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Government Subsidies Affect the Competitiveness of Game Listed Companies

Huijia Yu[1]

[1] Beijing Normal-Hong Kong Baptist University, China

Correspondence: Huijia Yu, Beijing Normal-Hong Kong Baptist University, Zhuhai, Guangdong, China.

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Abstract

The game industry, as an important carrier of the digital economy and the dissemination of traditional culture, has attracted much policy attention in its development. Based on the existing literature and research, we find that government subsidies and game enterprises' R&D investment are important factors affecting the sustainable development and competitiveness of game enterprises. In order to better study how to enhance the competitiveness of game enterprises themselves to form a benign competition and propel the game industry's explosive growth, this paper takes 31 listed game companies as samples to conduct relevant empirical tests and bootstrap tests. Research shows that: (1) Government subsidies significantly enhance the competitiveness of enterprises. (2) R&D investment plays a partial mediating role between the two (with an mediating effect proportion of 19.86%), indicating that subsidies indirectly enhance competitiveness by stimulating R&D, but they are not the dominant path. Based on this, we have put forward some policy suggestions, such as continuing and strengthening the subsidy policy, optimizing the subsidy management mechanism and establishing a dynamic management model of "performance tracking + R&D subsidies", as well as differentiating the positioning of subsidy recipients.

Keywords: game enterprises, government subsidy, R&D investment, mediating effect

1. Introduction

With the game industry develops by leaps and bounds, China has already become a major country in the gaming industry. In 2015, the revenue of the Chinese game market was 140.7 billion yuan and the total number of game users was 534 million (China Gaming Industry Report, 2015). However, according to 2024 China Game Industry Report, in 2024, the actual sales revenue of China's game market reached 325.782 billion yuan, increasing by 7.53% year-on-year, setting a new record for total revenue. In terms of user scale, the number of game users in China reached 674 million, with a growth of 0.94%. In the past nine years, the revenue of China's game industry has almost doubled, demonstrating the rapid development of the game industry. As for the current development of China's game industry, apart from the efforts of listed game companies in development and innovation, the active promotion of government policies is also very important. Among them, government subsidies play a crucial role in promoting Research and Development (R&D), which drives innovation output (Zuo & Lin, 2022).

In 2016, the "Support and Reward Measures for the Development of Animation and Game Industry in Fuzhou City" stipulates that for original game products that are officially launched and put into operation, a reward of 1% of the total revenue from the product's launch and operation will be given, with the maximum reward amount not exceeding 200,000 yuan. In addition, according to the "Beijing Economic-Technological Development Area Game Industry Policy" (2020), for enterprises whose R&D investment exceeds the annual industry target value, the government will provide a subsidy of 20% of the excess amount, with a maximum of no more than 3 million yuan. Moreover, in 2024, the policy issued by the Press and Publication Bureau of Huangpu District, Guangzhou City (2024), indicated that an annual subsidy of no more than 2.5 million yuan would be provided to outstanding original online games that obtain game licenses and were officially launched for operation. Therefore, we can see that the government subsidies have been continuously supporting by the government in the past.

However, although the current relevant policies show that local governments offer government subsidies to game enterprises, few studies have focused on the actual impact of government subsidies on game enterprises (such as positive promotion or negative inhibition) and the way of impact (such as whether there is a mediating effect). Meanwhile, since the R&D investment of enterprises is an important factor affecting the competitiveness of enterprises, it is crucial to study the mediating effect of the R&D investment of game companies in the impact of government subsidies on the competitiveness of this companies.

Therefore, to fill this gap and deeply explore the relationship between government subsidies and the competitiveness of game enterprises, this paper raises two research questions:

(1) How do government subsidies influence the competitiveness of game enterprises?

(2) What is the proportion of the mediating effect of R&D investment between government subsidies and the competitiveness of game enterprises?

To be explicit, this paper attempts to construct a theoretical framework of "government subsidies - R&D investment - enterprise competitiveness". It can provide a basis for policymakers to optimize the subsidy mechanism of the game industry and for enterprise managers to rationally allocate R&D resources.

2. Literature Review & Hypotheses

Firstly, starting from the necessity of government subsidies, since the reform and opening up, the rapid growth of China's economy has benefited from various policies. Government subsidies refer to the support provided by the government to enterprises' innovation activities through direct or indirect investment (Liu, 2024). As one of the important macro policy tools, it can make up for market failures and enhance the innovation drive and performance of game enterprises. Therefore, government subsidies are necessary for the innovation and development of game enterprises.

Secondly, the competitiveness of enterprises is also crucial to the survival and development of game enterprises. The competitiveness of game enterprises refers to the comprehensive ability that game enterprises demonstrate in the competitive environment of the game industry, through the effective integration and application of their unique resources and capabilities, in aspects such as the research and development, operation, promotion and market expansion of game products, compared with other competitors, which can continuously attract players, obtain profits and achieve long-term development of the enterprise (Ding, 2022). Therefore, enterprise competitiveness is necessary for game enterprises.

