Research On The Relationship Between Female Executives, Risk Taking And Technological Innovation

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Abstract: *As society changes, the gender gap has naturally narrowed along with social changes. After entering the 21st century, with the development of economic globalization and the gradual integration of cultures from all over the world, Chinese women have freed themselves from the traditional role of "good wife and beloved mother" and began to step into professional situations. At present, the number of women in the corporate executive team is increasing, but according to psychology, female executives have higher risk aversion than men. Based on this article exploring the impact of female risk-taking on corporate technological innovation, we selected 2009-2018 China A-share main board listed companies as the research sample, and Pearson is used to do correlation coefficient analysis and 2SLS instrumental variable regression to conduct empirical tests. The results show that: (1) The proportion of female executives is negatively correlated with corporate technological innovation. The higher the proportion of female executives, the higher the level of innovation will be inhibited; (2) It has a significant regulatory effect on the nature of property rights, product market competition and the degree of marketization. The research in this paper suggests that companies should consider the number or proportion of female executives introduced into the executive team, which will have a better role in promoting corporate governance and corporate technological innovation.*

Keywords: *Female executive; Risk taking; Technological innovation*

I. Introduction

In term of enterprise technological innovation is not only the sustainable development of enterprises and the driving force of social development, but also an important factor of national development. From the perspective of innovation, talents are the core resources of enterprise innovation. Although enterprises have excellent resources in the market, but they do not have talented person, companies cannot use resources most efficiently or rationally. Enterprises often cannot do without the support of human resources in the activities of technological innovation. Therefore, the senior management team is not only the representative of the development direction of the enterprise, but also the important manager of the enterprise making strategic decisions. Innovation will also have a restrictive effect. In the traditional Chinese concept of "regard men as superior than women", so, women are not treated equally by the society as men. This situation restricts women's development in the workplace, so the issue of equality between men and women is being promoted. , The degree of change in gender discrimination in various parts of the world will also be affected by time. Later, with the development of society, more and more women entered the company, and even entered the senior management team, so that the proportion of women in the company naturally increased. On the other hand, due to the different nature of the property rights of the companies in which female executives are located, state-owned and non-state-owned companies have different commitments, which results in female executives not giving full play to their talents. In the case of high or low product market competition, female executives may also promote enterprises to actively invest and innovate in technology. In psychology, the risk aversion of women's own personality characteristics is higher than men, so they tend to avoid strategic decision-making, which may have an adverse impact on the company. In addition, the regional characteristic of the marketization process is the effective degree of local legal system construction, which makes enterprises subject to supervision and control and affects their innovation capabilities. At the same time, the level of risk-taking will affect the performance of female executives and corporate technological innovation. Due to the various factors mentioned above, this article intends to use the theory of high-level echelon and risk preference theory to analyze the influence of female executives on enterprise technological innovation, and to explore the moderating effect of the external environment of the enterprise on this influence mechanism.

Theoretical analysis and research hypothesis
(1) The impact of female executives on technological innovation performance
1. The impact of female executives on corporate technological innovation based on risk preference theory
Innovation is the core activity of enterprise development. Enterprises meet the market demand of the times through continuous innovation. Only innovation can make enterprises change. Therefore, enterprises are often inseparable from innovation. Technological innovation is also the core competitiveness of enterprises. In addition, technological innovation can improve the production capacity of enterprises. It can be seen that the improvement level of technological innovation of enterprises depends on the effectiveness of corporate governance.

The Upper Echelons Theory believes that the values of senior managers are closely related to the personal characteristics of managers. Bass and Stogdill (1990) believe that executives are brokers and cannot be completely rational individuals. Their experience, gender, and education level will all affect the values of managers, and personal values will affect the decision-making behavior of individuals. Ferdinand AG, Bin S and Anthony CN (2011) research found that companies with greater gender differences in executives perform better in terms of operating efficiency, governance structure, ownership mechanism, and human resource policies. Compared with male managers, in the external environment of the company, female executives can give more play to their own advantages. Female managers are more careful and patient, and can promote harmony among team members. Due to these characteristics of women, they can interact with customers. Establish a good relationship with competitors Reguera-Alvarado (2015), so as to successfully obtain investment and financing and expand customer channels Hillman (2000). Kirton (1976) pointed out that women's pursuit of innovation is lower than men's. This view is also endorsed by Hisrich and Brush (1984). Their research found that companies founded by women tend to rely more on the modification of existing products than on product innovation. In recent years, a study by scholar Marvel et al. (2015) found that compared with women, men are more inclined to obtain more patents and pay more attention to research and development.

Research based on psychology has shown that many resources must be introduced in the investment of enterprise innovation. In the investment activities of innovation and R&D, enterprises will face uncertainty and investment unknowns, resulting in high risks. When enterprises make decisions, managers take risks. Evaluation and comprehensive consideration can only make a decision to determine whether it is worthwhile to invest in research and development. Psychological research shows that, to a certain extent, the physical differences between men and women can lead to differences in their behaviors. Risk preference theory divides the treatment of risks into three types: risk preference, risk neutrality and risk aversion. Therefore, different personal risk preferences will lead to obvious differences in decision-making. Psychological research shows that men and women have different levels of risk-taking, and women are more averse to risk-taking, and have different influences in the strategic decision-making process of enterprises. In view of the above analysis, as the proportion and number of female executives change, female executives sometimes have a promoting effect on corporate innovation, and sometimes they have a restraining effect. There has not yet been a unified conclusion between female participation in the senior management team and corporate technological innovation. In view of this, this article proposes Hypothesis 1:

Hypothesis 1: Female participation in the senior management team has a significant negative impact on corporate technological innovation, that is, the increase in the proportion of female senior management participation is not conducive to corporate technological innovation.

