Modern Economy, 2022, 13, 532-544
https://www.scirp.org/journal/me
ISSN Online: 2152-7261
ISSN Print: 2152-7245

Capital Structure and R&D: Empirical Evidence from China and USA

Yatong Yang

International Department, Shandong Experimental High School, Jinan, China
Email: 1278997741@qq.com

How to cite this paper: Yang, Y. T. (2022). Capital Structure and R&D: Empirical Evidence from China and USA. *Modern Economy, 13,* 532-544.
https://doi.org/10.4236/me.2022.134028

Received: March 3, 2022
Accepted: April 19, 2022
Published: April 22, 2022

Abstract

This paper focuses on how the capital structure of enterprises affects their R&D intensity, introduces the asset-liability ratio to compare the capital structure of China and the United States, and introduces the tradable shares to compare the capital structure of state-owned enterprises and non-state-owned enterprises. The final result is that the asset-liability ratio and R&D intensity are negatively correlated in both China and America, and this negative relationship will be weakened in China. The existence of tradable shares increases the R&D intensity, ceteris paribus, in SOEs, the negative correlation between capital structure and R&D intensity is far greater than that of private enterprises. Based on the fact that under the modern business era, an enterprise's innovation capability is closely related to its core competitiveness, and at the same time, the promotion speed of innovation ability depends on the scale of R&D investment, and the relationship between capital structure and enterprise R&D investment can be deduced from this paper.

Keywords

Capital Structure, R&D Investment, China, USA, SOEs and Non-SOEs

1. Introduction

Does capital structure matter for firms' R&D investment? In 1958, the unconnected theory put forward by Modigliani and Miller appeared in their pioneering paper. Their view was that enterprise investment and financing were completely independent decisions in a perfect capital market. However, R&D is a long-term sizeable investment that does not immediately generate cash flows but does provide opportunities for future growth. It is characterized by uncertainty, irreversibility and long investment horizons. Undoubtedly, R&D investment and financing activities are mutually reinforcing and inseparable, which has been confirmed in subsequent documents.

One view is that low leverage determines R&D investment, and equity financing is better for firm innovation (Bradley et al., 1984; Titman & Wessels, 1988). Two reasons justify this view. The first reason considers the supply side of credit to firms. As debt holders receive fixed payment, unless there are issues of insolvency, the risk of R&D investment is basically not bored to debt holders. By contrast, shareholders receive variable returns, which depend on whether R&D investment is successful and profitable. The differences in risk-sharing between debt and equity financing thus lead to different incentives for R&D decisions. Debt holders are less motivated for R&D, because of the huge risk of R&D investment, tangible assets as collateral will not be generated, and firms generally find it difficult to raise external debt to finance their R&D investment (Wang & Thornhill, 2010).

The second reason considers the demand side of credit from firms. Ardalan (2017) proposed that debt financing could benefit from the interest tax shield, while the cost of financial difficulties would increase. The sum of the tax shield and the value of the non-leveraged company, and the value obtained by removing the cost of financial distress is the value of the leveraged company (Ross et al., 2015). This means that highly leveraged companies face higher financial hardship costs. Because the risk of R&D and its long-term property is extremely high, the increase in R&D investment will inevitably put firms in front of larger risk of uncertainty and financial distress. Therefore, due to excessive debt, enterprises usually choose equity instead of debt to finance R&D investment when they are in excessive debt.

On the other hand, however, others hold the view that equity financing may also impede firm innovation. There are also two main reasons. First, as pointed out by Stein (1988), information asymmetry is a challenge that managers and investors must face. Based on this, managers are likely to be forced by acquisition pressure to exchange for current profits at the same time, and will sacrifice long-term gains (such as innovative investment) to avoid underestimating the stock value. On the other hand, the incentive managers for innovative investment failed to give more, the main reason is that the managers of shareholders' power have little control, and at the same time, they are threatened by hostile takeover. Second, short-term gains may be what institutional investors seek, so they are more willing to choose to invest in enterprises with larger short-term gains (Bushee, 2001). It is proven that the main reason for data managers to reduce R&D management income is that they are under great pressure (Bushee, 1998). Short-sightedness is a common feature of managers. This view is obtained by Graham et al. (2005) after investigation and research.

