Research on the Impact of Corporate R&D Investment on Audit Costs

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Abstract

This paper selects all A-share listed companies in China from 2011 to 2020 as the research sample and empirically investigates the relationship between corporate R&D investment and audit fees, and further differentiates the relationship between the two by the nature of ownership. The findings show that for A-share listed companies, there is a significant positive relationship between R&D investment and audit fees, and the higher the R&D investment, the higher the audit fees; by nature of ownership, the positive relationship between R&D investment and audit fees is more significant for non-state-owned listed companies than for state-owned listed companies. The above findings provide new empirical evidence for CPAs to conduct audits of listed companies, and auditors should consider R&D investment and the nature of ownership as important influencing factors in measuring audit fees when conducting audits.

Keywords

R&D Investment; Nature of Property Rights; Audit Costs.

1. Introduction

Innovation is an important driving force for the continuous development of the economy and society, and enterprise innovation is an eternal topic and an important force for promoting the perpetual vitality of enterprises and realizing their value. The report of the 19th Party Congress mentions science and technology more than ten times and emphasizes innovation more than fifty times, which all indicate the importance that the Party and the State attach to science and technology innovation.The Outline of the 14th Five-Year Plan and 2035 Vision for National Economic and Social Development of the People's Republic of China, adopted in March 2021, states that it is necessary to adhere to the central position of innovation in the overall situation of China's modernization, to deeply implement the innovation-driven development strategy and attach importance to the important role of R&D in it.

Since 2006, when China's auditing model was established as risk-based auditing, CPAs are required to identify, assess and take measures to address the risks of audited entities from a risk perspective in the course of auditing annual reports of listed companies. 2007 saw the full implementation of the revised new Accounting Standards for Business Enterprises in China, which made corresponding changes to the accounting policies related to R&D investments of enterprises. That is, R&D expenditures that meet the capitalization conditions can only be transferred to intangible assets, and the judgment of whether R&D expenditures meet the capitalization conditions and the timing of capitalization are to some extent influenced by the subjective factors of the company's decision makers. The decision makers may indirectly engage in malicious surplus management by manipulating the application of accounting policies, resulting in more costs for the CPA in identifying and assessing the risks of the audited entity, and the firm may also take greater risks.

2. Review of the Literature

Audit fees are not only of great concern in the field of practice, but also have been a hot issue of research by scholars at home and abroad. At present, scholars' research on audit fees is mainly carried out from two main subjects: one is from the perspective of the audited entity, which focuses on the size of the company, management or governance characteristics and business risks, and the other is from the perspective of the accounting firm, which focuses on the size and reputation of the firm.

The audit pricing model identified by Simunic (1980) is a cornerstone work in the field of empirical research on the factors influencing audit fees, and has been continuously studied in depth by domestic and foreign scholars since then.Francis (1984) conducted a study based on the above study with a sample of Australian listed companies and found that company size, business risk, etc. have an impact on audit fees. Myers et al. (1984) study on the free cash flow and liabilities of the company, etc. found that the lack of external monitoring by creditors exposes the company to greater risk in terms of capital flows and thus higher audit fees.Johnson et al. (1995) study with a sample data of companies in New Zealand found that firm size has an impact on audit fees, i.e. the existence of the size premium phenomenon was initially confirmed.

Xing Liquan et al. (2013) empirically investigate the impact of product market competition intensity and competitive position on audit fees from two theoretical perspectives: agency costs and operational risk, and conclude that CPAs will consider product market competition intensity and competitive position when conducting audits and determining audit fees. Shen, Huayu et al. (2018) empirically study the impact of executive characteristics and external governance mechanisms on audit fees and find that audit fees are relatively less in the case of listed companies where executives have academic experience, and this negative correlation is more significant in non-state listed companies. Referring to the Simunic audit fee model, grounded in corporate financial risk, Deng et al. (2021) show its positive effect on audit fees and further study finds that equity concentration attenuates this effect.

In summary, domestic and foreign scholars have studied various aspects of the subject of the factors influencing audit fees, and the studies from the firm's perspective have basically presented a consistent conclusion that the size and reputation of the firm are positively related to audit fees. However, the research from the perspective of the audited unit has not yet formed the same conclusion, especially in terms of the business risk of the audited unit and distinguishing the nature of property rights. Therefore, this paper empirically investigates the impact of corporate R&D investment on audit fees from the risk level, with a view to enriching the theoretical research on audit fees in China.