(2) The regulatory role of the external influence mechanism of the enterprise
1. Nature of property rights
In view of the inconsistency of the nature of the property rights of Chinese enterprises, corporate ownership is usually divided into two types: state-owned enterprises and non-state-owned enterprises. The agency costs and supervision and control of companies with different nature of property rights will vary. Whether internal control can be effectively carried out and implemented still depends on the opportunities and challenges of external factors such as government management and the market. Li Zhibin (2013) believes that due to the long history of development of state-owned enterprises and strict government control over them, the adjustment and adaptability of the internal governance structure of state-owned enterprises have become stronger, and that their internal control mechanisms have undergone many adjustments and become more stable. It is more resistant to external shocks and can enjoy national resources and policy support. In addition, because state-owned enterprises have to support social responsibilities and policies, enterprises may sometimes sacrifice their own interests and tend to pursue a non-profit society. Activities (Yang Hanming and Liu Guangrui, 2014) even believe that state-owned enterprises do not have private interests in pursuit of control rights.The holding of non-state-owned enterprises has a stronger incentive to obtain private income (Chen Yugang and Mo Xiajun,

2013). The controlling shareholder holds the actual control rights of the enterprise. Innovative activities. In short, compared with non-state-owned enterprises, female executives in state-owned enterprises are less likely to obtain incentive levels and development space. In addition, when the positions of female executives are stable, they will have fewer incentives to actively improve the operating efficiency of the enterprise. Then in different enterprise property rights, this article puts forward the following hypotheses:

Hypothesis 2: Differences in corporate ownership can strengthen the positive moderating effect of female executives' participation in the executive team and technological innovation.

2. Product market competition

Product competition is the external market mechanism for enterprise development, and the market environment is the basic support for enterprise development. Because the corporate governance environment, resources, and legal guarantees in different regions will affect corporate innovation activities, the market environment is important in the product development and innovation process The role of. The level of regional marketization is used as an index for evaluating marketization. Comprehensive calculations based on factors such as the relationship between enterprises and the government, factor markets, and platform markets can fully reflect the regional market environment, which is essential for regional innovation and new product development. Therefore, technological innovation belongs to the high-tech field, and the key to the success of innovation is whether the product can be recognized by consumers (Xue Lei et al., 2011). Women have a better understanding of the market and consumer needs, and can provide more accurate strategic suggestions for the company's product innovation (Jin Shenghua and Zhang Jie, 2001). The transition from the economy to the manufacturing industry has led to the development of new technologies and the emergence of new industries, which may bring new market opportunities to certain companies, and may also bring environmental threats. Therefore, this paper proposes the following hypotheses:

Hypothesis 3: Market environment differences can strengthen the positive moderating effect of female executive participation and corporate technological innovation.

3. Different degrees of marketization

The degree of marketization is an important external environmental factor for enterprise innovation. From the perspective of the degree of marketization, the degree of marketization constitutes the most important living environment for enterprises. If market competition is very fierce in areas with a high degree of marketization, it will be less difficult for companies to intervene in the market. In order to avoid being eliminated from the fierce market competition, companies will improve their performance and productivity through innovation, and government supervision will also be enhanced Marketization will naturally make companies operate more transparently. In areas with a high degree of marketization, companies can conduct external audits to improve company reliability and monitor company internal behavior. Management uses the market environment to provide corporate institutional resources. Scholars discovered the property rights system environment (Guo Tao and Zhang Guohong, 2008), the degree of marketization (Feng Zongxian, Wang Qing, etc., 2011), the degree of financial development (Xie Weimin and Fang Xinghong, 2011), and the degree of political relevance (Yang Zhansheng and Yu Feng, 2014) And so on are important factors that affect the innovation motivation of enterprises. The degree of marketization is used as a moderating variable to explore the possible impact of innovation ability and other related variables. The empirical study of Zhu Yongming and Jia Ming'e (2017) found that the process of marketization will strengthen the negative effect of financial constraints on the level of technological innovation. Thus, based on the analysis of the degree of marketization, this article puts forward the following hypotheses:

Hypothesis 4: The difference in the degree of marketization regulates the relationship between the participation of female executives and the technological innovation of enterprises.

Table 1：Research model
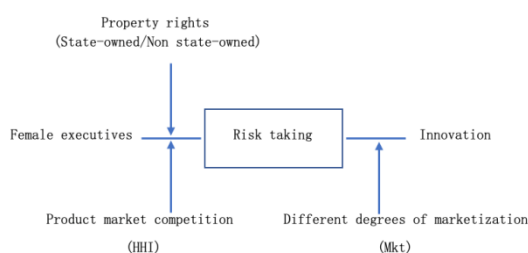
II. Data and Methodology

(1)Research design

In order to avoid the impact of the economic crisis, this article chooses to use the relevant data of China's A-share listed companies from 2009 to 2018 as the research sample, and conducts a lagging process for patent applications. The data comes from the CSMAR database and disclosed by listed companies Almanac annual report. At the same time filter data based on column conditions:

(1) Exclude ST and *ST company samples:

(2) Excluding the sample of financial and insurance listed companies:

(3) According to the set research variables, remove the sample of companies with missing data:

This article uses Excel to process relevant data, and finally obtains 19,724 valid samples. Statistical software uses STATA to sort and analyze the sample data.