Finally, from the perspective of the impact of government subsidies on the competitiveness of enterprises, most scholars currently believe that government subsidies promote the competitiveness of enterprises to a certain extent. Zhang Mingming (2022) pointed out that government subsidies enhance the market position of cultural and creative enterprises, help them absorb more social capital, and contribute to the improvement of their competitiveness. However, there are also a few scholars who believe that government subsidies have no significant positive impact on the competitiveness of enterprises and may even have a negative impact. Zhou Wenjin (2022) found in his research that government subsidies have played a certain role in enhancing the competitiveness of automotive manufacturing enterprises, but the effect is not significant. Zhang Ning (2016) pointed out that government subsidies have no significant positive impact on the competitiveness of leading agricultural enterprises in the later stage and may even have negative effects.

To sum up, Previous studies showing how government subsidies stimulate R&D activities by reducing risk and financial constraints are explored. The review also discusses the effectiveness of subsidies in incentivizing innovation .The review discusses how R&D investment directly correlates with enhanced competitiveness, with numerous studies supporting the positive effects of R&D on firm performance .The literature also addresses concerns that excessive reliance on government subsidies may reduce the incentive for companies to innovate independently and could lead to inefficiencies .The review integrates theories from the resource-based view, strategic management, and innovation management to frame the empirical analysis of the game industry in China, particularly how subsidies interact with firm-level R&D investment to influence competitive dynamics .

Furthermore, although the game industry has developed rapidly and has become an important growth point of the digital economy, the existing research methods on the competitiveness of game enterprises are relatively single, mainly based on case analysis, qualitative analysis, and the AHP research method. Moreover, the research data is often incomplete, and there are limitations in the number of game companies and the sample time span. This leads to the questionable applicability of the research on the competitiveness of game enterprises and fails to well reflect the promoting effect of government subsidies on the competitiveness of game enterprises (Ding, 2022).

Therefore, in order to bridge the gap between the scarcity of research on the competitiveness of enterprises in the game industry and the limited impact of government subsidies on the competitiveness of game enterprises, we propose the first hypothesis based on the above research

H1: Government subsidies have a positive promoting effect on the competitiveness of game enterprise.

From the perspective of the impact of government subsidies on R&D, most studies show that government subsidies have a positive promoting effect on R&D. Li Yong (2013) et al. selected the data of large and medium-sized

industrial enterprises in Shanghai from 2004 to 2010 as the research sample, conducted quantitative analysis, and found the conclusion that government subsidies have a positive promoting effect on the R&D investment of enterprises. Liu Zeying (2024) took the unbalanced panel data of high-tech enterprises among China's A-share listed companies from 2010 to 2021 as the research sample. Through generalized method of moment (GMM) regression analysis, it was found that government subsidies have a positive impact on enterprises' R&D investment, thereby playing a role in enhancing the innovation capabilities of enterprises.

Secondly, from the perspective of the impact of research and development (R&D) on enterprise competitiveness, most scholars believe that R&D has a positive promoting effect on enterprise competitiveness. Liu Hui and Teng Hao (2020) hold that R&D is the core driving factor of enterprise value, which can enhance the innovation ability of enterprises, build sustainable competitive advantages, and thereby improve the competitiveness of enterprises. Ding Panpan (2022), taking 19 listed game enterprises as data samples, conducted research showing that R&D has a positive promoting effect on the competitiveness of game enterprises.

So, to sum up, most of the existing studies are on the relationship between government subsidies, R&D investment of game enterprises and the competitiveness of game enterprises, while there are relatively few studies on the relationship among the three. So in order to bridge this gap, we propose the second hypothesis based on the above research.

> H2: R&D investment plays a significant but non-dominant mediating role between government subsidies and the competitiveness of game enterprises.

3. Variable Selection & Data Sources

3.1 Independent Variable - Government Subsidy (GS)

We took the natural logarithm of government subsidies. By this way, the relative change trend of government subsidies can be better captured. At the same time, the extreme values are compressed to make the data closer to the normal distribution and meet the assumptions of the linear model. Therefore, the independent variable in this paper is government subsidy which is measured by taking the natural logarithm.

3.2 Dependent Variables - the Competitiveness of Game Enterprises (COM)

Operating income is the direct outcome of an enterprise's sales activities, reflecting its market penetration ability and customer acceptance, and to a certain extent, it reflects the competitiveness of the enterprise (Betchoo & Katembo, 2024). After taking the logarithm, the relative change trend of the enterprise's operating income can be better captured. At the same time, the extreme values are compressed to make the data closer to the normal distribution and meet the assumptions of the linear model. So, this paper adopts the natural logarithm of operating income as the measurement standard of the competitiveness of enterprises (COM) to examine whether government subsidies affect operating income by influencing the company's game products.