3. Theoretical Analysis and Research Hypothesis

3.1. Corporate R&D Investment and Audit Costs

The audit fee referred to in this paper consists of audit cost, reasonable profit and risk premium, where audit cost includes time cost, personnel cost, resource cost, etc., and risk premium refers to the cost that the firm and auditors bear to compensate for exceeding the underlying risk indicator. These two components of audit fees are influenced by the size of the audited entity, the level of governance and the risk of the business, while corporate R&D investment belongs to the third category, i.e., corporate R&D investment brings corresponding risks to the entity and thus affects audit fees.

Enterprise R&D investment projects are generally characterized by large capital investment, long R&D time and slow transformation of results, and there are risks in all aspects of the process, such as unsuccessful project initiation in the early stage, deviation of R&D direction in the middle stage and difficulties in the transformation of results in the later stage. Auditors

currently conduct audits mainly from the risk point of view, in accordance with the risk-oriented audit model, focusing on the various risks that may exist in the audited unit. Therefore, when auditing listed companies with R&D investments, auditors have to pay more attention to them. On the one hand, when the listed company has more R&D investment, it will face greater risk of material misstatement, and under the circumstance that the audit risk remains unchanged, the auditor has to increase the audit procedures for specific purposes to reduce the inspection risk accordingly, i.e. invest more human, material and financial resources to meet the audit needs and expand the scope of substantive testing, thus increasing the audit cost and accordingly increase the audit fee to compensate for the expenses . On the other hand, the audit report issued by the CPA has an insurance function for the financial report of the audited unit, and the risk of R&D input projects brings uncertainty for the future of the audited unit, increasing the risk of lawsuits and other risks from audit failure, and the firm will charge higher audit fees. Accordingly, this paper proposes hypothesis 1.

Hypothesis 1: Among all A-share listed companies with R&D investment, the higher the R&D investment of the company, the higher the audit cost.

3.2. Impact of the Nature of Property Rights

Considering the influence of the nature of property rights, listed companies can be divided into state-owned listed companies and non-state-owned listed companies. From the perspective of state-owned listed companies, their R&D investment has strong capital, sufficient human resources, diverse national policy preferences, strong risk tolerance, and state-owned assets as a guarantee, and state-owned listed companies are conservative in making investment decisions, and the possibility of significant risks is small, weakening the correlation between enterprise R&D investment and audit costs. From the perspective of non-state-owned listed companies, firstly, their ownership and operation rights are separated, and the management, under the scenario of pressure, uses the subjective judgment of the timing and amount of capitalization of R&D investment to manipulate the company's surplus for the purpose of whitewashing financial statements, and there is a risk of fraud. Secondly, non-state listed companies will increase the investment in R&D projects and the number of projects based on obtaining policy and tax benefits, while their ability to take risks is weaker compared to state capital, thus enhancing the correlation between corporate R&D investment and audit costs. Accordingly, hypothesis 2 is proposed in this paper.

Hypothesis 2: The positive relationship between R&D investment and audit fees is more significant for non-state listed companies compared to state listed companies.

4. Study Design

4.1. Sample Selection and Data Sources

In this paper, all A-share listed companies in China from 2011 to 2020 are selected as the primary sample and treated as follows: (1) exclude the sample of companies that are ST or *ST in that year; (2) exclude the sample of companies in the financial sector; (3) exclude the sample with missing values; (4) to ensure that the continuous variables are not affected by extreme values, this paper performs the 1% and 99% quantile on the Winsorize treatment. The final sample of 21,442 year-firms is obtained through screening. The data on firms' R&D investment and financial and audit data used in this paper are all sourced from the CSMAR database. The processing and regression of the data was done mainly through EXCEL 2019 and STATA 16.0 software.

4.2.   Definition of Variables

4.2.1. Explained Variables

Based on the existing scholarly research, the explained variable of this paper, audit fees (LnFee), is expressed using the natural logarithm of audit fees of listed companies.

4.2.2. Explanatory Variables

In this paper, the natural logarithm of the amount of R&D investment of the firm in the current year (LnRD) is selected to measure the firm's R&D investment.