（2）**Definition and description of research variables**

1. Independent variable

Technological innovation is to innovate for the purpose of creating new technologies. This article selects the proxy variable of the variable that indicates the number of authorized patent applications is ended, because the amount of patent ownership of a company is based on the year of patent application. Taking into account the lag in the output of enterprise patent results, this paper treats the number of patents in a lagging period, that is, the number of patents required for the company's technological innovation efficiency calculated in year t uses the value of t + 1 year.

2. Dependent variables

The explanatory variable of this article is female executives. This article adopts the proportion of female executives in the executives as the explanatory variable of this article. The female executive ratio (Female ratio) is used to measure the relative proportion of female executives, and the number of female executives is divided by The total number of executives is used to reflect the absolute number of female executives.

3. Moderator variables

(1) Nature of property rights

This article divides the entire sample into state-owned enterprises and non-state-owned enterprises by the nature of the actual controller of the enterprise. According to the nature of the actual controller, an enterprise with investment in state-owned assets or holding more than 50% of its shares is a state-owned enterprise; natural persons and other social groups, such as natural persons and other social groups, are defined as non-state-owned enterprises.

(2) Product market competition

This article uses the Herfindahl-Hirschman Index or Household Income (HHI) to measure the degree of product market competition. HHI represents the degree of industry concentration. For example, the larger the HHI index, the higher the market concentration, and the smaller the degree of competition, the lower the degree of monopoly. The higher is, on the contrary, the smaller the index, the lower the industry concentration and the greater the degree of competition. The index not only reflects the market share of the market, but also reflects the market structure outside the enterprise. Generally speaking, the HHI value should be between 0 and 1. When the market is in a complete monopoly, HHI=1. When there are many companies in the market, HHI tends to 0. The index algorithm uses the main business income of each listed company to use the sum of the main business income of all listed companies in the industry in which the company is located, and the square of the percentage value will be obtained. In addition, this article positions the samples with HHI index higher than the median as

the low-product market competition group, and the samples with HHI index lower than the median as the high-product competition group.

(3) Degree of marketization

This paper adopts the "China Provincial Marketization Index Report (2016)" formulated by Fan Gang, Yu Jingwen, and Wang Xiaolu, a marketization index system in various regions of China. According to their research, they examine the relationship between the government and the market, the development of the non-state economy, and the development of the product market. The five major aspects of development, the development of the factor market, the development of market intermediary organizations, and the legal system environment measure the degree of marketization in China's provinces, autonomous regions, and municipalities directly under the Central Government. Taking the median of the marketization index as the dividing line, when a company's one-year corresponding marketization index is higher than the median index, the index is deemed to belong to the high degree of marketization group, and when the marketization index is lower than the median index The index identifies the company as a low degree of marketization, with Mkt=1 representing a high degree of marketization, and Mkt=0 representing the first degree of marketization.

4.Control variables

Because the research in this article is about the performance of technological innovation, this article comprehensively draws on previous studies and sets the following control variables: company size, return on total assets, company growth, government subsidies, directors, board size, management shareholding Proportion, corporate risk-taking behavior, financing constraints, company years.The variables set in this article are as follows:

$$\text{Patent}_{i,t+1} = \beta_0 + \beta_1 \times \text{Female\_ratio}_{i,t} + \sum \beta_{j} \times \text{Controls}_{i,t} + \text{Ind} + \text{Year} + \varepsilon_{I,t}$$

Table2: Definition of variables

Variable type	Variable type	Variable type	Variable type
Independent variable	Patent application	ln Patent1	The natural logarithm of the total number of development patents the company applied for in the year
		ln Patent2	The natural logarithm of the total number of new patents applied for by the enterprise in the year
		ln Patent3	The natural logarithm of the total number of design patents applied by the enterprise in the year
Dependent variable	Female executives	Female ratio	Proportion of women in senior management
Moderator variable	Market environment competition	HHI	Herfindahl Index to measure product market competition
	Property rights	State	State-owned is 1, non-state-owned is 0
	Degree of marketization	Mkt	Fan Gang et al. marketization index
Intermediate variable	Risk taking	Cscore	Accounting Robustness Index
		RiskT	Risk-taking level, ROA volatility
Control variable	Company size	Size	Company size, natural logarithm of total assets
	Return on total assets	Roa	Return on total assets, net profit/total assets
	Company growth	Growth	Growth rate of operating assets
	Government subsidy	Sub	Government grants/total assets
	Board size	Boardsize	Total number of board members
	Management shareholding ratio	Ms	Management shareholding ratio, total number of shares held by senior management/total number of shares
	Corporate risk taking	Risk	Market risk, standard deviation of daily rate of return
	Financing constraints	KZ	Financing constraints KZ index
	Years	Age	Age of company establishment

4. Empirical results and analysis

(1) Descriptive statistics

This section uses the 2009-2018 Chinese A-share listed companies as the sample data to conduct descriptive statistical analysis to reflect the distribution of the sample. The descriptive statistical results of the samples used in this study are shown in Table 2.