Chief Investment Officers (CFOs) said in the survey that they can even abandon long-term sustainability in order to achieve short-term profit targets. Realizing the stability of the company's stock price is its ultimate goal, hence impeding firm innovation that affects long-run return.

Given the theoretical debate discussed above, Experience is actually the essence of the relationship between R&D investment and capital structure. This paper uses China and the U.S. firm level data as studying sample and addresses this question. In particular, we ask 1) What is the relationship between capital structure and R&D intensity in China and America? 2) Are there significant differences between the two countries and why? 3) How does the existence of tradable shares (or the so-called share split reform) affect R&D investment? And 4) Is the intensity of capital structure and R&D investment consistent with that of state-owned enterprises and non-state-owned enterprises?

The reason we choose China and the U.S. as the research samples is because the financial market in these two countries differs significantly. In China, firm financing is dominated by indirect financing, i.e., borrowing from commercial banks. In the U.S., by contrast, firm financing is dominated by direct financing, i.e., raising equity or corporate debt. We compare the results obtained in these two distinct markets and see whether the empirical predictions are consistent.

In addition, we study the effect of the share split reform in China to test the hypothesis by Bushee (2001), who argues that institutional investors may go after short-term performance. This mechanism works only if shares are tradeable. The share split reform in China provides a natural experiment for this study, as before the reform, a large fraction of shares of the listed company are not tradeable or have to wait for at least years to be tradeable. Moreover, State-owned enterprises account for a large proportion in China, we are also interested in the impact of ownerships on the choice of financial structure and the R&D investment decisions of firms. By researching we found that there is a negative correlation between the asset-liability ratio and R&D intensity of the two countries, showing that the increase of debt would reduce the willingness of a company to innovate. Such relationship is weaker in China compared to that in the U.S., and is weaker in private firms compared to SOE. Regarding the tradable shares, our empirical finding shows that the share split reform increases the R&D intensity, contrary to the view by Bushee (2001).

2. Data and Methodology

2.1. Data and Variables

We collected the data of Chinese companies listed on the domestic securities market and Chinese companies listed on the US securities market and firms listed in Nasdaq stock market. The data is obtained from WIND and CSMAR database. Sample period is 2011 to 2018. We use 2011 as the beginning year because R&D expenditure data is not available for many listed firms before this year. We use 2018 as the ending year to avoid the unusual period such as COVID-19 pandemic. In addition, we drop the financial industry due to their unique accounting standard and their sensitivity to macroeconomic policy (Aghion et al., 2013).

The key variable that we are interested in is the R&D investment. In our original sample, some companies didn't report this data. Other control variables are relatively standard balance-sheet variables. After dropping the firms that have missing R&D data, the first sample we use for estimation includes 339 American listed companies from 2012-2017 and the second sample includes 1047 Chinese listed companies from 2011-2017 covering 23 different industries. The two samples are converted into panel data respectively. A brief discussion about the key variables we use in this study is given below.

In this paper, the result variable is R&D intensity, which represents the measurement of the degree of R&D investment of a company. This variable is defined in three main ways according to literature: R&D expenditure of an enterprise exceeds total assets, R&D expenditure exceeds sales and R&D expenditure exceeds market value (Chai, 2010). Some papers also directly choose the value of R&D expenditure to measure the investment degree, which is not a suitable way because it ignores the possibility that large companies usually have more funds to put into research program (Lee & Sung, 2005). In this paper, R&D intensity is calculated by the method commonly used in literature, that is, R&D expenditure divided by sales.

The main explanatory variable is the asset-liability ratio measured as total debt divided by total asset based on the book value reported in balance sheet. Most papers related to capital structure choose this calculation method (e.g., Bragoli et al., 2016; Davidson & Brooks, 2004; Huang et al., 2016). The merit of this method is that the definition of asset-liability is clear, and the data is of high availability. A dummy variable indicating tradable shares is also included in one of the models.

Following the literature of Bragoli and others, we choose the following control variables such as profitability, growth capacity, company size, non-debt tax shield, etc., collateral as the control variables. Firm size is usually measured by the firm's market value or the amount of sales income (Bragoli et al., 2016; Chai, 2010). This paper defines firm size as sales in the form of natural logarithm following Wang and Thornhill (2010). The reason why the form of natural logarithm is used is that it can omit the impact from heteroscedasticity and multicollinearity and it is also the method that many literatures have employed (Fang, Tian, & Tice, 2014). The difference in firm size between small and large companies results in different advantages. Generally speaking, small companies have more flexibility in the aspect of innovation while big firms own more resources which can be employed for them. There are two streams of theory about the relationship between firm size and R&D spending: one group argues that large companies have the better external condition so that they would make the best use of this point to engage innovation. Another group thinks that the increase in R&D costs seems to be proportional to the size of the company (Wang & Thornhill, 2010). Anyway, the size of the firm is widely believed to be related with R & D investment.