4.2.3. Control Variables

Table 1. Definition of variables

Classification of variables	Variable Name	Variable symbol	Variable Description
Explained variables	Audit costs	LnFee	Natural logarithm of audit fees
Explanatory variables	Corporate R&D investment	LnRD	Natural logarithm of the amount invested by the enterprise in R&D in the year
Control variables	Business Size	Size	Natural logarithm of the number of total assets of the enterprise at the end of the year
	Nature of property rights	Soe	Dummy variable, Soe=1 if the firm is a state enterprise, otherwise Soe=0
	gearing	LEV	Total liabilities/total assets of the enterprise at the end of the year
	current ratio	LIP	Current assets/current liabilities of the enterprise at the end of the year
	Total net asset margin	ROA	Average net profit of the enterprise for the year/total assets
	Growth rate of operating income	Growth	(Current year's operating income - Prior year's operating income)/Prior year's operating income
	Inventory as a percentage	LNV	Closing inventory/total assets at the end of the period
	Percentage of accounts receivable	REC	Accounts receivable at the end of the period/total assets at the end of the period
	Corporate losses	Loss	dummy variable, if the company's net profit for the year is negative then Loss=1,otherwise Loss=0
	Firm Size	Big4	Dummy variable, if the company's audit unit for the year is International IV Big4=1 if large, otherwise Big4=0
	Audit opinion	Opinion	Dummy variable, if the firm issued a standard audit opinion during the year See then Opinion=1,otherwise Opinion=0

To ensure the accuracy of the empirical results, this paper controls for variables that have a significant impact on audit fees.

The specific variables are defined in Table 1.

4.3. Model Construction

To test hypothesis 1, the following regression model was constructed.

$$Lnfee = \beta_0 + \beta_1 LnRD + \beta_2 Size + \beta_3 Soe + \beta_4 LEV + \beta_5 LIP + \beta_6 ROA + \beta_7 Growth + \beta_8 LNV + \beta_9 REC + \beta_{10} Loss + \beta_{11} Big4 + \beta_{12} Opinion + \varepsilon \qquad (1)$$

The β_1 coefficient is expected to be significantly positive, i.e., the higher the firm's R&D investment the higher the audit cost.

To test hypothesis 2, this paper regresses the above regression models in groups depending on the nature of property rights.

5. Empirical Analysis

5.1. Descriptive Statistics

Table 2 shows the results of descriptive statistics of the variables. The standard deviation of the explanatory variable audit fees LnFee is 0.7239, and the maximum and minimum values are 19.4027 and 11.5129, respectively, indicating that there is a relatively large difference between audit fees of different companies. The explanatory variable corporate R&D investment LnRD has a standard deviation of 1.5307, with maximum and minimum values of 25.0252 and 7.4085 respectively, indicating that there is a large gap between the R&D investment of different companies. The mean value of the control variable nature of ownership (Soe) is 0.3097, indicating that 30.97% of the selected sample companies are state-owned listed companies; the mean value of firm size (Big4) is 0.0537, indicating that 5.37% of all A-share listed companies are audited by international "Big Four" accounting firms; the mean value of audit opinion (Big4) is 0.0537. The mean value of audit opinion (0pinion) is 0.9796, indicating that 97.96% of all companies in the sample were issued with standard audit opinions.

Table 2. Descriptive statistics

variable	Sample size	minimum value	maximum value	average value	standard deviation
LnFee	21442	11.5129	19.4027	13.7867	0.7239
LnRD	21442	7.4085	25.0252	17.8002	1.5307
Size	21442	17.8061	28.6365	22.0937	1.3143
Soe	21442	0.0000	1.0000	0.3097	0.4624
LEV	21442	0.0075	1.6981	0.3948	0.2003
LIP	21442	0.3865	17.7864	2.7499	2.8036
ROA	21442	-1.1559	0.9156	0.0478	0.0749
Growth	21442	-0.4689	1.8656	0.1407	0.3241
LNV	21442	0.0000	0.8223	0.1320	0.1033
REC	21442	0.0000	0.8133	0.1372	0.1055
Loss	21442	0.0000	1.0000	0.0878	0.2830
Big4	21442	0.0000	1.0000	0.0537	0.2254
Opinion	21442	0.0000	1.0000	0.9796	0.1415

5.2. Relevance Analysis

Figure 1 shows the results of correlation analysis of the variables. It can be seen that the correlation coefficient between corporate R&D investment (LnRD) and audit fees (LnFee) is 0.445, which is significantly positive at the 1% level, indicating that among the sample listed companies, there is a situation that the higher the R&D investment, the higher the audit fees of the company, which initially verifies hypothesis 1.