Table 2: Descriptive statistics results

variable	N	min	mean	p50	max	sd
ln Patent1	19724	0	0.850	0	5.187	1.193
ln Patent2	19724	0	0.796	0	5.170	1.224
ln Patent3	19724	0	0.307	0	4.317	0.830
Female ratio	19724	0	0.176	0.167	0.524	0.107
HHI	19724	0.0148	0.0876	0.0525	0.932	0.103
State	19724	0	0.394	0	1	0.489
Mkt	19724	2.790	8.020	8.230	11.40	1.854
Cscore	16692	-129.6	-0.209	0.00730	13.25	4.576
RiskT	18197	0.00135	0.0515	0.0203	0.561	0.0831
Size	19724	18.33	22.09	21.92	27.56	1.273
Roa	19724	-0.694	0.0356	0.0357	0.231	0.0682
Growth	19724	-0.460	0.171	0.0960	4.497	0.340
Sub	19724	0	0.00474	0.00235	0.0533	0.00700
Boardsize	19724	5	8.689	9	15	1.700
Ms	19724	0	0.126	0.00168	0.705	0.197
Risk	19724	0.0100	0.0296	0.0277	0.234	0.00992
KZ	19724	-11.34	0.892	1.171	10.32	2.174
Age	19724	4	17.25	17	38	5.442

As can be seen from Table 2, in terms of the independent variables, the mean value of the natural logarithm of the invention patents applied by Chinese listed companies is 0.851, the standard deviation is 1.193, the mean value of the natural logarithm of the utility model patents applied for is 0.796, the standard deviation is 1.224, and the appearance of the application is The mean value of the natural logarithm of design patents is 0.307, and the standard deviation is 0.830. The standard deviations of the above three types of patents are much larger than the mean, indicating that the innovation capabilities of listed companies in China are highly diverse, and technological innovation is concentrated in some companies, indicating a need Further enhance the overall innovation level of listed companies.

In terms of dependent variables, the percentage of female executives in listed companies as a whole is 17.6%, the highest percentage is 52.4%, and the standard deviation is 10.7%. The percentage of female executives in listed companies in China is still relatively low, and women's participation in corporate governance is still relatively low.In terms of control variables, the average asset size after taking the logarithm is 22.09, the average return on total assets is 3.56%, the average growth rate of the company is 17.1%, the average proportion of government subsidies to the total assets of the company is 0.47%, and the average size of the board of directors is 8.689 The average shareholding ratio of the management is 12.6%, the average standard deviation of the daily return is 0.0296, the average financing constraint is 0.892, and the average year of establishment of the company is 17.25 years.

In terms of moderator variables and intermediate variables, the average value of the Herfindahl index is 0.0876; the proportion of state-owned enterprises is about 39.4%; the average value of the marketization process is 8.02. The mean value of enterprise risk exposure is 0.0515, and the mean value of accounting conservatism is -0.209.

(2) Correlation analysis

This paper uses the Pearson correlation coefficient analysis method to test the correlation between female executives and corporate innovation, and also analyzes the main variables in the model. The Pearson correlation coefficient is detailed in the Pearson correlation coefficient matrix in Table 3.

Through the correlation coefficient matrix, this paper finds that the natural logarithm of the explanatory variable invention patent applications, the natural logarithm of the utility model patent applications, the natural logarithm of the design patent applications, and the explanatory variable female executives' correlation coefficients are respectively − 0.087, -0.103, and -0.004, and all passed the 1% significance level test, indicating that there is a significant negative correlation between female executives and corporate innovation, and preliminary verification of our first hypothesis.

Table 3: Correlation analysis

	ln Pa~t1	ln Pa~t2	ln Pa~t3	Female~o	Size	Roa	Growth
ln Patent1	1						
ln Patent2	0.713***	1					
ln Patent3	0.420***	0.459***	1				
Female_ratio	-0.087***	-0.103***	-0.004***	1			
Size	0.079***	0.072***	0.044***	-0.175***	1		
Roa	0.091***	0.054***	0.102***	0.025***	0.008	1	
Growth	0.022***	0.022***	0.014	0.032***	0.039***	0.215***	1
Sub	0.098***	0.050***	0.058***	-0.023***	-0.180***	0.065***	0.004
Boardsize	0.013*	0.014**	-0.009	-0.168***	0.256***	0.015	-0.037***
Ms	0.109***	0.098***	0.073***	0.161***	-0.321***	0.132***	0.148***
Risk	-0.004	-0.003	-0.038***	0.039***	-0.214***	-0.062***	0.143***
KZ	-0.100***	-0.061***	-0.123***	-0.074***	0.134***	-0.497***	-0.279***
Age	-0.099***	-0.120***	-0.030***	0.081***	0.187***	-0.079***	-0.090***
	Sub	Boards~e	Ms	Risk	KZ	Age	
Sub	1						
Boardsize	-0.014	1					
Ms	0.049***	-0.204***	1				
Risk	0.094***	-0.109***	0.133***	1			
KZ	-0.040***	0.037***	-0.287***	0.043***	1		
Age	-0.140***	0.019***	-0.224***	-0.064***	0.143***	1	

Note: ***, ** and * indicate significant at the level of 1%, 5% and 10%, respectively.

