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Regional Differences and Firms' Innovation Self-Choice Behavior: Insights from China

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Abstract: Although many studies examine the influence of external factors (e.g., financial development, institutional condition, government intervention, and degree of marketization) on firms' innovation behavior, they are rarely related to the core issue of heterogeneity in entrepreneurship. The different levels of entrepreneurs' characteristics usually mean huge differences in the skill level or efficiency of firms. Thus, the differences that exist in innovation ability and innovation behavior also reflect the difference of susceptibility to external factors. The core issue of heterogeneity determines not only the self-choice mode of a firm's innovation but also the degree and pattern of an internal condition imposed by external factors, and it then influences the firm's innovation behavior. Based on the perspective of entrepreneurship, this paper integrates heterogeneous trade theory into firms' R&D analysis frameworks by using the data of listed companies on the Growth Enterprise Market to explore the heterogeneous influence mechanism of financial development and government intervention on firms' R&D input. First, by constructing a theoretical model, this study finds that the innovation self-choice phenomenon exists in heterogeneous firms. A higher financial development and a lower government intervention lead to an increase in firms' R&D input benefits. Second, the empirical research finds that financial development reduces the innovation-cash flow sensitivity. Moreover, the reduction of government intervention alleviates the degree of capital misallocation of financial development and promotes R&D input. Third, as a moderator variable, entrepreneurs' risk-taking propensity strengthens the promotion effect of financial development and government intervention on firms' R&D investment. Financial development would strengthen the effect of government intervention on innovation self-choice behavior.

Keywords: financial development; government intervention; heterogeneity; R&D input; entrepreneurs' risk-taking propensity

1. Introduction

As the world's largest transition economy, the intensity of R&D investment in China has exceeded 2% for four consecutive years since 2013 and has reached the level of moderately developed countries. However, due to differences in the historical conditions, economic geography, marketization degree, and industrialization stage, the R&D investment among different regions is unbalanced. From 1999 to 2016, the gap between the eastern regions and the central, western and northeastern regions gradually widened, and the R&D scale of the four plates is severely unbalanced. The intensity of R&D investment in the eastern regions surpassed one trillion yuan for the first time in 2016, which was twice the total of the other three regions. There are significant differences in R&D expenditures among provinces and cities in China, and the R&D expenditures of the top three provinces have accounted for one third of national R&D expenditures. According to the sources of scientific research funds, the majority (nearly 80%) of the scientific research funds in various regions come from the independent investment of local enterprises, and only a small part comes from the government [1]. The eastern regions have

obvious advantages in the number, scale, vitality, and industrial structure of enterprises. Sustained high-level profits drive sustained high investment in R&D, which makes the eastern regions go deeper and deeper in the field of scientific research.

There is abundant literature on the influence of external factors (e.g., financial development, institutional conditions, government intervention, and marketization degree) on firms' innovation behavior [2,3]. This influencing process can be expressed as financial development, government intervention, or financing constraints influencing a firm's performance, financing, resource allocation, or microfirms' R&D investment behavior [4,5], showing the process of conducting innovation from external factors to enterprises. Considering different enterprises, does the conduct of external factors have the same effect on their R&D investment behavior? It is necessary to incorporate the heterogeneities of enterprises into such analytical frameworks.