Profitability is the capability of an enterprise to create income. This element is calculated from the rate of return on assets (ROA) or the rate of return on equity (ROE). In this paper, the indicator we use to measure profitability is ROA. R&D activities need the support of larger funds and are motivated by excess profits. In this sense, the higher profit rate and sufficient funds are of great help to carry out innovation activities.

Growth is another important variable for R&D investment spending. We use the annual net income growth rate to measure the growth potential. The calculation process is to use the difference in net income in two years over the last year's net income. A high growth rate would push up the confidence of the company's stockholders. In order to maintain the sustained growth of business, listed companies in the growing period may need to increase R&D investment to maintain their competitiveness. High-growth companies have the incentive to increase investment in R&D to create more profit growth points (Liu, 2017).

Following Bragoli et al. (2016), we also control for the collateral, which is measured by net fixed asset over total asset. R&D is an investment program with the characteristics of long-term, high risk, high uncertainty and large funding (Brown et al., 2009). R&D projects with high risk will increase the possibility of bankruptcy, especially for small businesses. The collateral is thus important for the firm to raise external finance.

Finally, non-debt tax shield is measured according to the sum of depreciation and amortization and total assets (Bragoli et al., 2016). This indicator represents other expenses, such as depreciation and deferred tax losses, excluding interest on liabilities. Non-debt tax shield is negatively correlated with debt level. This non-debt tax shield does not pose a risk of debt maturity. As a result, companies that have a large number of non-debt tax shields use fewer debts than those that do not, which can replace debt. The decrease in the level of liability reduces the financial distress cost and bankrupt cost, which would motivate enterprise to invest more in R&D.

Table 1 shows the variables and their abbreviations. **Table 2** shows the summary statistics of main variables.

Table 1. Summary of variables.

Variables	Label	Definition
R&D intensity	R&D	R&D spending/total sales
Capital structure	DA	Debt/asset
Profitability	ROA	Net income/asset
Growth	Grow	Net income(t)-NI(t − 1)/NI(t − 1)
Firm size	Lnsale	Ln(sale)
Non-debt tax shield	Shield	Depreciation + amortization /total asset
Collateral	Collateral	Net fixed asset/total asset
Tradable shares	Tra	Tradable: D = 1, otherwise, D = 0

Table 2. Summary statistics.

		US firms			
Variable	Obs	Mean	Std. Dev.	Min	Max
R&D	1938	0.4851	2.3334	0.0006	41.0818
DA	1938	0.4146	0.2052	0.0113	0.9603
Lnsale	1938	20.4025	2.5268	12.4655	27.6082
ROA	1938	−0.0131	0.2234	−1.8208	3.2676
growth	1938	0.2097	21.8489	−427.883	486.6667
shield	1938	0.0400	0.0294	0.0006	0.5330
collateral	1938	0.1548	0.1814	9.95E−05	1.1618
		China			
Variable	Obs	Mean	Std. Dev.	Min	Max
R&D	6282	0.0459	0.0445	1.36E-05	1.6943
DA	6282	0.3926	19.8248	0.0080	0.8548
Lnsale	6282	21.3410	1.3373	16.3643	25.1338
ROA	6282	0.0432	5.6749	−0.7765	0.2144
growth	6282	−0.3655	579.499	−195.114	8.6592
shield	6282	0.0050	0.0035	1.41E−05	0.0200
collateral	6282	0.2155	0.1364	0.0005	0.6162

2.2. Empirical Models

The first objective is to test whether there is a negative correlation between asset-liability ratio and R&D investment intensity, and whether the degree of this negative relationship differs in China and US (hypothesis 1). Our second objective is to study the impact of tradable shares (hypothesis 2), and our third objective is to test whether the relationship between capital structure and R&D investment intensity is different between SOEs and non-SOEs, and whether non-SOEs have higher R&D investment intensity (hypothesis 3).