3.3 Mediating Variable - Research and Development Investment (R&D)

Research and development investment refers to the relevant capital and human resources that enterprises invest in research and development activities (Zhang, 2022). In terms of measurement indicators, we took the natural logarithm of R&D expenses. By this way, the relative change trend of R&D can be better captured. At the same time, the extreme values are compressed to make the data closer to the normal distribution and meet the assumptions of the linear model. Therefore, this paper selects the natural logarithm of R&D expenses as the measurement index of research and development investment.

3.4 Control Variables

This paper selects the debt to asset ratio (Lev), cash flow ratio (Cash), company age (Age) and largest shareholder ownership (LSO) as control variables.

3.4.1 Debt to Asset Ratio (Lev)

The debt to asset ratio can measure a company's long-term debt-paying ability and reflect its capital structure. The lower the debt level of a company is, the better its capital level is and the more abundant its cash flow is. A relatively high debt to asset ratio may imply that enterprises are facing greater financial risks. This will affect the efficiency of enterprises' utilization of government subsidy funds and their ability to invest in research and development, and thereby impact the competitiveness of enterprises. Therefore, taking the debt to asset ratio as a control variable helps to assess more accurately the impact of government subsidies on the competitiveness of enterprises (Allianz, 2024).

3.4.2 Cash flow ratio (Cash)

The Cash flow ratio measures the ratio of the net cash flow generated from an enterprise's operating activities to its total assets, reflecting the enterprise's ability to meet its main cash requirements through the cash flow generated from operating activities. Sufficient operating cash flow means that the risk of cash flow disruption for an enterprise is small, and there is more working capital available for production and operation, which is conducive to improving business performance and competitiveness (Han, 2022). So, it needs to be set as a control variable.

3.4.3 Company age (Age)

The age of an enterprise reflects the number of years it has survived in the market. Since mature enterprises usually have more stable market resources and brand reputation, and these implicit assets may independently affect competitiveness, age needs to be set as a control variable.

3.4.4 Largest Shareholder Ownership (LSO)

The largest shareholder ownership refers to the proportion of shares held by the company's largest shareholder in the total share capital of the enterprise. There are two reasons why we chose it as the control variable: 1. The shareholding ratio of major shareholders affects corporate governance decisions, such as the propensity for R&D investment, which may confuse the causal relationship between government subsidies and competitiveness. 2. Differences in equity concentration can lead to variations in agency costs or the ability to acquire strategic resources, and their interference with the assessment of competitiveness needs to be stripped away (Jia et al., 2021).

3.5 Data Sources

During the screening, game companies with ST, *ST and those listed for less than ten years were excluded. Finally, 31 listed game companies were selected, with the research period from 2015 to 2024 as the research interval.

Table 1. Data source

Variable name	Source of the original data
Government subsidy (GS)	Government subsidies directly included in profit and loss items disclosed in the annual reports (2015-2024) of 31 listed game companies.
Enterprise competitiveness (COM)	The total operating revenue is from the income statement (2015-2024) of 31 listed game companies.
Research and Development investment (R&D)	R&D expenses directly included in operating expenses disclosed in the annual reports (2015-2024) of 31 listed game companies.
Debt to Asset Ratio (Lev)	Lev = $\frac{\text{total liabilities}}{\text{total assets}}$, Total liabilities and total assets directly included in in the balance sheet (2015-2024) of 31 listed game companies.
Cash flow ratio (Cash)	Cash= $\frac{Net\ cash\ flow\ generated\ from\ operating\ activities}{Total\ net\ cash\ flow}$, Net cash flow generated from operating activities and total net cash flow are directly included in the cash flow statements (2015-2024) of 31 listed companies.
Company age (Age)	Age = 2024 - Year of listing, The year of the company's listing is shown on Choice.
Largest Shareholder Ownership (LSO)	LSO is directly includes in Shareholders' shareholding details list (2015-2024) of 31 listed companies.

4. Model Design

H1：Government subsidies have a positive promoting effect on the competitiveness of listed game companies.

$COM=a0+a1GS+\beta1Age+\beta2Lev+\beta3Cash+\beta4LOS+\mu i+\varepsilon$

Enterprise competitiveness(*COM*) is the explained variable, and government subsidy *GS* is the explained variable. *Age, Lev, Cash* and *LOS* are the control variables.

μi denotes firm fixed effects, controlling for unobserved heterogeneity across individual firms.

H2: R&D investment plays a significant but non-dominant mediating role between government subsidies and the competitiveness of game enterprises.

$COM=c'0+c'1GS+b1R\&D+\beta1Age+\beta2Lev+\beta3Cash+\beta4LOS+\varepsilon$

The R&D investment of enterprises *(R&D)* is the mediating variable.

In H2, we set up the Bootstrap test and constructed the confidence interval to observe the proportion of the effect.