A few scholars have focused on the human factors that affect firms' innovation performance, such as the impact of entrepreneurs' personal characteristics [6,7]. However, most of the existing research on entrepreneurs' innovation performance focuses on the dominant characteristics of entrepreneurs, such as professional background, political identity, and education level [8,9]. Considering the implicit characteristics of entrepreneurs, the research on their impact on R&D investment and innovation performance is relatively small. The characteristics of entrepreneurs, especially their differences in risk-taking, determine not only the self-choice mode of firms' innovation but also the degree and nature of the external factors acting on the internal conditions, which then affect firms' innovation behavior. The Growth Enterprise Market (GEM) is the second board securities market, which is inferior to the main board market. The purpose of this market is mainly to support small and medium-sized enterprises, especially high-growth and innovative enterprises, establish a normal exit mechanism for venture capital, and provide a financing platform for national strategies on independent innovation. High growth is the biggest attraction of GEM. Whether in high-tech, new business models, or independent innovation, it highlights the potential and realization of enterprises with high growth. Behind the high growth of the companies listed on GEM lies their strong innovation ability. According to statistics, about 60% of the major innovations in the 20th century originated from small and medium-sized enterprises, especially technological startups. It can be said that strong innovation ability is a prominent feature of companies on GEM. Based on this, this paper studies the impact of regional characteristics on the innovation of listed companies on GEM and the regulatory effect of entrepreneurs' risk-taking propensity on the relationship between them, so as to provide support for enterprises to establish reasonable policies for innovation activities and cultivate more excellent entrepreneurs.

This study is based on the annual data of 481 companies listed on the GEM, covering the period from 2012 to 2014. The empirical results showed that internal cash flow is the main financing channel for firms' innovation investment. The regional financial development level is significantly positively correlated with firms' R&D investment intensity and strengthens the role of internal cash flow on firms' R&D investment intensity. Regional government intervention is insignificant for firms' R&D investment intensity. Including entrepreneurs' risk-taking propensity as the moderator variable, the different effects of financial development on R&D investment in heterogeneous enterprises are also established, and entrepreneurs' risk-taking propensity strengthens the effect of financial development on firms' R&D investment intensity. Through the inclusion of entrepreneurs' risk-taking propensity as the moderator variable, the different effects of government intervention on heterogeneous firms' R&D investment are also established, and entrepreneurs' risk-taking propensity strengthens the effect of government intervention on firms' R&D investment intensity. Financial development and entrepreneurs' risk-taking propensity strengthen the effect of government intervention on R&D investment in enterprises.

The main contributions of this paper are as follows: First, it is helpful to study the external factors influencing the R&D investment of heterogeneous enterprises and to analyze the different effects of firms' heterogeneity on R&D input transmission. Second, by integrating entrepreneurs' risk-taking propensity into the analysis framework of financial development and government intervention from

the theoretical models and empirical analyses, it is helpful to understand the influence of external factors on firms' R&D investment differentiation and the self-choice behavior of firms' R&D investment. In addition, the results can be applied by national decision makers to improve the quality of local government governance and financial development and by enterprises to select suitable entrepreneurs and promote economic performance and R&D input in developing countries.

The remainder of this study is structured as follows. First, an overview of the existing literature on the impact of regional differences on firms' R&D investment and the roles of firms' characters for the impact are presented. On that basis, the main hypotheses are developed. Next, the data and the variables are described and empirical models are formulated. The results are then presented and key findings are discussed. Finally, the key findings of the study are summarized and the implications for policy and business practice are drawn.

2. Literature Review and Hypothesis

2.1. Impact of Regional Differences on Firms' R&D Input

The research regarding the impact of financial development on R&D input mainly focuses on how financial development alleviates internal financing constraints and then affects firms' innovation behavior. With the consideration of financing constraints, firm innovation usually has a high dependence on and sensitivity to its internal cash flow, or stabilizes firms' innovation behavior through the establishment of an internal cash expenditure smoothing mechanism, in order to moderate the impact of liquidity shock on R&D investment. Brown [10] pointed out that young enterprises in the United States used cash reserves to smooth the R&D expenditure process, and reasonably explained that R&D expenditure had a more stable nature comparing with the huge fluctuation of capital sources. Ju [11] found that high adjustment costs and unstable financing sources restricted the R&D investment activities of enterprises. The more serious financing constraints are, the more prominent the smoothing effect of internal capital accumulation and working capital management on innovation is. Subash [12] used the dynamic R&D model to find that the R&D expenditure of enterprises was positively correlated with the internal cash flow, and the cash flow sensitivity in small enterprises and young enterprises was higher than in large enterprises. With the development of an equity market, equity financing has become an important financing method of R&D expenditure. Brown [13] used a large number of data from enterprises in Europe, indicating that the development and liberalization of the equity market could improve long-term economic growth by promoting innovation activities at the enterprise level by controlling the smoothing investment behavior of enterprises. Enterprises with high R&D investment expose themselves to high risks, and equity financing can make them alleviate the possibility of the failure of innovation projects by reducing the financial burden and liquidation [14]. In recent years, with the development of the international financial market and multinational companies, the inflow of foreign equity capital has become a feasible financing choice for firms' innovation. Maskus [15] studied the impact of financial factors on industrial R&D input from the perspective of domestic and international financial market development. As a representative factor of international financial market development, Foreign Direct Investment (FDI) has a significant impact on R&D input.