Our methodology for comparison of groups (China versus the US, or SOE versus non-SOE) is to introduce a dummy variable and an interaction term. We take hypothesis 3 for example. First, introduce a dummy variable D_i. If the firm is non-SOE, $D = 0$, otherwise, $D = 1$. Thus, we estimate the following model:

$$\begin{aligned}\text{R\&Dintensity}_{it} &= \alpha_{1i} + \beta \text{DA}_{1it} + \delta \text{Dummy}_{\text{non-SOE}} \times \text{DA}_{1it} \\ &+ \gamma \text{Dummy}_{\text{non-SOE}} + \gamma \text{Controls}_{it} + \varepsilon\end{aligned} \tag{1}$$

It is obvious that when $D = 0$ which represents non-SOE, the equation becomes:

$$\text{R\&Dintensity}_{it} = \alpha_{1i} + \beta \text{DA}_{1it} + \gamma \text{Controls}_{it} + \varepsilon \tag{2}$$

When $D = 1$ which represents SOE, the equation becomes:

$$\text{R\&Dintensity}_{it} = (\alpha_{1i} + \gamma) + (\beta + \delta) \text{DA}_{1it} + \gamma \text{Controls}_{it} + \varepsilon \tag{3}$$

Comparing Equations (2) and (3), it is obvious that the coefficient δ reflects the coefficients difference of asset-liability ratio variable in these two subsamples. Therefore, we transform this comparison into testing whether the coefficient δ equals 0. The rest part is that we integrate two subsample and run regression using Equation (1) to check whether the coefficient δ is significant. If it is significant, we argue that the two sub-samples have significant different coefficient for DA, otherwise, there is no statistically significant difference.

The main regression model (for hypothesis 1) is proposed below, where control variables are selected according to literature introduced above.

$$\begin{aligned}\text{R\&D intensity}_{it} = {} & \alpha_{1i} + \beta_1 \text{DA}_{1it} + \beta_2 \text{Size}_{2it} + \beta_3 \text{ROA}_{3it} + \beta_4 \text{Growth}_{4it} \\ & + \beta_5 \text{Nondebtaxshield}_{5it} + \beta_6 \text{Colleteral}_{6it} + \varepsilon_i\end{aligned}$$

The Chinese and US samples would be respectively employed in this equation to obtain the coefficients of independent variables. We expect that β_1 is negative and significant. The method for comparison of coefficients of Chinese and US listed companies would be illustrated in the following methodology part.

As to study the impact of tradable shares, we estimate the following model:

$$\begin{aligned}\text{R\&D intensity}_{it} = {} & \alpha_{1i} + \beta_1 \text{DA}_{1it} + \beta_2 \text{Size}_{2it} + \beta_3 \text{ROA}_{3it} + \beta_4 \text{Growth}_{4it} \\ & + \beta_5 \text{Nondebtaxshield}_{5it} + \beta_6 \text{Colleteral}_{6it} \\ & + \beta_7 \text{Dummy}_{\text{tradable}} + \varepsilon_i\end{aligned}$$

where the dummy for the tradable share is employed. The estimation of the role of SOE has been introduced above.

3. Empirical Results

3.1. The Main Model and Comparison between China and U.S.

The regression results of our main model and the comparison of Chinese and American listed companies are presented in Table 3. The first and second columns of Table 3 show the results of FEM regression. We can conclude that the asset-liability ratio of the core independent variable is significantly and negatively related with R&D intensity in both countries, which is consistent with the hypothesis 1. This coefficient means that the increase of debt level would reduce a company's innovation incentive and investment. High debt will cause enterprises to bear excessive interest burden and face greater debt repayment pressure. And enterprises need to maintain a stable cash flow to support the payment of debt interest. Once enterprises invest more cash in high-risk and long-term R&D projects, the capital chain may face the risk of breaking, and then lead to financial and operational risks and bankruptcy risks, threatening the survival and development of enterprises. Therefore, debt financing is not conducive to promoting R&D investment. There is no difference between the results and the literature (Jia, 2016; Nam, Ottoo, & Thornton Jr., 2003).

In addition, firm size has significantly negative coefficient for both China and U.S firms. This supports the argument that small firms have stronger innovation incentives. The difference between the two countries' regression is that the U.S. ROA and its growth strength are largely unrelated to R&D strength.

Table 3. Main model regression result.

