{i,t} + \beta_2 prd_{i,t} + \beta_3 X_i + \varepsilon_i \quad (2)$$

To verify H1b, model (3) is constructed; to verify H1c, model (4) is constructed. If the regression coefficients β_1 and β_2 in models (3) and (4), respectively, are positive and the P -values are significant, H1b and H1c are confirmed.

$$ep_i = \beta_0 + \beta_1 ol_i + \beta_2 dr_i + \beta_3 X_i + \varepsilon_i \quad (3)$$

$$ep_i = \beta_0 + \beta_1 ms_i + \beta_2 size_i + \beta_3 X_i + \varepsilon_i \quad (4)$$

To verify H2, it is tested by introducing the interaction term between entrepreneurship and regional economy ($eshipgdp$) and constructing model (5), which can analyze whether entrepreneurship is affected by the high or low level of regional economy, which in turn affects the enterprise performance.

$$ep_i = \beta_0 + \beta_1 eship_i + \beta_2 eshipgdp_i + \beta_3 X_i + \varepsilon_i \quad (5)$$

4. Results and Discussion

4.1 Descriptive Statistics and Correlation Analysis of Variables

The results of the specific analyses are shown in Tables 4 and 5.

Table 4 Descriptive Statistics for Each Variable

Var	Obs	Mean	Median	Std	Min	Max
<i>ep</i>	3183	9.3243	5.7572	27.6925	-39.6347	108.3422

<i>eship</i>	3183	-0.0085	-0.0255	-.02548	-1.0226	1.1729
<i>eshipgdp</i>	3183	-0.1098	-0.2825	4.9156	-11.2947	13.2164
<i>gdp</i>	3183	11.0867	11.2608	0.6097	9.4781	11.7685
<i>rd2022</i>	3183	6.0638	4.5700	5.1382	0.1300	26.5700
<i>rd2021</i>	3183	5.5732	4.3500	4.5149	0.0600	22.6800
<i>prd2022</i>	3183	16.2880	13.9400	11.0056	0.0000	53.0900
<i>prd2021</i>	3183	15.6610	13.4600	10.7019	0.0000	51.1500
<i>ol</i>	3183	3.8833	1.7680	16.1323	-41.1510	76.0480
<i>dr</i>	3183	37.7688	36.9514	18.4595	6.6050	77.0250
<i>ms</i>	3183	0.0002	0.0000	0.0005	8.17e-06	0.0029
<i>size</i>	3183	22.1571	21.9665	1.1253	20.3017	25.1577
<i>dual</i>	3183	0.3852	0	0.4867	0	1
<i>expan</i>	3183	19.0986	8.7765	34.6210	-18.1525	168.6673
<i>top10</i>	3183	56.7221	57.2200	15.8392	24.3400	86.5500

Note: *rd2022* and *rd2021* represent the R&D investment ratios in year 2022 and 2021, respectively; *prd2022* and *prd2021* represent the percentage of R&D personnel in year 2022 and 2021, respectively.

The mean value of enterprise performance (*ep*) in the sample is 9.3243, but the median is only 5.7572, and combined with the maximum and minimum values of enterprise performance, it indicates that there are individual enterprises with high levels of performance, which overall pulls up the average; the mean value of entrepreneurship (*eship*) is -0.0085, and the median is -0.0255, and again combined with the maximum and minimum values of entrepreneurship, it indicates that a larger proportion of entrepreneurs have a higher sense of innovation, risk-taking and competitiveness, and a higher level of spirit.

Table 5 Correlation Analysis of Main Variables

Dependent Variable	Independent Variables	Correlation Coefficient	P-value
<i>ep</i>	<i>eship</i>	0.1011***	0.0000
	<i>eshipgdp</i>	0.1026***	0.0000
	<i>rd2022</i>	-0.0710***	0.0001
	<i>rd2021</i>	0.0640***	0.0003
	<i>prd2022</i>	0.0175	0.3246
	<i>prd2021</i>	0.0387**	0.0291
	<i>ol</i>	0.0834***	0.0000
	<i>dr</i>	0.1030***	0.0000
	<i>ms</i>	0.0926***	0.0000
	<i>size</i>	0.0569***	0.0013

Note: ***, **, and * indicate significant at the 1%, 5%, and 10% levels, respectively, and the same below.

