

## Research on the Influencing Factors of R&D Investment in New Generation Information Technology Industry

Ma Xi<sup>a,\*</sup>

School of Economics and Management, Nanjing University of Science and Technology, Nanjing 210000, China

<sup>a</sup>782641825@qq.com

\*Corresponding author

**Keywords:** New Generation Information Technology Industry, R&D Investment, Government Subsidy

**Abstract:** Recently, a number of IT companies in China have been restricted technologically in developed countries like the United States. This paper selects a total of 290 new-generation information technology companies listed on the a-share market from 2009 to 2016 as research samples and constructs a fixed-effects panel model to analyze the government subsidy and the factor index data affecting the company's R&D investment ,it also studies the relevant factors for the enterprise. The results show that the government subsidies and corporate R&D investment are in a “U” relationship, and government subsidies need to be within a reasonable range.

### 1. Introduction

After the continuous promotion of several national five-year plans, the information technology industry developed rapidly nationwide, and local governments responded to the call and adopted different levels of policy support for regional enterprises. From dot to line, from line to plane, the Yangtze river delta, the pearl river delta, developed the Midwest has formed a distinctive industrial concentration area, the next generation communication network, Internet of things, triple play, new type of flat-panel display, high-performance integrated circuits and represented by the cloud of high-end software development of a new generation of high and new technology industries, such as content has made significant progress.

Research and development investment as a new generation of information technology industry to expand the competitiveness of the key factor is the source of enterprises to obtain competitive advantage and maintain sustainable development. Most of China's information technology enterprise will still be the main research and development spending remains in the production of products of technology improvement and product appearance on the convergence of the social people, consumers, can always see the existence of fake goods on the market, basic research, very few enterprises involved in innovative areas, the basic research class fee of 82.3 billion yuan, an increase of 15% over the previous year. We spent 161.1 billion yuan on applied research, up 6% year on year. Funding for pilot and development projects is 1324.3 billion yuan, up 12 percent. Among the above types, the proportion of experimental development funds is 84.5%, which also reflects that the experimental development funds are still the activities with the highest proportion of national R&D funds, and the basic research funds are less than 6%. The country still has a long way to go on the road of innovative research. The main reason is that the research and development cost is too high, and enterprises face a great risk of full input and no output. Therefore, although the research and development input increases, the research and development input intensity is low. Building an innovation-oriented country is an effective consensus reached in today's world. How to better encourage enterprises to invest in research and development needs to understand the factors affecting research and development investment, reduce unnecessary costs, enhance production and creativity, and make enterprises become the backbone of China's development of information technology.

Today, ZTE, Huawei, LeTV, and other information technology related enterprises in the master control core technology lack of means, increase the economic development of the enterprise value in the bottleneck, is faced with many related enterprises are not willing to put too much money into research and development, information technology updates faster, lack of talent and brain drain problem. The effective solution of the research and development investment will become the key to promote the new generation of information technology enterprises to achieve new breakthroughs. This paper hopes to analyze the impact on the research and development investment of the new generation of information technology industry from multiple influencing factors, and provide reasonable and effective Suggestions for the national strategic deployment of future information research.

## 2. Data acquisition and processing

In order to comprehensively and concretely study and analyze the distribution characteristics of R&D investment of the new generation of it industry, the data in this paper are all from Wind information financial terminal, and the financial data related to the new generation of it industry listed in a-shares for 8 consecutive years from 2009 to 2016 are selected as the initial samples, with specific reference to table 3.1. The screening methods of the initial samples are as follows: (1) Enterprises that lack the relevant research data of nearly eight years, including government subsidies, R&D investment, etc. (2) In the past 8 years, due to the abnormal operation status of the enterprise, it is in the state of ST or ST\* in A shares. (3) For enterprises under the age of one year, most of these enterprises have unsound financial data and unstable operation, which have an impact on the data research of this paper. (4) Main data indicators, such as: net profit / sales income greater than 1, or total liabilities / total assets is negative, are not consistent with the reality, indicating that there are problems in filling data, which do not meet the research requirements, and so on, shall be deleted. Through screening, data of 312 enterprises were eliminated, and 290 listed enterprises were selected as research objects. Conclusions of the remaining research samples were representative.

Table.1. Variable Definition

Variable type	Variable name	Variable symbol
Explained variable	R&d investment intensity (%)	Rd
Explanatory variables	Asset-liability ratio	St
	The enterprise scale	Size
	Enterprise profit margin	Pro
	Return on equity	Roe
	Enterprise age	Age
	Government subsidy rate (%)	Sub
	The square of the government subsidy rate	Sub <sup>2</sup>

In this paper, Guellec&Van's research and design method is adopted to introduce the square term of government subsidy rate, considering that the influence of government subsidy on enterprise R&D investment may be non-linear.