	China	US	China and US
	intensity	intensity	intensity
DA	−0.0002***	−0.8419**	−0.0032**
	(−2.64)	(−1.98)	(1.96)
ROA	−0.0007***	−1.6338	0.0058***
	(−5.62)	(−1.32)	(2.41)
Grow	0.0000**	0.0102	0.0000**
	(1.98)	(1.13)	(2.18)
Lnsale	−0.0065***	−1.0520***	−0.2944***
	(−4.49)	(−3.11)	(−2.82)
collateral	0.0015	−0.3568	−0.3012*
	(0.17)	(−0.51)	(−1.76)
shield	0.2526	−0.9172	−0.3580
	(0.90)	(−0.33)	(−0.58)
D*Da			0.0019**
			(2.01)
country			0.0000
			(.)
cons	0.1942***	22.3681***	6.2580***
	(6.42)	(3.22)	(2.89)
N	6282	1938	8220

As is illustrated in the methodology part, I introduce an interaction term to test whether there is significant difference in the coefficients of independent variable between the two countries. The regression results are shown in the third column in Table 3. As is shown in the table, this coefficient is significant at 95% confidence level with the value of 0.019. The result shows that ceteris paribus, the change of R&D intensity generated by capital structure in US would be greater than that in China. This may be resulted from the existence of SOEs which can finance from banks without bearing as much risk as private enterprises. Consequently, the negative relationship in China is relatively weaker (Wang, 2013).

3.2. The Role of Tradable Share

Hypothesis 2 aims to study the effect of equity based on the relationship between capital structure and R&D intensity. Table 4 shows the final regression results. Compared with the main regression model in Table 3, a new dummy variable representing tradable shares is added. As can be seen in Table 4, Virtual variables are significantly positively correlated with R&D intensity at 95% confidence level. The positive sign means that the existence of tradable shares increases the R&D intensity. Theoretically speaking, there are two offsetting forces

Table 4. The impact of tradable shares.

	China
	intensity
DA	−0.0001** (−2.50)
ROA	0.0001*** (5.15)
Grow	1.86e−06** (2.43)
Lnsale	−0.0055*** (−4.77)
collateral	0.0071 (0.98)
shield	0.5591* (1.92)
D_tra	0.0070** (2.07)
cons	0.149*** (6.28)
N	7329

regarding the impact of tradable share on R&D intensity. The negative force is that investors may be myopic and they have incentives to improve firms' short-term performance by sacrificing long-term R&D investment, if their shares are tradable. The positive force is that the increase of equity liquidity would attract institutional investors to be the shareholders, and if the managers only focus on the short-term merit instead of long-term development, they would encounter the withdrawal menace, which would force executives to concentrate on the future development, such as increasing R&D intensity (Hui & Jian, 2012). Some researchers hold similar arguments that the liquidity of listed companies' stocks in the secondary market is strong, which is conducive to the formation of large shareholders who actively supervise the governance of listed companies. The existence of large shareholders will effectively curb the management's short-term behavior of reducing R&D investment (Admati, 2017). Our result shows that, when putting these two forces together, the positive force dominates.

3.3. Comparison between SOE and Non-SOE

As for the third hypothesis, **Table 5** shows the regression results of SOE and non-SOE. The method used in this hypothesis is the same as hypothesis 1. First, we use the fixed effect model to get the coefficient of asset-liability ratio. We can see from the first two-column that the sign of the coefficient is consistent with the previous test for China. The asset-liability ratio in both two styles of enterprises strongly correlated with R&D intensity.

Table 5. Regression results of SOE and non-SOE.

	SOE	Non-SOE	ALL
	intensity	intensity	intensity
DA	−0.0002**	−0.0002**	0.0001
	(−2.26)	(−2.46)	(0.77)
ROA	−0.0005***	−0.0010***	−0.0005***
	(−2.72)	(−6.34)	(−4.41)
Grow	0.0000	0.0000	0.0000
	(1.49)	(1.61)	(1.26)
Lnsale	−0.0020	−0.0048***	−0.0187***
	(−0.47)	(−3.22)	(−14.17)
collateral	0.0666	−0.0024	0.0114
	(1.36)	(−0.33)	(1.50)
shield	0.6384	0.5316*	0.2415
	(0.53)	(1.76)	(1.03)
DA*D_SOE			−0.0002*
			(−1.90)
D_SOE			0.0000
			(.)
_cons	0.0723	0.1582***	0.4308***
	(0.92)	(5.24)	(15.91)
N	2156	5173	7329