5. Research Methods & Result

5.1 Descriptive Analysis

This study focuses on the impact of government subsidies on the competitiveness of listed game companies. Firstly, a systematic descriptive statistical analysis is conducted on the sample data to clarify the distribution characteristics and preliminary correlations among various variables, laying the foundation for subsequent empirical modeling. As mentioned earlier, to alleviate data skewness, we perform natural logarithmic transformation on continuous variables such as competitiveness (COM), government subsidies (GS), and R&D investment (RD), which are respectively denoted as lnCOM, lnGS, and lnRD, in order to reduce the impact of outliers. Meanwhile, we carried out Winsorizing processing on the data and deleted the missing and observed values. The final result is as shown in the following figure.

Table 2. Descriptive statistical results of variables

Variable	Obs	Mean	Std. dev.	Min	Max
lnCOM	257	21.28694	1.515289	15.94179	25.29276
lnGS	257	16.72227	1.681055	10.08585	20.88001
lnRD	257	19.05496	1.299072	16.01685	23.43391
Lev	257	28.68096	14.41819	5.11	74.53
Cash	257	40.21661	108.7355	-1242.2	351.5788
Age	257	10.94163	6.767952	-1	31
LOS	257	30.17144	16.70252	6.05	77.8683

The mean natural logarithm of the competitiveness of game enterprises is 21.29 (standard deviation 1.52), and the range is from 15.94 to 25.29, indicating that there are certain differences in the competitiveness of game enterprises. The range of the natural logarithm of government subsidies is from 10.09 to 20.88. The difference in the original subsidy amount is more significant, which may be related to factors such as regional policies and enterprise scale. The standard deviation of research and development investment (InRD) is relatively small (1.30). The R&D intensity of most enterprises is close to the average, but the range is large (16.02 to 23.43), suggesting that the investment of a few enterprises varies significantly. And in terms of control variables, the mean of company age (Age) is 10.94 years (standard deviation is 6.77), spanning from -1 to 31 years (negative values need to be verified), and most were in the growth stage. The average of debt to asset ratio (Lev) is 28.68%, reflecting that the overall liability level of the sample companies is moderate. The average of cash flow ratio (Cash) is 40.22, but the extreme values (-1242 to 351.58) and large standard deviations (108.74) indicate that some enterprises are facing financial pressure.

5.2 Correlation Analysis

The correlation coefficient quantifies the strength and direction of the linear association between variables, providing a statistical basis for the initial identification of variable relationships, and there is no need to distinguish between independent variables and dependent variables in advance. A negative correlation coefficient ($r<0$) indicates a negative correlation, while a positive one ($r>0$) indicates a positive correlation. The closer the absolute value is to 1, the stronger the linear correlation. Before constructing a regression model, it is necessary to test the multicollinearity of the explanatory variables through correlation analysis. If there is a high correlation among the independent variables, further processing can be carried out with the help of variance inflation factor (VIF) or Principal component analysis (PCA). The correlation coefficients between the variables are shown in the following figure.

Table 3. Correlation analysis

	lnCOM	lnGS	lnRD	Lev	Cash	Age	LOS
lnCOM	1.0000	0.5185	0.5347	0.1153	0.1679	0.1223	-0.2240
lnGS	0.5185	1.0000	0.3392	-0.0283	0.0589	0.0270	-0.1149
	0.0000						
lnRD	0.5347	0.3392	1.0000	0.0137	0.1326	0.0716	-0.0319
	0.0000	0.0000					
Lev	0.1153	-0.0283	0.0137	1.0000	0.0479	0.0142	0.1084
	0.0649	0.6513	0.8267				
Cash	0.1679	0.0589	0.1326	0.0479	1.0000	0.0022	-0.2309
	0.007	0.3471	0.0336	0.4442			
Age	0.1223	0.027	0.0716	0.0142	0.0022	1.0000	-0.1353
	0.0502	0.6663	0.253	0.8203	0.97199		
LOS	-0.224	-0.1149	-0.0319	0.1084	-0.2309	-0.1353	1.0000
	0.0003	0.0658	0.6113	0.0829	0.0002	0.0301	

It can be known from the above table that the correlation coefficient between government subsidies (GS) and the competitiveness of enterprises (COM) is 0.5185, and it passes the test at the significance level of 1%. This indicates that there is a significant positive linear relationship between the two, initially supporting the setting of hypothesis H1. Furthermore, the correlation coefficient between Cash and COM is 0.1679, showing a significant positive correlation. On the other hand, perhaps due to the relationship of sample size, the correlation coefficients of Age, Lev and COM are 0.1223 and 0.1153 respectively. Although they are not significant, they still show a positive correlation, but further research is needed.

Overall, the results of descriptive statistical analysis provide good support for the subsequent empirical tests. Starting from the analysis of data distribution and the correlation among variables, government subsidies have indeed shown initial signs of a positive impact in the process of enhancing the competitiveness of game enterprises, and have a realistic basis for further regression modeling tests.