The correlation coefficients of enterprise performance (*ep*) with entrepreneurship (*eship*), interaction term (*eshipgdp*), ratio of R&D investment in 2022 (*rd2022*), ratio of R&D investment in 2021 (*rd2021*), operating leverage (*ol*), debt ratio (*dr*), market share (*ms*), and size of the

enterprise (*size*) were 0.1011, 0.1026, -0.0710, 0.0640, 0.0834, 0.1030, 0.0926, 0.0569, which are significant at 1% significance level, and the correlation coefficient between enterprise performance (*ep*) and the percentage of R&D personnel in the year 2021 (*prd2021*) is 0.0387, which is significant at 5% significance level, and the correlation coefficient between the enterprise performance (*ep*) and the percentage of R&D personnel in year 2022 (*prd2022*) did not pass the significance level test. The truth of H1, H1b, H1c, and H2 are preliminarily tested.

4.2 Regression analysis

Based on the five models constructed above, empirical tests were conducted by controlling variables such as regional economy, province, region, leadership structure, asset expansion multiple, and concentration of the top ten shareholders (Xu & Chen, 2022). The specific regression results are shown in Tables 6, 7, 8, 9, 10, 11, and 12.

Table 6 Regression Analysis of Entrepreneurship and Enterprise Performance

Var	Regression Coefficient	Validation	Conclusion
<i>eship</i>	6.2981*** (0.000)	The regression coefficient is greater than 0 and is significant at the 1% level	Entrepreneurship is significantly and positively related to firm performance, and fostering and promoting entrepreneurship helps to improve enterprise performance, H1 is valid
<i>_cons</i>	9.3777		
<i>N</i>	3183		
<i>AdjR²</i>	0.010		

Table 7 Regression Analysis of Enterprise R&D Investment Ratio, R&D Personnel Share and Enterprise Performance

Var	Regression Coefficient	Validation	Conclusion
<i>rd2022</i>	-0.7989*** (0.000)	The regression coefficients for R&D investment in the current year are less than 0, while the regression coefficients for the percentage of R&D personnel are greater than 0, and both are significant at the 1% level	There is a significant negative correlation between the current year's R&D investment ratio and enterprise performance; there is a significant positive correlation between the proportion of R&D personnel and enterprise performance
<i>prd2022</i>	0.2922*** (0.000)		
<i>_cons</i>	9.4099		
<i>N</i>	3183		
<i>AdjR²</i>	0.012		

Table 8 Regression Analysis of Enterprise R&D Investment Ratio and Enterprise Performance in Lagged Period

Var	Regression Coefficient	Validation	Conclusion
<i>rd2021</i>	0.3925*** (0.000)	The regression coefficient of enterprise R&D investment is greater than 0 and significant at the 1% level	R&D investment ratio is significantly and positively related to enterprise performance in lagged period
<i>_cons</i>	7.1371		
<i>N</i>	3183		
<i>AdjR²</i>	0.004		

The findings in Tables 7 and 8 indicate that for manufacturing enterprises, enhancing current R&D investment, on the contrary, negatively affects the performance of the enterprises due to the fact that R&D projects usually take a period of time to complete and may have to go through several phases, including research, development, testing and marketing. In this process, enterprises may need to invest a lot of resources and time, but the improvement in performance may not be immediately seen until the R&D project is completed. At the same time, the results of R&D require further technological transformation and commercialization before they can be transformed into market competitiveness and tangible benefits. This process usually takes time to build up market share and consumer acceptance, which can have a positive impact on enterprise performance. Finally, during the initial R&D phase, enterprises need to adapt to new technologies, optimize their R&D processes, and develop talent in order to improve the efficiency and quality of their R&D. This process also takes some time until an enterprise is able to fully utilize its R&D investment before it can see a significant improvement in performance. Therefore, the impact of R&D investment on enterprise performance usually has a lag. Overall, enterprise's innovation spirit shows a positive impact on enterprise performance, and H1a is valid.