The third column in the table shows that the interaction term coefficient is significantly negative. A negative value means that when assets and liabilities increase by one unit, the R&D intensity of the private enterprise is 0.0002 units higher than that of the state-owned enterprise. This is consistent with the literature that non-SOE has stronger motivation to engage in innovation activity (Hart, Shleifer, & Vishny, 1997). In state-owned enterprises, due to the serious problems of principal-agent and soft budget constraints, managers of SOEs tend to pursue the goal of maximizing personal benefits during their office. Then, the investment projects which can bring the profits in the short term and show the achievements will become the rational choice of the managers of SOE, while the innovation investment projects which cannot get the returns during their tenure will lack the investment incentives (Wu, 2012).

4. Concluding Remark

On the one hand, in modern business world, the innovation ability of a firm has been closely connected with the core competence. Meanwhile, the amount of R&D investment determines how fast the growth rate of innovation ability could be. On the other hand, apart from internal cash flow generated from a company's daily operations, debt and equity financing are the primary financing resources that support the engagement of innovation activity. Therefore, this paper concentrates on determining how a company's capital structure affects R&D strength.

This issue has been analyzed from three perspectives. Firstly, this paper starts from the comparison of China and US, because the financing environment in these two countries significantly differ and the American capital market is one of the most important and mature markets in the world, which is suitable to be the reference object (Nadiri & Mamuneas, 1991). From the regression results, we found that the asset-to-liability ratio was associated with negative R&D intensity in two countries that met hypothesis 1 presented earlier and the dominant theory of the problem. In other words, the increase in debt would reduce the willingness of a company to innovate. In addition, the comparison result of US and China suggests that this negative relationship would be weakened in China.

Hypothesis 2 is presented under the background of share split reform. Before this reform, a large proportion of shares are non-tradable shares, which restricts the healthy development of Chinese equity market (Guo, Dai, & Lien, 2015; Liao et al., 2014). With the introduction of split share reform, more and more listed companies finish this transformation and become tradable. Additionally, tradable shares generate and aggravate the short-term trade of small investors aiming at capital gain which is contradictory to the long-term R&D investment. Based on this point, a dummy variable is introduced in the previous equation. The result shows that the existence of tradable shares increases the R&D intensity, ceteris paribus.

The result of hypothesis 3 is fitted with the expected conclusion. The relationship between capital structure and R&D intensity is not only negatively related but also differs between different enterprise styles. The R&D intensity of private enterprises is less related to the negative capital structure than that of state-owned enterprises.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

Admati, A. (2017). A Skeptical View of Financialized Corporate Governance. *The Journal of Economic Perspectives, 31,* 131-150. https://doi.org/10.1257/jep.31.3.131

Aghion, P., Van Reenen, J., & Zingales, L. (2013). Innovation and Institutional Ownership. *The American Economic Review, 103,* 277-304. https://doi.org/10.1257/aer.103.1.277

Ardalan, K. (2017). Capital Structure Theory: Reconsidered. *Research in International Business and Finance, 39,* 696-710. https://doi.org/10.1016/j.ribaf.2015.11.010

Bradley, M., Jarrell, G. A., & Kim, E. H. (1984). On the Existence of an Optimal Capital

Structure: Theory and Evidence. *Journal of Finance, 39,* 857-878. https://doi.org/10.1111/j.1540-6261.1984.tb03680.x

Bragoli, D., Cortelezzi, F., & Marseguerra, G. (2016). R&D, Capital Structure and Ownership Concentration: Evidence from Italian Microdata. *Industry and Innovation, 23,* 223-242. https://doi.org/10.1080/13662716.2016.1145573

Brown, J. R., Fazzari, S. M., & Petersen, B. C. (2009). Financing Innovation and Growth: Cash Flow, External Equity, and the 1990s R&D Boom. *Journal of Finance, 64,* 151-185. https://doi.org/10.1111/j.1540-6261.2008.01431.x

Bushee, B. J. (1998). The Influence of Institutional Investors on Myopic R&D Investment Behavior. *The Accounting Review, 73,* 305-333.