(3) Regression analysis

Table 4 reports the benchmark regression results of female executives and corporate innovation. As mentioned earlier, this paper adopts the Tobit regression model and controls the year effect and industry effect. This article measures the level of enterprise innovation from three perspectives: the natural logarithm of invention patent applications, the natural logarithm of utility model patent applications, and the natural logarithm of design patent applications. It can be seen that the regression coefficients of female executives and invention patents and utility model patents are significantly negatively correlated (column 1: $\beta1=-1.418$, $p<0.01$; column 2: $\beta1=-1.299$, $p<0.01$), and the number of design patents Negative correlation but not significant ($\beta1=-0.393$, $p>0.1$). This is because my country's listed companies generally do not pay attention to design patent applications, and the difficulty of design innovation is relatively low, and listed companies have low willingness to innovate.

In terms of control variables, the regression results are basically consistent with expectations, and the 10 control variables are all significant. Company size, return on total assets, government subsidies, management shareholding, and state-owned enterprises have a significant positive correlation with the innovation level of enterprises, and the growth rate of total assets, market risk, financing constraints, and company age are negatively correlated with the innovation level of enterprises. This is basically consistent with the existing literature.

Therefore, the research hypothesis of this article H1, the proportion of female executives inhibits the innovation level of enterprises to be verified.

Table 4 : Regression analysis

Variable name	（1） F.patent1	（2） F.patent2	（3） F.patent3
Female_ratio	-1.418***	-1.299***	-0.393
	（-7.17）	（-5.79）	（-1.04）
Size	0.348***	0.318***	0.471***
	（17.40）	（14.09）	（11.83）
Roa	3.386***	3.450***	4.868***
	（8.38）	（7.09）	（5.86）
Growth	-0.140**	-0.161**	-0.373***
	（-2.30）	（-2.33）	（-3.11）
Sub	17.465***	2.028	23.381***
	（6.67）	（0.67）	（4.73）
Boardsize	0.054***	0.047***	-0.013
	（4.44）	（3.46）	（-0.56）
Ms	0.668***	0.456***	0.695***
	（5.95）	（3.59）	（3.27）
Risk	-11.322***	-14.131***	-27.713***
	（-3.54）	（-3.81）	（-4.14）
KZ	-0.043***	-0.040***	-0.115***
	（-3.80）	（-3.11）	（-5.29）

Age	-0.041***	-0.044***	-0.002
	（-9.81）	（-9.20）	（-0.21）
State	0.119**	0.060	0.018
	（2.41）	（1.07）	（0.19）
Constant term	-9.686***	-10.569***	-26.031
	（-16.62）	（-12.70）	（-0.02）
Year effect	控制	控制	控制
Industry effect	控制	控制	控制
Sample size	15122	15122	15122
Pseudo R^2	0.123	0.149	0.128

Note: ***, **, and * are significant at 1%, 5%, and 10%, respectively. The t statistic is in parentheses.

(4) Based on the external environmental impact mechanism of the enterprise
1. The regulatory role of the nature of property rights

Table 5 reports the regression results of the impact of samples of state-owned enterprises and non-state-owned enterprises on the relationship between female executives and corporate innovation capabilities. The results show that the relationship between female executives and corporate innovation capabilities in the sample of state-owned enterprises is not significant (β=-0.723, p>0.1; β=-1.860, p>0.1; β=0.716, p>0.1), but not in the sample of state-owned enterprises The negative impact of the relationship between female executives and corporate innovation capabilities is significant at the 1% level (β=-1.646, p<0.01; β=-1.269, p<0.01; β=-0.882, p<0.05), assuming H2: Compared with state-owned enterprises, female executives of non-state-owned enterprises have more obvious influence on the relationship of enterprise innovation capability, which has been verified.

The results show that compared with private enterprises, state-owned enterprises undertake more policy tasks and social responsibilities, which brings more behavioral constraints to state-owned enterprise executives, and their decision-making flexibility and free space become smaller. The personal characteristics of female executives are difficult to fully reflect, and they cannot play an obvious guiding role in the decision-making behavior of executives. In non-state-owned enterprises, executives' behaviors are less subject to policy constraints, decision-making is more flexible, and executives' opportunistic motives are stronger. At this time, female executives are more likely to spontaneously form a supervision and risk mechanism to regulate enterprises. Investment and financing decisions.