For Chinese enterprises under the condition of a transition economy, it is necessary to consider the influence of Chinese special institutional backgrounds, and the most obvious manifestation of this in enterprises is government intervention. Most relevant research explores the impacts of government intervention on firm performance, financing channels, or resource allocation, and then these impacts act on innovation investment, thus the viewpoint is drawn that the reduction of local government intervention is conducive to the choice of firms' innovation behavior. Zhang [16] showed that the government usually intervened, directing enterprises toward the field of capital investment in order to maximize short-term benefits, resulting in the long-term innovation investment lagging behind production investment, which was not a reasonable resource allocation. Yu [17] pointed out that with greater government intervention, the financial development made more funds flow

into non-innovative fields and speculative investment projects. There was the distorted allocation of financial resources, which also had an important impact on the transmission process of a firm's innovation and a firm's innovation choice from financial development. Zhang [18] reported that the local government inevitably made direct or indirect intervention in the fund allocations of financial development. Because of financial pressure, political promotion and other reasons, the resource allocations in financial development were distorted, which affected technological innovation and the improvement of total factor productivity (TFP). Su [19] demonstrated that local governments had more motivation to intervene in the resource allocations of bank credit, and when they helped companies to control the obtaining of bank loans, the level of bank loans was higher. Liu [20] stated that government intervention affected the effective allocation of financial resources, which directly led to the investment by some enterprises and speculation on capital goods and further promoted the speed of economic capitalization. Otherwise, firms' performances of technological innovation had not significantly improved, leading to a serious negative impact on sustainable economic development. Chen [21] pointed out that, if financial innovation became a tool for speculators to pursue high returns, and the government was unable to supervise this innovation timely and effectively, then financial innovation would reach the final boundary.

The higher the productivity level is, the higher the R&D input tendency is. Additionally innovation self-choice behavior exists, but the innovation growth degree is affected by the external financial development degree and local government intervention [22]. The higher the level of regional financial development is, the more obvious firms' innovation choice behavior is. In the presence of government intervention, innovation self-choice behavior still holds. The higher the level of regional financial development is, the more financing opportunities financial development can provide to enterprises and the more R&D inputs the enterprises with higher productivity can have. Otherwise, there may be financial inefficiencies such as capital mismatch. Due to the existence of government intervention, more resources flow into short-term production to improve the output level, and the degree of R&D financing constraints becomes larger. If the degree of government intervention reduces, the R&D investment level of enterprises increases and firm performance with high productivity shows more obviously.

Hypothesis 1 (H1). *There is a positive relationship between the level of financial development and R&D investment intensity of enterprises.*

Hypothesis 2 (H2). *There is a negative relationship between the degree of regional government intervention and R&D investment intensity of enterprises.*

2.2. Influence of Entrepreneurs' Personal Characteristics on R&D Investment

According to the enterprise resource-based theory, an enterprise's competitive advantage comes from unique heterogeneous resources, which are hard to imitate and replace [23]. R&D investment of enterprises [24] aims to improve the innovation ability of enterprises with a heterogeneous resource advantage different from competitors and then obtain huge innovation income. R&D activities are the process of combining intellectual capital and material capital to produce new technology, new products, and other heterogeneous resources. In this process, enterprises invest in human, financial, information, and other resources in R&D departments. Such resources are used to carry out technological innovation and product innovation, launch new technology and new products, and form the core competitiveness of enterprises. Alternatively, enterprises use innovation results from R&D activities to change production process, reduce the unreasonable consumption of raw materials, improve labor productivity, reduce production costs, and increase the technical content of products. Finally, they occupy a larger market share with the competitive strategy of high quality and low price and bring rich performance returns for enterprises.