Set Rd for enterprise R&D intensity, represent different company, different years of enterprise R&D efforts, I said the company, in the Angle of standard under the t for years, beta 0 is constant, beta 1-7 for beta coefficient, Sub for government subsidy rate, Sub2 of government subsidy rate of square, St said the asset-liability ratio, the Size of enterprise scale, Pro said profit margins, Roe as the return on equity, Age is the Age of the said enterprise; Whether the coefficient is positive or negative and significant or not is related to the relationship between various explanatory variables and the R&D investment of the enterprise, and represents the random error term. EVIEWS is used to calculate all beta values and observe the correlation and significance of various factors on the impact of enterprise R&D investment. If the significance is strong, it proves that it has a significant impact on enterprise R&D investment.

Table.2. Empirical Test Result

Variable	(1)	(2)	(3)	(4)
Sub		41.3494*		50.6622*
		(22.3315)		(17.2517)
Sub2			-0.0829*	0.0598*
			(-11.7358)	(5.4098)
St	-0.0802*	-0.0458*	-0.0624*	-0.0539*
	(-19.0275)	(-11.5787)	(-14.4676)	(-13.2643)
Size	2.1038*	1.2614*	1.6809*	1.4703*
	(21.5296)	(13.2344)	(17.2868)	(14.6841)
Pro	-0.0643*	-0.0043	-0.0202*	-0.0262*
	(-9.1045)	(-0.6458)	(-2.6456)	(-3.4536)
Roe	0.0406*	-0.05258*	-0.0164*	-0.0169*
	(8.4739)	(-9.61085)	(-2.5119)	(-2.6199)
Age	0.1531*	0.115539*	0.1758*	0.1060*
	(6.6449)	(4.8990)	(8.0138)	(4.3242)
N	2320	2320	2320	2320
F	31.1941	36.8023	35.9022	34.9062
Adj.R <sup>2</sup>	0.7929	0.8200	0.8162	0.8123

First column of table 1 considering the variables except government subsidies to the influence of R&D input level, the enterprise profit margin (6.43%), enterprise asset ratio (8.02%) and the correlation coefficient between corporate R&D input is negative, the data shows that the enterprise's R&D spending as a cost, at the balance sheet and income statement of the enterprise reflected in reduced profits, enterprises to increase investment in research and development, is bound to increase the enterprise cost, lead to an increase in corporate profits and liabilities. The age of enterprises is positively correlated with the intensity of R&D input, indicating that the earlier enterprises are listed, the more powerful they are in terms of capital supply, and the more likely they are to transform enterprises from production-oriented to creative-oriented. Table 1, 2&3 columns, respectively, to join the government subsidy rate and the square of government subsidy rate calculation, government subsidies in the model not only examines the government subsidy rate to the linear relationship of corporate R&D input, also considering the government subsidies could reach a certain level will have a negative effect on R&D investment in the enterprise, therefore, added government subsidies of square, you can see from the data analysis, government subsidy rate squared with the enterprise research and development into a "U" relationship, and a significant relationship, and there exists a critical value for government subsidies, when did not reach the value, increase government subsidies, enterprises will increase spending on research and development. The increase of government subsidies will not encourage enterprises to increase research and development investment, but will reduce the amount of investment. In the last column of table 1 all relevant variables are accounted for uniformly, and R<sup>2</sup> obtained is 81.23%, indicating that the overall correlation obtained by studying all variables at the same time is the most significant, and the T value of each variable is significant at the 5% confidence level, and each research variable has a strong correlation with RD. Research data show that the government can subsidize enterprises' research and development through subsidies, but there is only a certain effective range after enterprises receive subsidies. Therefore, according to empirical analysis, there is a "u-shaped" relationship between government subsidies and enterprises' R&D investment, and there is a negative correlation between asset-liability ratio, enterprise net profit margin and return on equity and enterprise R&D investment, and enterprise size and age have a positive effect on R&D investment.

Table. 3. Empirical Test Result (2)

Variable	Central state-owned enterprise	The public enterprise	The private enterprise	Local state-owned enterprises	The foreign capital enterprise
Sub	68.4804*	93.1507*	109.1900*	5.3991	75.0940*
	(4.8640)	(4.8052)	(11.8356)	(0.2737)	(2.3052)
Sub2	-2.3556*	-0.8887*	-0.4209*	1.659074*	0.1310
	(-1.6741)	(-2.0238)	(-2.6378)	(2.6050)	(1.3263)
St	-0.0452*	-0.1317*	-0.0689*	-0.0719*	-0.0834*
	(-3.6955)	(-3.0532)	(-4.1977)	(-4.0289)	(-5.5979)
Size	0.8993*	2.1994*	2.2997*	0.2007	-0.9108*
	(3.2742)	(2.1113)	(5.6777)	(0.3950)	(-2.0737)
Pro	0.0548*	-0.1116*	-0.1210*	-0.0047	-0.0057
	(2.9856)	(-1.6581)	(-5.6892)	(-0.2796)	(-0.5555)
Roe	-0.0391*	0.0416	0.0658*	-0.0016	-0.0176
	(-3.1434)	(0.6153)	(3.0159)	(-0.1642)	(-1.2479)
Age	0.2054*	-0.2040	-1.5363*	0.5618*	0.6010*
	(4.7754)	(-0.7920)	(-3.4951)	(6.5601)	(3.7143)
N	312	176	1624	120	64
F	53.2501	19.8289	14.1777	20.0620	437.5299
Adj.R <sup>2</sup>	0.8832	0.7508	0.6370	0.7708	0.9898