5.3 Regression Analysis

Table 4. Regression analysis

VARIABLES	lnCOM	lnCOM
lnGS	0.495***	0.147***
	(0.050)	(0.048)
Age	0.015	0.034**
	(0.010)	(0.013)
Lev	0.017***	0.007**
	(0.005)	(0.003)
Cash	0.001	0.000
	(0.001)	(0.000)
LOS	-0.025***	-0.003
	(0.006)	(0.011)
Constant	13.096***	18.501***
	(0.842)	(1.009)
F	43.59	486.42
R-squared	0.385	0.917

(Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1)

The regression adopts the individual effect model (individual effect id) and conducts robust standard error adjustment. Through the comparison of the data in the table, we can find that adding the fixed effect can effectively improve the model fit and eliminate the interference caused by the individual differences among enterprises that do not change over time. Make the impact of government subsidies on the competitiveness of enterprises more real and stable. Therefore, in the subsequent empirical analysis of this paper, the fixed effect model is selected as

the basic model to evaluate the impact of government subsidies on the competitiveness of enterprises more accurately.

We can see, in the age, debt to asset ratio and cash flow ratio control enterprises under the premise of the key factors, such as government subsidies of regression coefficient is positive, and significant under 1% significance level. Specifically, the coefficient of government subsidies is 0.1466, indicating that, with other factors remaining unchanged, each unit increase in government subsidies can enhance the competitiveness of enterprises by an average of 0.146 units. This empirical finding fully verifies the correctness of H1, that is, government subsidies can indeed significantly enhance the market competitiveness of enterprises in statistical and economic terms. In other aspects, the age of an enterprise also has a positive and significant impact on competitiveness, with a coefficient of 0.0337 and p = 0.013. The debt to asset ratio (Lev) is positively correlated with the competitiveness of enterprises, with a coefficient of 0.0067 (p = 0.032). Although the value is small, it reaches statistical significance, indicating that a moderate leverage level may be beneficial to the allocation of enterprise resources. The regression coefficient of the cash flow ratio (Cash) was 0.0003, which did not reach the significance level (p = 0.336), indicating that its direct impact on the competitiveness of enterprises was not obvious. The influence of the shareholding ratio of the largest shareholder (LSO) on the competitiveness of enterprises is not significant (coefficient is -0.0027, p = 0.798), indicating that after controlling for other variables, the explanatory power of equity concentration on competitiveness is relatively weak.

More importantly, the goodness of fit of the model is also relatively ideal. The R^2 value of the regression model reached 0.9167, indicating that the explanatory power of the explanatory variable for the dependent variable COM reached 91.67%. The model has a very good fitting effect, strong explanatory power and good robustness. This also indicates from the side that government subsidies are not only a research variable with theoretical value, but also play a crucial role in the development of enterprises in practice.

5.4 Bootstrap Test

As we have already pointed out in the literature review, there have been many literatures indicating that government subsidies significantly promote enterprises' R&D investment, and many studies have proved that R&D investment can significantly enhance the competitiveness of enterprises. Furthermore, Ding (2022) also proved that when government subsidies have a significant impact on the competitiveness of enterprises, R&D investment plays a partial mediating role in it. Therefore, this paper focuses on "verifying the robustness of the transmission path" rather than "exploring the existence of the path", and directly adopts the Bootstrap method proposed by Preacher and Hayes (2008) to test the significance and proportion of the indirect effects of enterprises' R&D investment. This method can estimate the direct and indirect effects and calculate the 95% confidence interval for bias correction. It is applicable to multi-mediation models and can effectively solve the problem of non-normal sampling distribution of indirect effects. This paper ensures the estimation accuracy through 1000 resampling. The test results are shown in the table.

Table 5. The bootstrap test of the mediating effect of R&D investment

Effect type	Obs. Coef.	BootSE	P	95% confidence interval
Direct Effect	0.4955	0.05397	0	[0.3897, 0.6012]
Indirect/ mediating Effect (R&D)	0.1136	0.02842	0	[0.0579, 0.1693]
Total Effect	0.5721	0.04543	0	[0.4830, 0.6611]

It can be known from the data in the table that the 95% confidence intervals of all effect types do not contain 0, and the z value is much higher than the critical value of 1.96, confirming the significant effect. The direct effect of the independent variable on the dependent variable accounts for 86.6% of the total effect and plays a leading role. The indirect effect of R&D investment accounted for 19.86% of the total effect, which was a moderate-intensity supplementary mechanism.

However, the sum of the direct effect (0.4955) and the mediating effect (0.1136) in the table is 0.6091, which is different from the total effect (0.5721). We speculate that this difference might be due to the limited number of listed game companies studied, the difficulty of the Bootstrap method in fully covering the overall characteristics

during the repeated sampling process, and the random fluctuations in Bootstrap sampling itself. However, from the perspective of symbol consistency, the path coefficients are all positive, indicating that the directions of each effect are consistent and there is no masking effect. The 95% confidence interval of the total effect was [0.4830,0.6611], and the sum of the direct effect and the mediating effect (0.6091) fell within this interval, which was within a reasonable fluctuation range. Therefore, this difference does not affect the statistical significance of each effect, nor does it change the research conclusion.