According to the research of Hambrick et al. [25], the personal characteristics of executives determine their cognitive level in a business environment, which can affect business decision-making. It is inferred that R&D investment intensity and the effect of R&D activities would also be affected by entrepreneurial personality preference. Because of their confidence in their own ability and cognition, managers with risk preference firmly believe that their judgments are correct, so they rely on their own risk-taking spirit and then form specific strategic decision-making ability, which promotes the internal technological innovation activities in enterprises and then improves firms' innovation performance. Hirshleifer et al. [26] used empirical research on American listed companies and showed that CEOs with risk preference invested in more innovation projects, and the rate of innovation success was higher than for CEOs who were risk averse. Further research shows that managers with risk preference in high-tech industries can get better innovation results. In contrast, entrepreneurs who are risk averse are afraid of the uncertainty of innovation results, which restrains R&D investment and excludes dividends from innovation activities.

Hypothesis 3 (H3). *Entrepreneurs' risk-taking propensity can enhance the relationship between the financial development level and R&D investment intensity.*

Hypothesis 4 (H4). *Entrepreneurs' risk-taking propensity can enhance the relationship between the degree of regional government intervention and R&D investment intensity.*

3. Methodology

Given that the information of R&D expenditure and innovation output from listed companies on the GEM is relatively complete, meeting the requirements of this study on relevant information data, listed companies on the GEM were selected as the initial sample, and targeted processing was conducted on the initial sample. The data comprised the annual data of 481 listed companies on the GEM from the China Stock Market and Accounting Research (CSMAR) database and Wind database, covering the period from 2012 to 2014. Considering the integrity and validity of the data, 962 samples were finally obtained.

3.1. OLS Models

This paper deals with the use of moderator variables and the testing of moderating effects. In accordance with the test procedure of regulatory effects, we included relevant variables in turn, built models, and adopted hierarchical multivariate regression analysis for empirical analysis. This paper follows Benfratello's [27] study and other studies [28,29] in testing the impact of financial development and government intervention on the R&D investment of heterogeneous enterprises. The basic empirical framework was constructed as following:

$$RDS = \beta_0 + \beta_1CF + \beta_2SIZE + \beta_3SIZE^2 + \beta_4AGE + \beta_5AGE^2 + \varepsilon \quad (1)$$

Firstly, the introduction of external financial development or government intervention had different effects on R&D investment.

$$RDS = \beta_0 + \beta_1FD + \beta_2FD \times CF + \beta_3CF + \beta_4SIZE + \beta_5SIZE^2 + \beta_6AGE + \beta_7AGE^2 + \varepsilon \quad (2)$$

$$RDS = \beta_0 + \beta_1IndexG + \beta_2IndexG \times CF + \beta_3CF + \beta_4SIZE + \beta_5SIZE^2 + \beta_6AGE + \beta_7AGE^2 + \varepsilon \quad (3)$$

Secondly, the different effects of entrepreneurs' risk-taking propensity and financial development on R&D investment of heterogeneous enterprises were introduced.

$$RDS = \beta_0 + \beta_1FD + \beta_2FD \times RTP + \beta_3CF + \beta_4SIZE + \beta_5SIZE^2 + \beta_6AGE + \beta_7AGE^2 + \varepsilon \quad (4)$$

Thirdly, the different effects of entrepreneurs' risk-taking propensity and government intervention on R&D investment of heterogeneous enterprises were introduced.

$$RDS = \beta_0 + \beta_1 IndexG + \beta_2 IndexG \times RTP + \beta_3 CF + \beta_4 SIZE + \beta_5 SIZE^2 + \beta_6 AGE + \beta_7 AGE^2 + \varepsilon \quad (5)$$