According to the attributes of a-share listed companies, enterprises are divided into central state-owned enterprises, local state-owned enterprises, private enterprises, foreign-funded enterprises and public enterprises. Table 2 by distinguishing the ownership nature of enterprises, the differences in R&D input of different company attributes is studied. On the whole, companies have different attributes, and R&D investment reflects different levels of government subsidies. In different company attributes, the government subsidy rate coefficient presents different effects. The central state-owned enterprises, public enterprises and private enterprises data results show that the government subsidies and inverted "U" relationship between R&D, shows three different types of enterprise R&D intensity is effective for government subsidy has certain interval, R&D after entering a certain interval, government subsidies, and more also won't increase R&D investment, it will lead to negative effect of subsidies. And local state-owned enterprises 15 sample study conclusion shows that the enterprise R&D investment and government subsidies, there is a "U" shaped relationship relative central without more money, local governments in previous although will invest to encourage local enterprises to carry out research and development, but with the enterprise research and development requirements, local governments can't timely supply, lead to enterprise's R&D spending levels. Foreign capital enterprise R&D investment and government subsidies has a positive correlation relationship between linear relationship, has no significant correlation Sub2, because in the foreign capital enterprises in technological innovation by foreign investors, foreign operators and managers and other innovative ideas, pay more attention to innovation research, so the government subsidies have the effect of further advance, support enterprises to carry out innovative research on R&D.

### 3. Conclusion

This paper USES A total of 290 new-generation information technology enterprises listed in a-share market from 2009 to 2016 as research samples, and USES the fixed effect model to empirically test the influence degree of related factors of enterprise R&D investment. The research results show that: (1) the whole new generation of information technology industry will further invest in research and development in the future. The eastern region is in the leading position in both the

amount of research and development input and the intensity of research and development input. Due to its strong economic foundation, it will attract more enterprises to invest here and get more funds to invest in research and development. (2) the continuous expansion of enterprise scale has a significant positive effect on R&D investment. With the continuous growth of enterprise age, the capital strength is enough to support enterprises to increase R&D investment. The new generation of information technology enterprises is still in the initial stage of development. The government subsidies can improve the enthusiasm of enterprises to carry out research and development activities, thus promoting enterprises to increase the intensity of research and development investment. (3) the industry as a whole analysis of government subsidy and a "U" shaped relationship between corporate R&D input, through the analysis of enterprise property further divided into local state-owned enterprises, foreign enterprises of government subsidies to the same as the whole the influence of R&D input, and the central state-owned enterprises, public enterprises and private enterprises of government subsidies and R&D is inverted "U" type, and the overall conclusion on the contrary, that the enterprise type, government subsidies for investment, enterprise R&D input level is different.

The new-generation information technology industry is the primary development object of national innovation driving force. Based on the research and analysis of the influencing factors of R&D investment in the new generation of information technology industry, the following countermeasures and Suggestions are proposed: First of all, for the sake of the future is no longer as the core technology problems restricted by developed countries, the enterprise in R&D spending on aligning with the developed countries, from the simple application of basic research, experimental development to study, from the enterprise total assets, asset-liability ratio and other financial indicators, change the internal operation management, expand the scale of enterprises, make full use of external geographical and political factors, promote enterprises to accelerate innovation, to improve their technology innovation ability, the enhancement enterprise competitiveness and influence. Second, the government in formulating relevant subsidy policy to the need to control for each new generation of information technology enterprise scope of subsidies, subsidies, subsidies should be targeted, by studying the enterprise annual R&D level reasonable transfer subsidy payments, make sure every related businesses in the R&D subsidies will maximize use efficiency. In addition, after receiving government subsidies, enterprises should reasonably invest in research and development according to their own development situation to maximize the promotion effect of subsidies on research and development input. Finally, the national government to promote a new generation of the innovation of information technology industry, research and development of the enterprise subsidies is only one aspect, promote the industry development, countries must constantly strengthen the economic strength, to further improve the protection of intellectual property rights and the interpretation of the relevant law details file, create a cohesive, innovation of innovative entrepreneurial environment to attract more innovative talents, organize the cultivation of innovative talent team and construction, and create a good environment for innovation entrepreneurship, do overall consideration, and balanced development.

## References

- [1] Wakelin K. Productivity growth and R&D expenditure in UK manufacturing firms [J]. *Research Policy*, 2001.30(7):1079-1090.
- [2] Bong H. Han, David Manry. The value-relevance of R&D and advertising expenditures: Evidence from Korea [J]. *International Journal of Accounting*, 2004.39(2):155-173.
- [3] Cotti C, Skidmore M. The impact of state government subsidies and tax credits in an emerging industry: Ethanol production 1980-2007 [J]. *Southern Economic Journal*, 2010.76(4):1076-1093.
- [4] Hitaj C. Wind power development in the United States [J]. *Journal of Environment Economics and Management*, 2013.65(3):394-410.