Table 5: Sub-master inspection of the nature of property rights

Variable name	State- owned			Non state - owned		
	F.patent1	F.patent2	F.patent3	F.patent1	F.patent2	F.patent3
Female_ratio	-0.723	-1.860	0.716	-1.646***	-1.269***	-0.882**
	（-1.06）	（-1.59）	（0.93）	（-7.46）	（-5.13）	（-2.06）
Size	0.404***	0.373***	0.500***	0.347***	0.318***	0.482***
	（13.23）	（10.72）	（8.34）	（12.33）	（10.02）	（8.71）
Roa	2.420***	1.957**	5.843***	3.815***	4.276***	4.232***
	（3.12）	（2.16）	（3.74）	（8.09）	（7.42）	（4.38）
Growth	0.260*	0.119	0.096	-0.237***	-0.213***	-0.536***
	（1.66）	（0.67）	（0.32）	（-3.67）	（-2.90）	（-4.07）
Sub	19.602***	8.216*	30.326***	17.896***	-0.276	20.900***
	（4.59）	（1.65）	（3.81）	（5.37）	（-0.07）	（3.31）
Boardsize	0.011	0.023	-0.018	0.071***	0.053***	-0.025
	（0.59）	（1.06）	（-0.48）	（4.46）	（2.93）	（-0.80）
Ms	2.116*	1.781	2.152	0.629***	0.456***	0.622***
	（1.90）	（1.38）	（1.15）	（5.70）	（3.69）	（2.90）
Risk	-14.205**	-15.902**	-56.816***	-8.005**	-10.177**	-15.016**
	（-2.31）	（-2.18）	（-4.12）	（-2.16）	（-2.39）	（-1.97）
KZ	-0.024	-0.029	-0.030	-0.053***	-0.045***	-0.152***
	（-1.03）	（-1.09）	（-0.69）	（-4.18）	（-3.10）	（-6.01）
Age	-0.045***	-0.047***	0.023	-0.042***	-0.047***	-0.020**
	（-5.93）	（-5.32）	（1.64）	（-8.38）	（-8.26）	（-1.98）
Intercept term	-11.090***	-11.843***	-26.208	-9.253***	-10.293***	-25.433
	（-11.81）	（-9.23）	（-0.01）	（-11.89）	（-9.01）	（-0.02）
Year effect	Control	Control	Control	Control	Control	Control
Industry effect	Control	Control	Control	Control	Control	Control
Sample size	6231	6231	6231	8891	8891	8891
Pseudo R^2	0.176	0.173	0.208	0.096	0.145	0.097

Note: ***, **, and * are significant at 1%, 5%, and 10%, respectively. The t statistic is in parentheses.

2. The regulatory role of product market competition

With reference to previous literature, this paper uses the Herfindahl Index (HHI) as an indicator to measure the degree of external market competition faced by enterprises. According to the mean value of Herfindahl index, this paper divides the samples into two groups: high and low competition in the product market.

Table 6 reports the regression results of the impact of high and low product market competition on the relationship between female executives and corporate innovation capabilities. The results showed that in the sample of the lower HHI group, the negative impact of female executives on corporate innovation capability was significant at the 1% level (β=-2.070, p<0.01; β=-2.152, p<0.01; β=-0.956, p>0.05), while the impact of female executives in the sample of the higher HHI group on the innovation ability of the enterprise was not significant (β=-0.071, p>0.1; β=0.332, p>0.1; β=0.826, p>0.1) . Therefore, it is assumed that H3 has a significant moderating effect compared with the samples of the lower HHI group and the samples of the higher HHI group.

The results show that when the external market competition pressure is high (the HHI is low), companies will worry about the loss of market share caused by the failure of innovation, so they will be more willing to adopt the conservative and cautious principles of female executives and steadily promote innovative decision-making. Therefore, in HHI Significant negative correlation in the lower sample group. When the pressure of external market competition is low (higher HHI), the enterprise faces low market exit risk, and the trial and error cost of R&D innovation is low, so relatively radical innovation strategies will be adopted, and the caution of female executives will be less considered The conservative principle.

Table 6 : Group inspection of product market competition

Variable name	HHI high group			HHI low group		
	F.patent1	F.patent2	F.patent3	F.patent1	F.patent2	F.patent3
Female_ratio	-0.071	0.332	0.826	-2.070***	-2.152***	-0.956**
	（-0.19）	（0.85）	（1.18）	（-8.86）	（-7.89）	（-2.14）
Size	0.379***	0.323***	0.403***	0.344***	0.326***	0.508***
	（11.73）	（9.21）	（6.14）	（13.68）	（11.31）	（10.35）
Roa	1.973***	1.903**	4.034***	3.905***	4.209***	5.440***
	（2.62）	（2.24）	（2.64）	（8.15）	（7.09）	（5.48）
Growth	-0.102	-0.162	-0.225	-0.171**	-0.183**	-0.443***
	（-0.88）	（-1.30）	（-0.98）	（-2.40）	（-2.20）	（-3.14）
Sub	14.830***	10.771**	29.811***	17.382***	-3.293	18.945***
	（3.05）	（2.03）	（3.32）	（5.60）	（-0.90）	（3.21）
Boardsize	0.073***	0.049**	0.113***	0.047***	0.045**	-0.086***
	（3.57）	（2.23）	（2.79）	（3.08）	（2.58）	（-2.91）
Ms	0.812***	0.709***	1.052***	0.461***	0.297**	0.492**
	（4.01）	（3.24）	（2.77）	（3.73）	（2.07）	（2.08）
Risk	-6.332	-16.292***	-39.836***	-14.540***	-13.140***	-21.692***
	（-1.16）	（-2.62）	（-3.25）	（-3.70）	（-2.82）	（-2.72）
KZ	-0.020	-0.051**	-0.068*	-0.053***	-0.037**	-0.138***
	（-0.96）	（-2.25）	（-1.66）	（-3.99）	（-2.35）	（-5.37）
Age	-0.053***	-0.051***	-0.020	-0.034***	-0.039***	0.006
	（-6.86）	（-6.17）	（-1.34）	（-6.79）	（-6.66）	（0.66）
Intercept term	-10.626***	-10.644***	-25.530	-7.312***	-8.221***	-12.184***
	（-12.17）	（-9.81）	（-0.02）	（-11.68）	（-11.14）	（-9.86）
Year effect	Control	Control	Control	Control	Control	Control
Industry effect	Control	Control	Control	Control	Control	Control
Sample size	5074	5074	5074	10048	10048	10048
Pseudo R²	0.116	0.128	0.177	0.129	0.163	0.106