Table 9 Regression Analysis of Enterprise Operating Leverage, Debt Ratio and Enterprise Performance

Var	Regression Coefficient	Validation	Conclusion
<i>ol</i>	0.1321*** (0.000)	The regression coefficients for operating leverage and debt ratios are both greater than 0 and both are significant at the 1% level	Enterprise operating leverage and debt ratio have a significant positive relationship with enterprise performance, and H1b is valid
<i>dr</i>	0.1469*** (0.000)		
<i>_cons</i>	3.2644		
<i>N</i>	3183		
<i>AdjR²</i>	0.016		

Table 10 Regression Analysis of Enterprise Market Share, Enterprise Size and Enterprise Performance

Var	Regression Coefficient	Validation	Conclusion
<i>ms</i>	4866.0690***	The regression coefficients	Market share and size are

<i>size</i>	(0.000) 1.2714***	for market share and size are both greater than 0 and both are significant at the	both significantly and positively related to enterprise performance, and H1c is valid
<i>_cons</i>	(0.003) -20.04235	1% level	
<i>N</i>	3183		
<i>AdjR²</i>	0.011		

Table 11 Regression Analysis of the Interaction Term Between Entrepreneurship and Regional Economy and Enterprise Performance

Var	Regression Coefficient	Validation	Conclusion
<i>eshipgdp</i>	0.5781*** (0.000)	The regression coefficient is greater than 0 and significant at the 1% level	The interaction term is significantly and positively related to enterprise performance, suggesting that the regional economy plays an important role in entrepreneurship
<i>_cons</i>	9.3878		
<i>N</i>	3183		
<i>AdjR²</i>	0.010		

Table 12 Regression Analysis of Entrepreneurship and Enterprise Performance by Region

	Northeast China	South China	Eastern China	North China	Southwest China	Northwest China
<i>eship</i>	-7.3872 (0.294)	9.4058*** (0.000)	6.4879*** (0.000)	1.2967 (0.659)	13.0256*** (0.006)	-0.4283 (0.949)
<i>_cons</i>	11.2327	8.4508	9.2118	9.4074	11.3208	13.6816
<i>N</i>	99	750	1663	362	199	110
<i>AdjR²</i>	0.001	0.019	0.011	-0.002	0.032	-0.009
<i>mean_gd</i>	19315	52928	66214	35073	27426	14079
<i>p</i>						

Note: According to the division of regions by Choice database (excluding Hong Kong, Macao, and Taiwan), Northeast China includes Liaoning, Jilin, and Heilongjiang; South China includes Guangdong, Guangxi, Hainan, Hunan, and Hubei; East China includes Anhui, Fujian, Jiangsu, Jiangxi, Zhejiang, Shandong, and Shanghai; North China includes Beijing, Hebei, Henan, Neimenggu, Shanxi, and Tianjin; and Northwest China includes Gansu, Ningxia, Xinjiang, Qinghai, and Shanxi. Southwest includes Tibet, Guizhou, Chongqing, Sichuan, and Yunnan. GDP data are from the National Bureau of Statistics, and *mean_gdp* represents the average gdp of all provinces in the region in 2022.

The results in Table 12 show that in the case of sub-region, the three regions of Northeast, North China and Northwest have insignificant impact of entrepreneurship on enterprise performance. The possible reason for this is that the two regions of Northeast and Northwest China have relatively lower levels of economic development and fewer samples available compared to the other regions. These regions have a relatively homogeneous industrial structure, with less pressure for innovation and competition, and the stimulation and development of

entrepreneurship is relatively limited. In this case, the effect of entrepreneurship on enterprise performance may be relatively insignificant. On the other hand, the economic structure of North China is relatively more concentrated, with heavy industry and traditional manufacturing industries, which are usually affected by market demand fluctuations, environmental pressures and resource constraints, in addition to government policies and regulations, and these factors may have a greater impact on enterprise performance than the stimulation of entrepreneurship. Entrepreneurship in the three regions of South China, East China and Southwest China has a significant positive effect on enterprise performance, with correlation coefficients of 9.4058, 6.4879 and 13.0256, corresponding to an average GDP of 5,292.8 billion yuan, 6,621.4 billion yuan and 2,742.6 billion yuan, respectively. This suggests that entrepreneurship has a greater impact on enterprise performance in regions with lower economic levels, thus validating H2.