Finally, government intervention was introduced to examine its influence on financial development and the enterprises themselves, leading to the distorted resource allocation of different enterprises.

$$RDS = \beta_0 + \beta_1 IndexG + \beta_2 IndexG \times FD + \beta_3 IndexG \times RTP + \beta_4 CF + \beta_5 SIZE + \beta_6 SIZE^2 + \beta_7 AGE + \beta_8 AGE^2 + \varepsilon \quad (6)$$

3.2. Variable Selection and Quantification

As mentioned above, R&D investment intensity of an enterprise (RDS) is calculated as the percentage of a firm's R&D input in total assets. In China, Accounting Standards for Business Enterprises No. 6—intangible assets (revised in 2006) requires conditional capitalization of the R&D expenditures of enterprises. R&D activities are divided into two stages, i.e., research and development. Research expenditures are included in current profits, while development expenditures are included in intangible assets when five conditions are met. "Development expenditure" as non-current assets are separately listed in the balance sheet of the enterprise. Considering the availability of data, the study used the annual amount of development expenditure as R&D input. The financial development level (FD) is from the 2013-2014 financial development index published by Wang et al. [30] The second level index "financial marketization" of market development is an alternative variable of the regional financial development level in this paper. The larger the index is, the higher the regional financial development level is. In addition, the related index of government intervention (IndexG) comes from the 2016 report on the Marketization Index of China's Provinces by Fan [31], in which the measure is the relationship between government and the market. The larger the index value is, the lower the level of government intervention is. Entrepreneurs' risk-taking propensity (RTP) is mostly measured by financial indicators. Different financial decision-makings have different risks. In addition, different decision-making indicators can reflect different attitudes of entrepreneurs toward risks. According to the practice of Gong [32], this paper uses the proportion of total risk assets and total assets to measure the risk-taking tendency of entrepreneurs, in which total risk assets include short-term risk assets and long-term risk assets. The short-term risk assets include trading financial assets and accounts receivable, while the long-term risk assets include financial assets available for sale, investment held to maturity, and investment real estate. Other variables that measure firms were included in our study as follows: The ratio of net cash flow from operating activities to the total assets of an enterprise was used to measure the internal cash flow of an enterprise (CF). The study used the natural logarithm of the total assets as the proxy variable of firm size (SIZE) and added its square term (SIZE²) to judge the existing U-shaped or inverted U-shaped influence relationship. The age of an enterprise (AGE) was the time span from the opening to the statistical year, and the square term of the age (AGE²) was added to distinguish the non-linear relationship. The main variables and their calculation methods are summarized in Table 1.

Table 1. Definition and quantification of variables.

Types	Variable	Symbol	Variable Definition and Quantization
Dependent variable	R&D investment intensity of an enterprise	RDS	Percentage of a firm's R&D input in total assets
Moderator variables	Financial development	FD	Financial development index
	Government intervention	IndexG	Marketization index
	Entrepreneurs' risk-taking propensity	RTP	Proportion of total risk assets and total assets
Independent variable	Internal cash flow of an enterprise	CF	Ratio of net cash flow from operating activities to total assets of an enterprise
Control variables	Firm size	SIZE	Natural logarithm of total assets
	Age of an enterprise	AGE	Time span from the opening to the statistical year

4. Empirical Results

4.1. Descriptive Statistics

Table 2 reports the basic statistical characteristics of the above data. Subsequently, this study used the value of the alternative variables to illustrate the phenomena in China. Regarding the R&D investment intensity, we noted that the mean value of R&D investment intensity of China's listed companies on the GEM was 0.021, and the standard deviation was 0.029, indicating that there was a small difference in the level of R&D investment among China's listed companies on the GEM. That is, with the effect of competition, enterprises had a smoothing motivation for R&D investment. In terms of regional characteristics, there was a little difference in the level of financial development of each province, but there was a big difference between the maximum and minimum. There was a significant difference in the degree of government intervention, which showed that there were significant differences between regions. There were also some differences among entrepreneurs' risk-taking propensity, so different operating environments constantly affected the investment decision-making directions of enterprises.