In addition, for the control variables, the correlation coefficient between firm size (Size) and audit fees (LnFee) is 0.780 and is significantly positively correlated, indicating that firms with larger firm size have higher audit fees; the correlation coefficient between nature of ownership (Soe) and audit fees (LnFee) is 0.279 and is significantly positively correlated, indicating that for listed firms with different nature of ownership accounting firms will charge different audit fees for listed companies with different ownership nature. The correlation coefficient between firm size (Size4) and audit fee (LnFee) is 0.442 and is significantly positive, indicating the existence of firm size and reputation fee premium. The correlation coefficient between audit opinion (Opinion) and audit fee (LnFee) is -0.029 and significantly negative, indicating that audit fees are higher when a listed company is issued with a non-standard audit opinion.

	LnFee	LnRD	Size	Soe	LEV	LIP	ROA	Growth	LNV	REC
LnFee	1									
LnRD	0.445***	1								
Size	0.780***	0.531***	1							
Soe	0.279***	0.095***	0.413***	1						
LEV	0.426***	0.191***	0.540***	0.338***	1					
LIP	-0.328***	-0.157***	-0.371***	-0.227***	-0.666***	1				
ROA	-0.106***	0.065***	-0.071***	-0.141***	-0.357***	0.239***	1			
Growth	0.016**	0.071***	0.047***	-0.071***	0.028***	-0.063***	0.226***	1		
LNV	0.029***	-0.030***	0.070***	0.070***	0.257***	-0.155***	-0.071***	0.008	1	
REC	-0.124***	0.107***	-0.194***	-0.154***	0.082***	-0.069***	-0.032***	0.051***	-0.018***	1
Loss	0.039***	-0.069***	-0.019***	0.052***	0.190***	-0.106***	-0.592***	-0.204***	0.001	-0.01
Big4	0.442***	0.236***	0.354***	0.151***	0.124***	-0.077***	0.020***	-0.020***	-0.026***	-0.076***
Opinion	-0.029***	0.064***	0.014**	0.008	-0.119***	0.050***	0.213***	0.071***	0.016**	-0.009

Figure 1. Relevance analysis

5.3. Multiple Regression Analysis

Table 3 shows the results of the multiple regression analysis. Where equation (1) is a regression on the total sample, equations (2) and (3) are further divided into two sub-samples by nature of ownership, state-owned listed companies and non-state-owned listed companies, grouped together for regression. From the regression results (1), it can be seen that the coefficient of LnRD is 0.010 and significantly positive at the 1% level, thus verifying hypothesis 1, which states that auditors will pay attention to the size of a firm's R&D investment when conducting an audit and consider the possibility of R&D failure that may be hidden behind that investment, thus increasing audit input to find out the probability of converting a firm's R&D investment into intangible assets; firms accounting firms face higher audit risk when they maliciously hide the conversion rate of their R&D inputs, which will increase audit fees. The regression

coefficient between the nature of ownership and audit fees is -0.088 and significantly negatively correlated at the 1% level, providing preliminary evidence that hypothesis 2 holds. In addition, the adjusted R2 is 65.2%, indicating a good fit and strong explanatory power of the model.

Table 3. Multiple regression analysis

variable	(1) total sample	(2) State-owned listed companies	(3) Non-state listed companies
LnRD	0.010***	0.003	0.019***
	(4.33)	(0.75)	(5.95)
Size	0.398***	0.445***	0.360***
	(110.15)	(70.53)	(79.07)
Soe	-0.088***		
	(-12.32)		
LEV	-0.146***	-0.281***	-0.014
	(-6.06)	(-5.48)	(-0.50)
LIP	-0.018***	0.003	-0.018***
	(-12.65)	(0.45)	(-13.49)
ROA	-0.385***	-1.214***	-0.187***
	(-7.39)	(-8.31)	(-3.51)
Growth	-0.013	0.000	-0.013
	(-1.39)	(0.01)	(-1.29)
LNV	-0.100***	-0.065	-0.133***
	(-3.38)	(-1.18)	(-3.77)
REC	0.120***	0.187***	0.053
	(3.93)	(2.89)	(1.58)
Loss	0.081***	0.001	0.121***
	(6.24)	(0.03)	(7.96)
Big4	0.620***	0.614***	0.570***
	(44.50)	(28.12)	(29.66)
Opinion	-0.155***	-0.102**	-0.177***
	(-7.28)	(-2.19)	(-7.66)
Constant	5.067***	4.036***	5.727***
	(74.72)	(32.14)	(69.41)
Observations	21,442	6,640	14,802
R-squared	0.653	0.686	0.571
F test	0	0	0
r2_a	0.652	0.686	0.571
F	3354	1317	1791