4.3 Robustness Tests

To enhance the reliability and stability of the research conclusions, the following robustness tests were conducted:

(1) Data for each variable was exported from the Oriental Wealth Choice database. Outliers and extreme values were excluded, as were provinces with only a single-digit number of listed enterprises, and ST/*ST companies were removed to ensure that the sample contained no missing values or problematic enterprises. (2) Robust standard errors and robust statistical test methods were used to examine heteroscedasticity and serial correlation (Xu & Chen, 2022). A comparison with the results of ordinary linear regression shows that the values of the robust standard errors increased, resulting in a decrease in the t-values for the corresponding variables. However, the changes in the significance of the p-values were minimal, so the test results still support the research conclusions. The specific test data can be found in Table 13.

Table 13 The Test Results of Robustness

<i>ep</i>		std	t	p
<i>eship</i>	General Linear Regression	1.099	5.730	0.000
	Robustness Criterion Error Regression	1.226	5.140	0.000
<i>eshipgdp</i>	General Linear Regression	0.099	5.820	0.000
	Robustness Criterion Error Regression	0.110	5.250	0.000
<i>N</i>		3183	3183	3183

5. Conclusion and Recommendations

5.1 Conclusion

Based on the results of empirical tests, the following conclusions are drawn:

First, entrepreneurship has a significant positive effect on enterprise performance.

Second, innovation spirit also has a significant positive effect on enterprise performance, although its impact is delayed. Increasing the ratio of R&D investment within the enterprise promotes performance in subsequent periods. Moreover, raising the proportion of R&D personnel also positively influences enterprise performance.

Third, risk-taking spirit has a significant positive effect on enterprise performance. Additionally, increasing the enterprise's operating leverage and debt ratio, within reasonable and compliant limits, has a positive and significant effect on performance.

Fourth, competitive spirit positively impacts enterprise performance. By expanding market share, enterprises can achieve higher sales and income, thereby improving economic efficiency and enhancing the competitiveness of their products and services.

Fifth, economic level significantly influences entrepreneurship. In regions with lower economic development, entrepreneurship has a relatively stronger effect on enterprise performance. Specifically, in South China, East China, and Southwest China, entrepreneurship exerts a notable positive effect on enterprise performance, with entrepreneurs in Southwest China being more proactive in seeking innovations and opportunities compared to those in South and East China.

5.2 Recommendations

Based on the above findings, the following five recommendations are made:

1. Stimulate and cultivate entrepreneurial spirit

Enterprises should actively stimulate employees' entrepreneurial awareness and innovation potential through systematic innovation and entrepreneurship training and practical activities. For example, inviting industry experts to share their experiences, organizing creative competitions, and setting up innovation incubators. These activities not only enhance employees' innovation ability, but also provide a platform for enterprises to identify and cultivate new innovation opportunities. By encouraging cross-sectoral cooperation and innovative interactions, companies can create a vibrant and creative work environment.

2. Increase R&D investment and R&D personnel ratio

Enterprises should optimize the structure of their R&D teams, focus on the introduction of interdisciplinary talents, and at the same time set up incentive mechanisms to encourage R&D innovation. Strengthening cooperation with universities and research institutions can make full use of external research resources to promote technological innovation and industrial upgrading. In addition, enterprises should regularly evaluate the effectiveness of R&D investment and adjust the budget through data analysis and empirical research to ensure the effectiveness of the investment.

3. Reasonable use of financial leverage and debt ratios

Enterprises should set reasonable leverage and debt ratios in light of their financial situation, while maintaining financial transparency to enhance investor trust. In addition, adhering to financial norms and ensuring compliant operations can effectively avoid potential risks and improve the overall stability of the enterprise.

4. Increase market share and company size

Enterprises need to continuously optimize their products and services to meet customer needs and enhance brand competitiveness. Through mergers and acquisitions and cooperation, enterprises can rapidly expand their market scale. At the same time, developing and launching new products with market competitiveness can further enhance market position and company size. In addition, focusing on marketing and sales team training can also help market expansion and performance improvement.

5. Emphasize the development of entrepreneurship in regions with low economic levels

In regions where economic development is relatively lagging behind, governments and enterprises can help local entrepreneurs enhance their entrepreneurial capabilities through training, policy support and the establishment of innovation and entrepreneurship platforms. The government can create a favorable entrepreneurial environment and motivate more people to engage in innovation and entrepreneurship through policy support, tax incentives and business incubators. Strengthening cooperation with universities and research institutions can promote the transformation of scientific and technological innovation results, promote the upgrading of local industries and drive the development of the regional economy.

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