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Note: ***, **, and * are significant at 1%, 5%, and 10%, respectively. The t statistic
is in parentheses.
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3. The moderating effect of market evolution

With reference to previous research, this article uses the marketization process index calculated by Fan Gang et al. (2018) in the "Report on China's Marketization Index by Provinces" as an indicator to measure the degree of regional marketization. According to the average value of the marketization index, this paper divides the sample into two groups with high and low marketization degree.

Table 7 reports the regression results of the full sample and the effects of high and low marketization samples on the relationship between female executives and corporate innovation capabilities. Hypothesis 4 is

tested for the moderating effect. The results show that the negative impact of the relationship between female executives and corporate innovation capabilities in the sample with a high degree of marketization is significant at the 1% level (β=-1.378, p<0.01; β=-1.043, p<0.01; β=-0.412 , P>0.1), while the influence of the relationship between female executives and corporate innovation capabilities in the sample with a low degree of marketization is not significant (β=-1.696, p>0.1; β=-1.529, p>0.1; β=-0.398, p >0.1).

The results show that the influence of female executives and the marketization process on corporate innovation presents a complementary effect. The obvious feature of regions with low marketization process is that the establishment of laws and regulations is not sound, and the technological innovation of enterprises is controlled by many factors. In regions with a high degree of marketization, the supervisory mechanism and cautiousness of female executives can be brought into play, and enterprises will reduce their innovation capabilities in order to better allocate R&D resources.

Table 7: Group inspection of the degree of regional marketization

Variable name	High marketization			Low marketization		
	F.patent1	F.patent2	F.patent3	F.patent1	F.patent2	F.patent3
Female_ratio	-1.378***	-1.043***	-0.412	-1.696	-1.529	-0.398
	(-5.19)	(-3.48)	(-0.84)	(-0.72)	(-0.57)	(-0.68)
Size	0.320***	0.246***	0.421***	0.394***	0.416***	0.570***
	(11.59)	(7.95)	(7.95)	(13.87)	(13.02)	(9.79)
Roa	2.430***	3.579***	4.397***	4.367***	3.368***	4.928***
	(4.49)	(5.26)	(3.97)	(7.23)	(4.89)	(3.95)
Growth	-0.115	-0.175*	-0.378**	-0.158*	-0.165*	-0.314*
	(-1.36)	(-1.81)	(-2.34)	(-1.81)	(-1.70)	(-1.79)
Sub	21.526***	4.124	29.966***	14.431***	-0.208	17.702**
	(5.57)	(0.92)	(4.24)	(4.07)	(-0.05)	(2.55)
Boardsize	0.038**	0.010	-0.039	0.071***	0.079***	0.020
	(2.16)	(0.50)	(-1.16)	(4.22)	(4.17)	(0.58)
Ms	0.668***	0.338**	0.813***	0.376**	0.601***	0.318
	(4.82)	(2.16)	(3.15)	(2.26)	(3.23)	(0.99)
Risk	-14.518***	-17.274***	-24.794***	-7.537*	-7.962	-28.697***
	(-3.24)	(-3.36)	(-2.84)	(-1.71)	(-1.57)	(-2.79)
KZ	-0.055***	-0.059***	-0.149***	-0.022	-0.023	-0.074**
	(-3.57)	(-3.24)	(-5.02)	(-1.39)	(-1.25)	(-2.30)
Age	-0.032***	-0.028***	-0.007	-0.054***	-0.060***	0.007
	(-5.95)	(-4.59)	(-0.68)	(-7.79)	(-7.83)	(0.49)
Intercept term	-17.378	-16.170	-24.315	-10.577***	-12.888***	-28.814
	(-0.02)	(-0.01)	(-0.01)	(-14.01)	(-12.86)	(-0.01)
Year effect	Control	Control	Control	Control	Control	Control
Industry effect	Control	Control	Control	Control	Control	Control
Sample size	7830	7830	7830	7292	7292	7292
Pseudo. R^2	0.123	0.163	0.125	0.137	0.156	0.150

Note: ***, **, and * are significant at 1%, 5%, and 10%, respectively. The t statistic is in parentheses.

5. Robust inspection
(1) Replace the explained variable

In view of previous studies, this article uses the R&D intensity of listed companies to measure their level of innovation, that is, the proportion of the company's total R&D investment in the total operating income that year. The regression results are shown in Table 8. It can be seen from the results that the proportion of female executives is significantly negatively correlated with the intensity of corporate R&D investment (β1=-0.007, p<0.01), and the grouping test is also consistent with expectations.