Note: *** p<0.01, ** p<0.05, * p<0.1, t-values in parentheses

From the regression results (2) and (3), it can be seen that for state-owned listed companies, the correlation coefficient between corporate R&D investment and audit fees is 0.003, which is small and insignificant; while for non-state-owned listed companies, the correlation coefficient between corporate R&D investment and audit fees is 0.019 and is significantly positively correlated at the 1% level, which indicates that non-state-owned listed companies have a Because the corporate R&D risk is greater for non-state-owned listed companies compared to state-owned listed companies, many non-state-owned listed companies have imperfect

governance systems, inadequate risk monitoring and early warning mechanisms, and less tolerance for risk, and in the face of greater audit risk, accounting firms will charge higher audit fees to cover the cost of taking risks.

The results of the above study show that accounting firms consider the amount of corporate R&D investment in determining audit fees, and the effect varies among listed companies with different ownership nature.

5.4. Robustness Tests

Since corporate R&D investment is positively related to audit costs, in order to test the reliability and robustness of the above findings, the explanatory variable corporate R&D investment is replaced with the capitalization rate of R&D investment for robustness testing, and the ratio of net intangible assets to total assets at the end of the period of the sample companies is used to measure the capitalization rate of R&D investment. The following model was constructed.

$$Lnfee = \beta_0 + \beta_1 CapitalRatio + \beta_2 Size + \beta_3 Soe + \beta_4 LEV + \beta_5 LIP + \beta_6 ROA + \beta_7 Growth + \beta_8 LNV + \beta_9 REC + \beta_{10} Loss + \beta_{11} Big4 + \beta_{12} Opinion + \varepsilon \tag{2}$$

The robustness test of the original model is conducted with the capitalization rate of R&D inputs as the new explanatory variable and the control variables remain unchanged, and the results of the robustness test are shown in Table 4. It can be seen that the correlation coefficient between the capitalization rate of R&D inputs and audit fees is 0.308 and is significantly positive at the 1% level, which is generally consistent with the results of the benchmark model.

Table 4. Robustness tests

variable	modulus	T-value
CapitalRatio	0.308***	5.26
Size	0.387***	127.13
Soe	-0.062***	-8.80
LEV	-0.079***	-3.35
LIP	-0.012***	-8.42
ROA	-0.315***	-6.18
Growth	-0.004	-0.45
LNV	-0.013	-0.45
REC	0.119***	4.09
Loss	0.074***	5.85
Big4	0.640***	47.13
Opinion	-0.134***	-6.42
Constant	5.131***	75.89
Observations	21,442	
R-squared	0.670	
F test	0	
r2_a	0.669	
F	2068	

Note: *** p<0.01, ** p<0.05, * p<0.1

6. Conclusion and Recommendations

The results of the empirical analysis conducted in this study with a sample of all A-share listed companies in China from 2011 to 2020 find that (1) corporate R&D investment has a significant positive relationship with audit fees, i.e., corporate R&D investment will have an impact on audit fees, and the higher the R&D investment, the higher the audit fees; (2) the impact of corporate R&D investment on audit fees will vary depending on the nature of ownership, in state-owned listed companies, there is no correlation between corporate R&D investment and audit fees; in non-state-owned listed companies, corporate R&D investment and audit fees are significantly and positively correlated.

Based on the above findings, the following recommendations are made: first, for listed companies, they should reasonably approve their R&D projects, carefully implement feasibility analysis of the projects, and effectively allocate the amount of R&D investment, especially for non-state listed companies, continuously improve the company's R&D project investment management system, and establish a sound risk warning mechanism and risk bearing and transfer paths to provide a deep level of protection against R&D risks. Second, for accounting firms, experienced auditors should be assigned when auditing companies with high R&D risks, and CPAs should always maintain a professional skeptical attitude, pay attention to the risk of management manipulation of surplus management, implement specific audit procedures when necessary, and use them as an influencing factor in determining audit fees. Third, for the regulatory industries such as the SEC, it should pay close attention to the R&D activities of listed companies, improve the provisions of corporate accounting standards on R&D investment to prevent management from manipulating surplus and obtaining policy preferences through accounting policies, etc., standardize the information disclosure system of listed companies to reduce the risks caused by information asymmetry, and pay attention to the existence of situations where accounting firms and listed companies conspire to obtain abnormal audit fees, and enhance Supervision of audit fees.

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