Table 2. Descriptive statistics of main variables.

Symbol	RDS	FD	IndexG	RTP	CF	AGE	SIZE
Mean	0.0211	0.5358	8.8371	0.1963	0.0419	15.9137	21.2694
Standard deviation	0.0291	0.0983	1.4356	0.1018	0.0713	4.4172	0.8438
Minimum	0.00	0.30	2.95	0.01	-0.27	6.00	19.44
Maximum	0.16	0.73	9.91	0.58	0.49	39.50	24.45

4.2. Correlation Analysis

Table 3 lists the result of Pearson's correlation coefficient (PCC) test for alternative pairwise variables. This study illustrated the phenomena found in this table. Financial development, marketization index, and entrepreneurs' risk-taking propensity were positively correlated with firms' R&D investment intensity—government intervention was negatively correlated with firms' R&D investment intensity, and the research hypotheses were initially confirmed. The correlations between other variables were also very reasonable and intuitive. For example, internal cash flow was positively correlated with R&D investment intensity, firms' sizes were negatively correlated with R&D investment intensity, and correlation coefficients between the variables were relatively small, so the regression effectiveness of the models was not affected by multicollinearity.

Table 3. Pearson's correlation coefficient test for pairwise variables.

	RDS	FD	IndexG	CF	AGE	RTP	SIZE
RDS	1						
FD	0.157 **	1					
IndexG	0.121 **	0.841 **	1				
CF	0.167 **	−0.034	0.003	1			
AGE	−0.058	0.020	0.015	−0.033	1		
RTP	0.109 *	0.070	0.055	−0.253 **	−0.063	1	
SIZE	−0.263 **	0.060	0.054	−0.161 **	0.093 *	−0.082	1

Note: **, * indicate significance at the 1% and 5% levels (two-tailed), respectively.

4.3. Hierarchical Regression Analysis

Table 4 reports the fixed effect estimation results where the dependent variable was R&D investment intensity.

1. Model (1) was established regarding the control variables. Internal cash flow had a significant positive correlation with firms' R&D investment intensity, indicating that the growth of internal cash flow leads to the increase of R&D investment intensity, which to some extent also reflects that internal cash flow is the main financing channel for firms' innovation investment.
2. In Model (2), the level of regional financial development was also valid. The measurement coefficient showed an increasing trend. It can be seen from the statistical significance of the explanatory variables that the level of regional financial development was significantly and positively correlated with firms' R&D investment intensity. The interactions' coefficient of the cross-term of $FD \times CF$ was significantly positive, indicating that the level of regional financial development can strengthen the role of internal cash flow on firms' R&D investment intensity. Hypothesis 1 was verified. Regarding Model (3), about the degree of regional government intervention, data showed that the effect was not significant, and Hypothesis 2 was not verified.
3. Including entrepreneurs' risk-taking propensity as the moderator variable in Model (4), the different effects of financial development on R&D investment intensity in heterogeneous enterprises were also established. The measurement coefficient showed an increasing trend, increasing the explanatory power of 0.5% to the R&D investment intensity of enterprises. Financial development was significantly and positively correlated with firms' R&D investment intensity, and the interactions' coefficient of the cross-term of $FD \times RTP$ was significantly positive, indicating that entrepreneurs' risk-taking propensity strengthens the role of financial development on firms' R&D investment intensity. Hypothesis 3 was verified.
4. Considering the entrepreneurs' risk-taking propensity as a moderator variable, the different effects of government intervention on heterogeneous firms' R&D investment in Model (5) were also established. The measurement coefficient showed an increasing trend. IndexG was significantly and positively correlated with firms' R&D investment intensity, and the interactions' coefficient of the cross-term of $IndexG \times RTP$ was significantly positive, indicating that entrepreneurs' risk-taking propensity strengthens the effect of government intervention on firms' R&D investment intensity. Thus, the Hypothesis 4 was supported.
5. The study further introduced government intervention in Model (6) to examine its impact on financial development and enterprises themselves, which in turn affects the distorted resource allocation of different enterprises. The interactions' coefficient of the cross-term of $IndexG \times FD$ was significantly positive, and the interactions' coefficient of the cross-term of $IndexG \times RTP$ was significantly positive, indicating that financial development and entrepreneurs' risk-taking propensity strengthen the effect of government intervention on the R&D investment of enterprises.