Table 8 : Robustness: Replace the explained variable

Variable name	Sample	State-owned	Non State-owned	HHI high	HHI low	High marketability	Low marketability
	RD	RD	RD	RD	RD	RD	RD
Female_ratio	-0.007***	-0.007***	-0.008***	-0.005**	-0.008***	-0.010***	-0.004**
	(-5.16)	(-2.94)	(-4.65)	(-2.31)	(-4.52)	(-5.21)	(-2.15)
Size	-0.001***	-0.002***	-0.001***	-0.002***	-0.001***	-0.001***	-0.002***
	(-9.24)	(-9.17)	(-4.14)	(-7.82)	(-5.66)	(-4.47)	(-8.45)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Roa	0.029***	0.029***	0.027***	0.018**	0.034***	0.030***	0.028***
	（7.38）	（5.86）	（5.26）	（2.63）	（6.87）	（5.11）	（5.56）
Growth	-0.002***	-0.001	-0.003***	-0.002**	-0.003***	-0.003***	-0.001**
	（-5.55）	（-0.83）	（-5.70）	（-2.56）	（-5.19）	（-5.14）	（-2.28）
Sub	0.361***	0.241***	0.437***	0.204***	0.429***	0.514***	0.233***
	（13.57）	（6.57）	（12.21）	（4.68）	（12.94）	（12.42）	（7.10）
Boardsize	-0.000	0.000	-0.000	-0.000	0.000	-0.000	0.000
	（-0.27）	（0.45）	（-0.22）	（-1.17）	（0.42）	（-0.56）	（0.32）
Ms	0.002***	0.031**	0.003***	0.002*	0.003**	0.003**	0.002
	（2.89）	（2.42）	（3.81）	（1.67）	（2.52）	（2.51）	（1.25）
Risk	-0.013	0.017	-0.017	-0.020	-0.006	0.020	-0.050*
	（-0.57）	（0.54）	（-0.57）	（-0.61）	（-0.19）	（0.59）	（-1.90）
KZ	-0.001***	-0.001***	-0.001***	-0.001**	-0.001***	-0.001***	-0.001***
	（-8.17）	（-5.68）	（-6.50）	（-3.43）	（-7.65）	（-4.74）	（-6.39）
Age	-0.000***	-0.000***	-0.000	-0.000**	-0.000**	-0.000	-0.000***
	（-3.05）	（-6.29）	（-0.58）	（-3.15）	（-2.17）	（-1.32）	（-3.49）
State	0.000			-0.002***	0.001**	-0.001**	0.001***
	（0.04）			（-2.75）	（2.00）	（-2.36）	（2.97）
Intercept term	0.035***	0.035***	0.034***	0.046**	0.025***	0.025***	0.044***
	（9.23）	（7.72）	（5.64）	（8.79）	（5.48）	（4.46）	（8.88）
Year effect	Control	Control	Control	Control	Control	Control	Control
Industry effect	Control	Control	Control	Control	Control	Control	Control
Sample size	12409	4513	7896	4106	8303	6673	5736
adj. R^2	0.379	0.430	0.347	0.298	0.380	0.393	0.344

Note: ***, **, and * are significant at 1%, 5%, and 10%, respectively. The t statistic is in parentheses.

6.Research conclusions and recommendations
(1) Conclusion

Based on the theory of Upper Echelons Theory and risk preference theory, this paper uses the 2009-2018 Chinese A-share listed companies as the research sample. The female senior management team has made an empirical study on the impact of corporate technological innovation, and explored the nature of property rights and products. The degree of competition and the degree of marketization have a moderating effect on this impact. The research results show that (1) There is a negative correlation between female participation in the senior management team and technological innovation. The impact of female participation on corporate technological innovation is a tendency to inhibit innovation. Specifically, it depends on the number of risk prevention when women participate in the senior management team. Or if the proportion is too large, they will have an inhibitory effect on enterprises' under-low technological innovation activities; (2) The nature of property rights can adjust the technological innovation performance of female executives and enterprises, that is, state-owned and non-state-owned have different policy responsibilities, because state-owned and non-state-owned have different policy responsibilities. Enterprises undertake more policy tasks than non-state-owned enterprises, which brings constraints to state-owned executives. Therefore, when women enter state-owned enterprises, they will also be restrained and difficult to give full play to their talents; (3) When the degree of product market competition is high, companies adopt the conservative and cautious principles of female executives to promote innovative decision-making in order to survive in the market, and when the degree of product competition is low, companies seldom consider the caution of female executives. Principles; (4) The degree of marketization can adjust the technological innovation performance of female executives and enterprises. In areas with a high degree of marketization, the supervisory mechanism and cautiousness of female executives can be brought into full play, and enterprises can better allocate R&D resources. Will reduce its ability to innovate.

(2) Suggestions

Based on the above research, this article puts forward the following suggestions:

(1)　　　Given that the proportion of female executives in listed companies in China is still relatively low, there is still more room for improvement in women's participation in corporate governance. When introducing women into the senior management team, companies must appropriately consider the number or proportion of female senior managers in the team. Based on the perception of heterogeneous relationships, companies must also establish a diverse and inclusive senior management team in corporate governance to avoid companies Decision-making is subject to conflict and even affects the development prospects of the enterprise. (2) A region with a higher degree of marketization clearly shows that the region's laws are relatively complete and the ability to allocate resources is relatively high, which makes the market mechanism have the full potential, and the enterprise has also obtained the essential conditions for innovation. Therefore, all regions need to pay attention to improving the degree of marketization and strengthening the construction of regional marketization in order to promote the level of regional technological innovation.

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