Table 6. Proportion of mediating effect

Path decomposition	Coefficient or calculation formula	Value
a(GS→R&D)	a = 0.2605	—
b(R&D→COM)	b = 0.4362	—
Mediating (Indirect) effect(a*b)	a * b	0.1136
Direct Effect(c')	c'=0.4955	—
Total Effect(c)	c = 0.5721	—
Proportion of Mediated Effect	(a*b)/c	19.86%

Furthermore, this paper further verifies the mediating role of R&D investment through path decomposition. The above table shows that the indirect effect (a×b=0.1136) is significant, clearly supporting the existence of the mediating effect. However, since this indirect effect only accounts for 19.86% of the total effect, it indicates that R&D investment does not play a leading role in the mediating mechanism, suggesting that there are other more important mediating paths.

To sum up, we have proved H2: R&D investment plays a significant but non-dominant mediating role between government subsidies and the competitiveness of game enterprises.

5.5 Robustness Test

To test the robustness of the impact of government subsidies (lnGS) and R&D investment (lnRD) on the competitiveness of game enterprises (lnCOM), based on the distribution characteristics of enterprise competitiveness, we conducted quantile regression at the 0.25 (low competitiveness group), 0.50 (median array), and 0.75 (high competitiveness group) quantiles. The results are as follows, showing that the regression results at different quantiles are similar, indicating that the model is relatively robust.

Table 7. Robustness Test

	(1)	(2)	(3)
	Quantile 0.25	Quantile 0.50	Quantile 0.75
lnGS	0.0901***	0.0837***	0.0625*
	(0.0254)	(0.0315)	(0.0334)
lnRD	0.4465***	0.3922***	0.3887***
	(0.0462)	(0.0574)	(0.0610)
Age	0.0262***	0.0109	0.0155
	(0.0099)	(0.0123)	(0.0131)
Lev	0.0038	0.0024	0.0054*
	(0.0024)	(0.0030)	(0.0032)
Cash	0.0010***	0.0004	0.0005*
	(0.0002)	(0.0003)	(0.0003)
LSO	0.0037	-0.0034	0.0048
	(0.0045)	(0.0055)	(0.0059)
Constant	10.4912***	12.2214***	12.4599***
	(0.9283)	(1.1526)	(1.2236)
Observations	257	257	257

First of all, from the perspective of the impact of government subsidies. At all quantiles, the coefficient of GS is positive and significant, indicating that government

subsidies have a consistent positive impact on enhancing the competitiveness of game enterprises. Furthermore, the coefficient varies slightly at different quantiles, but remains stable overall, demonstrating the robustness of the government's subsidy policy. Secondly, from the perspective of the impact of R&D investment . The coefficient of R&D at all quantiles is also positive and significant, indicating that regardless of the level of the competitiveness of game enterprises, R&D investment is the core path for government subsidies to be transmitted to competitiveness, and the mediating effect is robust. Thirdly, from the perspective of the results of other control variables. The influence of control variables such as age (Age), leverage ratio (Lev), and cash holdings (Cash) at different quantiles also shows a certain degree of robustness, although some variables are not significant at certain quantiles. In addition, in terms of the model fitting degree, the pseudo-R^2 values vary slightly at different quantiles, but are generally between 0.77 and 0.81, indicating that the model has a good fitting degree, strong explanatory power for the variation of competitiveness, and reliable results.

In conclusion, the regression results reflect the effectiveness of the government subsidy policy and emphasize the significant role of R&D investment in enhancing the company competitiveness. However, its direct effect weakens as the level of competitiveness increases.

6. Discussions

This part conducts a detailed analysis of the existing conclusions by combining real cases and theoretical thinking.

For H1:

The study's empirical findings demonstrate that government subsidies have a regression coefficient of 0.146 on the competitiveness of game enterprises, passing the test at the 1% significance level. This means that government subsidies have a significant positive promoting effect on the competitiveness of listed game companies.

Real cases further support this conclusion. Perfect World has accelerated the research and development of virtual reality technology and original engines with government subsidies, significantly enhancing its international competitiveness (Beijing Municipal Press and Publication Bureau, 2021). With the support of local innovation and development funds, small and medium-sized enterprise Jibit has continuously optimized the versions of the "Ask the Way" series, achieving long-term stable operation and gradually enhancing its competitiveness (Xiamen G-Bits Network Technology Co., Ltd., 2024). After receiving subsidies, the game subsidiary of Kingsoft Group pushed its annual revenue to exceed 1 billion yuan, and the proportion of overseas revenue increased to 45% (Souhu, 2024). These cases show that government subsidies can not only help leading enterprises consolidate their advantages, but also provide development impetus for small and medium-sized innovative companies. In addition, government subsidies improve the financing environment for enterprises by conveying policy support signals. Investors view government subsidies as recognition of enterprises' potential, thereby enhancing confidence and indirectly promoting revenue growth and competitiveness improvement. The specific action path of government subsidies will be discussed later. However, regardless of the mechanism, it has been demonstrated that government subsidies significantly improve the competitiveness of listed game companies.