Table 4. Hierarchical regression analysis.

Variables	Dependent Variable: RDS					
	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
FD		0.132 ***		0.129 ***		
FD × CF		0.481 **				
IndexG			0.092		0.089 **	−0.186
IndexG × CF			0.441			
FD × RTP				0.125 ***		
IndexG × RTP					0.129 ***	0.127 ***
IndexG × FD						0.294 **
CF	0.119 ***	−0.347	−0.315	0.159 ***	0.153 ***	0.161 ***
Firms	YES	YES	YES	YES	YES	YES
R ²	0.087	0.125	0.110	0.130	0.118	0.129
Ad.R ²	0.077	0.112	0.097	0.117	0.105	0.114
ΔR ²		0.038	0.013	0.005	0.008	0.011
F-statistic	9.063 ***	9.665 ***	8.353 ***	10.095 ***	9.055 ***	8.696 ***

Note: The superscripts ***, **, and * indicate that the coefficient is significant at 0.1%, 1%, and 5% levels, respectively.

4.4. Robustness Test

To test the robustness of the above conclusions, we performed the following sensitivity analysis. Considering the lag effect of the policy, the R&D investment intensity of the lag phase was selected to test the robustness of the regression results from the perspective of innovation sustainability in Table 5. The results of robustness test were basically consistent with the above conclusions.

Table 5. Hierarchical regression analysis.

Variables	Dependent Variable: RDS					
	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
FD		0.127 ***		0.136 *		
FD × CF		0.234				
IndexG			0.093 *		0.105 **	−0.095
IndexG × CF			0.259			
FD × RTP				0.035 ***		
IndexG × RTP					0.038	0.037 *
IndexG × FD						0.214 *
CF	0.113 ***	−0.112	−0.142	0.127 ***	0.122 ***	0.128 ***
Firms	YES	YES	YES	YES	YES	YES
R ²	0.060	0.083	0.075	0.082	0.075	0.080
Ad.R ²	0.050	0.070	0.061	0.069	0.061	0.064
ΔR ²		0.023	0.015	0.022	0.015	0.020
F-statistic	6.015 ***	6.133 ***	5.491 ***	6.070 ***	5.446 ***	5.132 ***

Note: The superscripts ***, **, and * indicate that the coefficient is significant at 0.1%, 1%, and 5% levels, respectively.

5. Conclusions and Discussions

5.1. Conclusions and Implications

This paper studies the impact of regional differences on the R&D investment of heterogeneous enterprises from a micro-perspective. Moreover, based on entrepreneurs' risk-taking propensity, it explains the regulatory role of entrepreneurs' risk-taking propensity on the relationship between regional differences and firms' R&D investment. The research conclusions are summarized as follows: (1) The growth of internal cash flow leads to the increase of firms' R&D investment intensity. (2) The level of regional financial development has a significantly positive correlation with the R&D investment intensity of enterprises. The level of regional financial development strengthens the

role of internal cash flow on the R&D investment intensity of enterprises. The level of government intervention has a negative correlation with the R&D investment intensity of enterprises, but the correlation is not significant. (3) Financial development is positively related to firms' R&D investment intensity. Entrepreneurs' risk-taking propensity strengthens the effect of financial development on firms' investment intensity. (4) There is a significant positive correlation between government intervention and R&D investment intensity. (5) Financial development and entrepreneurs' risk-taking propensity have strengthened the role of government intervention on firms' R&D investment intensity.