Bushee, B. J. (2001). Do Institutional Investors Prefer Near-Term Earnings Over Long-Run Value? *Contemporary Accounting Research, 18,* 207-246. https://doi.org/10.1506/J4GU-BHWH-8HME-LE0X

Chai, B.-F. (2010). Empirical Study on the Relationship between R&D Investment, Capital Structure, and Firm Size of China Private Listed Companies. In *PICMET 2010 Technology Management for Global Economic Growth* (pp. 1-8). Institute of Electrical and Electronics Engineers.

Davidson, S., & Brooks, R. (2004). *R&D, Agency Costs and Capital Structure: International Evidence*. Working Paper Series, Institute for Democracy and Economic Affairs.

Fang, V. W., Tian, X., & Tice, S. (2014). Does Stock Liquidity Enhance or Impede Firm Innovation? *Journal of Finance, 69,* 2085-2125. https://doi.org/10.1111/jofi.12187

Graham, J. R., Harvey, C. R., & Rajgopal, S. (2005). The Economic Implications of Corporate Financial Reporting. *Journal of Accounting & Economics, 10,* 3-73.

Guo, L., Dai, Y., & Lien, D. (2015). The effects of China's Split-Share Reform on Firms' Capital Structure Choice. *Applied Economics, 48,* 1-20. https://doi.org/10.2139/ssrn.2678190

Hart, O., Shleifer, A., & Vishny, R. W. (1997). The Proper Scope of Government: Theory and an Application to Prisons. *The Quarterly Journal of Economics, 112,* 1127-1161. https://doi.org/10.1162/003355300555448

Huang, W., Boateng, A., & Newman, A. (2016). Capital Structure of Chinese listed SMEs: An Agency Theory Perspective. *Small Business Economics, 47,* 535-550. https://doi.org/10.1007/s11187-016-9729-6

Hui, C., & Jian, H. (2012). Company Characteristics, Ownership Structure and Stock Liquidity. *Investment Research, 3,* 90-100.

Jia, L. (2016). *Research on the Impact of Financing Modes on R&D Investment in High-Tech Enterprises*. Harbin University of Science and Technology.

Lee, C.-Y., & Sung, T. (2005). Schumpeter's Legacy: A New Perspective on the Relationship between firm Size and R&D. *Research Policy, 34,* 914-931. https://doi.org/10.1016/j.respol.2005.04.006

Liao, L., Liu, B., & Wang, H. (2014). China's Secondary Privatization: Perspectives from the Split-Share Structure Reform. *Journal of Financial Economics, 113,* 500-518. https://doi.org/10.1016/j.jfineco.2014.05.007

Liu, Q. (2017). *The Impact of R&D Investments on Market Values: A Comparison between the UK and US*. University of Nottingham.

Nadiri, M., & Mamuneas, T. (1991). *The Effects of Public Infrastructure and R&D Capital on the Cost Structure and Performance of U.S. Manufacturing Industries* (Working Paper No. 3887). National Bureau of Economic Research. https://doi.org/10.3386/w3887

Nam, J., Ottoo, R. E., & Thornton Jr., J. H. (2003). The Effect of Managerial Incentives to Bear Risk on Corporate Capital Structure and R&D Investment. *Financial Review, 38,* 77-101. https://doi.org/10.1111/1540-6288.00036

Ross, S. A., Westerfield, R. W., Jaffe, J., Lim, J., Tan, R., & Wong, H. (2015). *Corporate Finance* (Asia Global ed.). McGraw-Hill Education Asia.

Stein, J. C. (1988). Takeover Threats and Managerial Myopia. *The Journal of Political Economy, 96,* 61-80. https://doi.org/10.1086/261524

Titman, S., & Wessels, R. (1988). The Determinants of Capital Structure Choice. *Journal of Finance, 43,* 1-19. https://doi.org/10.1111/j.1540-6261.1988.tb02585.x

Wang, S. (2013). A Comparison of Financing Utilization Efficiency among Stated Owned, Private and FDI Enterprises. *Management & Engineering, No. 10,* 82-88.

Wang, T., & Thornhill, S. (2010). R&D Investment and Financing Choices: A Comprehensive Perspective. *Research Policy, 39,* 1148-1159. https://doi.org/10.1016/j.respol.2010.07.004

Wu, Y. B. (2012). What Kind of Ownership Type Enterprises Are the Most Innovative in China? *World Economy, 35,* 3-29.