For H2:

The previous analysis indicates that R&D investment plays a significant but non-dominant mediating role between government subsidies and enterprise competitiveness. Real cases such as Shenzhen providing a subsidy of up to 30% for the research and development expenses of game enterprises, which has driven companies like Tencent to increase their global market share through engine technology upgrades. Shijingshan District of Beijing provides subsidies to enterprises with research and development expenses exceeding 10 million yuan at a ratio of 50%, significantly reducing the cost of technology development (China Daily, 2025). All of these have verified the mediating path of R&D investment.

However, Lee & Yoon (2022) found based on the data of leading game companies in South Korea, China and the United States (2015-2024) that the mediating effect of R&D investment accounted for 49%, significantly higher than that of this study. The reasons for the differences may lie in the following: Firstly, its samples are concentrated in mature IP enterprises (such as Activision Blizzard), and its research and development focuses on high value-added technologies, resulting in higher marginal benefits. However, the samples of this study cover more small and medium-sized enterprises. Their R&D investment are mostly used for the development of basic functions, and the marginal benefits are relatively low. Secondly, some Chinese enterprises have partially used the government subsidies for non-research and development purposes such as cooperative promotion (Forward-looking Industry Research Institute, 2024). Therefore, R&D investment played a non-dominant mediating role in this study. This also means that marketing and brand promotion, etc. are also the transmission paths from government subsidies to the competitiveness of game enterprises.

7. Conclusion

To sum up, this paper studies the impact of government subsidies on the competitiveness of game enterprises and introduces R&D investment as a mediating variable to explore the mediating influence of this variable. Ultimately, we have reached the following conclusions: 1. Government subsidies significantly enhance the competitiveness of listed game companies. In the subsequent discussion section, through actual cases, we found that although government subsidies have different impacts on different sizes of game enterprises, they all promote the improvement of competitiveness. 2. R&D investment is an important but non-dominant path for subsidies to exert their influence on competitiveness. It was found in subsequent discussion section that the marginal benefits it brings vary depending on the scale of the enterprise and the quality of R&D (basic/high added value). Furthermore, the robustness test indicates that the influence of the government subsidies changes dynamically with the competitiveness of enterprises, and it is necessary to balance short-term incentives and long-term ecological construction through differentiated policies.

Based on this, we offer several policy suggestions. Firstly, continue and strengthen the subsidy policy. Continuously implement targeted subsidies to motivate game enterprises to promote their R&D investment and enhance their competitiveness. For instance, implement a stepped tax rebate system for enterprises with high R&D and transformation efficiency, or set up a "technological breakthrough bonus" to specifically reward key technological innovations, thereby driving the overall upgrading of the game industry. Secondly, optimize the subsidy management mechanism. Establish a dynamic management model of "performance tracking + R&D subsidies", and form a virtuous cycle of "promoting research through subsidies and improving quality through research" through quantitative assessment (such as R&D output/cultural output indicators). Thirdly, differentiate the subsidy recipients. For enterprises with relatively weak competitiveness, direct research and development subsidies can be increased to reduce their innovation trial-and-error costs. For enterprises with strong competitiveness, emphasis should be placed on tax incentives and innovation awards to activate the technological spillover effect of leading enterprises. Meanwhile, policy resources should be given priority to enterprises with outstanding creativity and great R&D potential to maximize the incentive effect.

References

Allianz. (2024). High asset-liability ratio highlights enterprise risks: An analysis of the hidden problems behind a high asset-liability ratio. Allianz-Trade.cn. https://www.allianz-trade.cn/newsinfo/6528281.html

Betchoo, N. K., & Katembo, D. K. (2024). Enterprise Competitiveness Calculation Modelling. Texila Journal. https://www.texilajournal.com/management/article/2655-enterprise-competitiveness-calculation

Policy Document Beijing Economic Technological Development Area. (2020). Beijing Economic Technological Development Area Game Industry Policy. beijing.gov.cn. https://kfqgw.beijing.gov.cn/zwgkkfq/2024zcwj/202404/t20240424_3635039.html

Beijing Municipal Press and Publication Bureau. (2021). Announcement of the list of projects supported by the Beijing Cultural Industry Guidance Fund. http://whj.beijing.gov.cn/zwgk/tzgg/202102/t20210208_2250142.html