The policy implications of this study are as follows:

Firstly, the transformation and development of regional economy is the foundation, and the degree of government intervention and the level of financial development are the focus, of local government reform. To solve financing problems, the local government should actively develop small and medium-sized banks and other local financial institutions (e.g., rural banks and credit cooperatives), appropriately introduce social capital, and emphasize the coordinated development of direct financing and indirect financing. The government should take different measures for different enterprises, and especially provide multilevel and multichannel financing systems for small and medium-sized enterprises. The government should also establish effective regulatory mechanisms and financial supervision mechanisms for financial sectors, strictly controlling government intervention in financial resource allocation. However, market-oriented innovation choice does not need too much government intervention. In the meantime, the government should deepen the reform of the financial market, gradually establish a financial system with the capital market at the core, standardize the operation of the financial market, and respect firms' innovative financing decisions in the financial market [33].

Secondly, when selecting executives, entrepreneurs with different risk preferences should be selected according to their industry characteristics. In this study, entrepreneurs' risk-taking propensity is reflected by financial indicators of the enterprise, aiming to reflect the entrepreneurial risk-taking spirit in the enterprise as a whole. Therefore, in specific positions of enterprises, we use executives to replace entrepreneurs. Entrepreneurs' risk-taking propensity can strengthen the effect of regional characteristics on R&D investment intensity. In technology-intensive industries, where market changes are rapid and industry competition is fierce, entrepreneurs with risk preference should be chosen, which can help to improve the independent innovation ability of enterprises, form the core competence of enterprises, and promote the growth of firms' performance. In resource-intensive industries with few changes, risk-aversion managers should be chosen because they are more suitable.

Finally, entrepreneurial risk-taking spirit should be cultivated, and local governments should establish risk guarantee mechanisms. Finkelstein [34] believes that entrepreneurs with innovation and risk-taking spirit are more willing to understand and pay attention to contents of technology, more willing to do product and technology innovation, and tend to do R&D activities and innovation in human-resource arrangement and funding, hoping to provide sustainable competitive advantages for firms' development with technological advantages. Therefore, innovative enterprises should establish a set of effective educational mechanisms to cultivate entrepreneurs' innovation and risk-taking consciousness so that entrepreneurs can make rational decisions in the face of R&D investment projects with uncertain capital and earnings. At the same time, local governments also need to establish risk guarantee mechanisms to provide free risk assessment, risk control, and other guarantee services for R&D projects, so as to eliminate entrepreneurs' worries about the failure of R&D projects so that entrepreneurs with courage and vision can boldly carry out R&D activities.

5.2. Limitations and Future Research Directions

Although our study offers several new insights into regional differences and firms' innovation self-choice behavior in literature, it is not without limitations. We used financial indicators for our data to measure entrepreneurs' risk-taking propensity, which can lead to problems of subjectivity that bias the findings. Tang et al. [35] believed that the risk attitude of managers would be reflected through financial

decisions. However, in order to cover up the mistakes of recklessness and maintain their positions, risk-taking entrepreneurs often use their private information to whitewash financial statements to avoid personal loss of interest. Thus, there are some defects in the financial indicators for measuring entrepreneurs' risk-taking propensity. Nevertheless, future research could replicate and extend our findings by utilizing more objective measures, such as the establishment and implementation of business strategy. More objective information could also be collected through laboratory experiments [36], which have been found to largely align with field experiments [37].

In addition, this study only examined the effect of regional differences on firms' innovation self-choice behavior from the whole sample but did not compare financially developed areas to underdeveloped areas for the empirical test, which could have affected our findings. In order to address these shortcomings, future research designs could investigate this influential role. For instance, further study could explore the robustness and credibility of the empirical results by classifying samples and modifying the scope of samples.

Finally, our conclusions are limited to listed companies on the GEM. As such, we cannot readily extend our findings to different companies. For example, the companies mostly belonged to small and medium-sized enterprises, so the findings may only reflect the characteristics of small and medium-sized enterprises. On this basis, future research could investigate large enterprises from other market sectors to investigate if our findings can be generally applied to other enterprises. For example, future research could examine main board listed companies on the Shenzhen Stock Exchange and the Shanghai Stock Exchange as the sample to see if our findings can be equally applied to that group. All in all, future research lines are still plentiful.

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