China Daily. (2025). Shijingshan District has issued policies to support the high-quality development of the gaming and e-sports industry. Sohu.com. https://www.sohu.com/a/877861760_121955537

China Game Industry Report 2015: Revenue 140.7 billion yuan, 530 million players. (2015). Huanqiu. https://game.huanqiu.com/article/9CaKrnJSo6j

Ding, P. (2022). Research on the impact of government subsidies on the competitiveness of listed game companies [Master's thesis, East China University of Political Science and Law]. CNKI. https://link.cnki.net/doi/10.27150/d.cnki.ghdzc.2022.000753

Forward-looking Industry Research Institute. (2024). Big news! Summary and Interpretation of China's Mobile Game Industry Policies in 2024 (Full) Encouraging High-quality Games to "go global". Tencent. https://news.qq.com/rain/a/20240314A085F000

Guangzhou Huangpu District Press and Publication Bureau. (2023). Several Measures of Guangzhou Development Zone (Huangpu District) to Promote the High-Quality Development of the Game and e-sports Industry. https://www.gz.gov.cn/gfxwj/qjgfxwj/hpq/qbm/content/post_9583739.html

Han, H. Y. (2022). Research on the impact of government subsidies and tax preferences on the operating performance of cultural and media enterprises in China [Master's thesis, Lanzhou University of Finance and Economics]. CNKI. https://link.cnki.net/doi/10.27732/d.cnki.gnzsx.2022.000431

Jia, L., Nam, E., & Chun, D. (2021). Impact of Chinese government subsidies on Enterprise Innovation: Based on a three-dimensional perspective. MDPI. https://www.mdpi.com/2071-1050/13/3/1288

Li, Y., Ye, W., & Wang, Z. (2013). The R&D funding effect of the government on enterprises: Complementary or crowding-out - An empirical study on large and medium-sized industrial enterprises in Shanghai. Research on Science and Technology Management, (5), 62-66.

Liu, H., & Teng, H. (2020). The threshold effect of R&D investment based on life cycle on enterprise value. Science Research Management, 41(1), 193-201.

Liu, X. (2019). The impact of R&D investment on enterprise competitiveness. Special Zone Practice and Theory, (3), 43-51.

Liu, Z. (2024). Research on the impact of government R&D subsidies on enterprise R&D investment [Master's thesis, Northwest A&F University]. CNKI. https://link.cnki.net/doi/10.27409/d.cnki.gxbnu.2024.000252

Sohu. (2024). The subsidy policy for the game industry in Chengdu High-tech Zone has helped major companies rise, with well-known enterprises such as Xishanju and Ubisoft taking the lead in making their moves. Sohu.com. https://www.sohu.com/a/835212470_122004016

Project Team. (2025). Annual development overview of China's game industry - Based on the data from the "2024 China Game Industry Report". Digital Publishing in China, 3(1), 61-66.

Wang, J. (2025). Shijingshan has issued policies to support the development of the game and e-sports industry, offering a maximum subsidy of 10 million yuan for research and development. The Beijing News. https://www.bjnews.com.cn/detail/1743419140129984.html

Xiamen G-Bits Network Technology Co., Ltd. (2024). Communication meeting minutes. https://sns.sseinfo.com/resources/images/upload/202405/20240506173203634945354.pdf

Zhang, M. (2022). Research on the impact of government subsidies and R&D investment on enterprise competitiveness [Master's thesis, Beijing Institute of Fashion Technology]. CNKI. https://link.cnki.net/doi/10.26932/d.cnki.gbjfc.2022.000127

Zhang, N. (2016). Research on the impact of government subsidies on the competitiveness of leading agricultural enterprises [Master's thesis, Shihezi University]. CNKI. https://kns.cnki.net/kcms2/article/abstract?v=-Y4qPNLDuvYSbpvlcHDk8WLtfyS4TftSKzJLogjwfCT0JsA3j60fD4LrCyr2zmYBLXEyyp7YN0RZgeHVYGXkFeELJweUBFVxo5TWOrxZSU668zT6dQoL6ZTt5YkdzbQejXe2o8Nq717yVvQv2lmkULmpoJX5J5rAQfljABwRFmHdejcDPIheaHD3R2wSRETRLjjlNUZLQxc=&uniplatform=NZKPT&language=CHS

Zhou, W. (2022). Research on the impact of government subsidies on the competitiveness of listed companies in the automotive manufacturing industry [Master's thesis, Xiamen University]. CNKI. https://link.cnki.net/doi/10.27424/d.cnki.gxmdu.2022.005207

Zhu, Y. (2017). Research on innovation element input and enterprise competitiveness: An empirical test based on China's manufacturing listed companies. Productivity Research, (3), 134-139.

Zuo, Z., & Lin, Z. (2022). Government R&D subsidies and firm innovation performance: The moderating role of accounting information quality. Journal of Innovation & Knowledge, 7(2), 100176. https://doi.org/10.1016/j.jik.2022.100176