

The Decomposed Effect of Tax Avoidance on R&D -- Empirical Research Based on SEM

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ABSTRACT

With the rapid development of Chinese society and the gradual rise of emerging industries, R&D and innovation are increasingly becoming the fundamental driving force leading enterprises to compete and grow. The 18th National Congress of the Communist Party of China put forward the strategy of innovation-driven development, which once again emphasized the importance of innovation to the country's destiny. For enterprises, an important factor affecting innovation activities is capital. Reasonable tax avoidance accumulates a large amount of capital for enterprises through cash flow saving effect and signalling effect, which meets the high demand of technological innovation for capital and promotes enterprises to actively expand the scale of R&D. In this paper, the structural equation model is constructed, and the total effect of tax avoidance on enterprise innovation is evaluated. Besides, the total effect is decomposed and evaluated as well, founding that tax avoidance by increasing the company's cash holdings level forms a positive direct impact, but tax avoidance by increasing management and large shareholder's opportunism behaviours also forms a remarkable negative indirect effect. This study is of great significance for the company to build a perfect governance mechanism, alleviate the conflict of interests of all parties, carry out tax planning rationally, and increase R&D.

Keywords: Tax avoidance, research and development, structural equation model, perks, tunnelling

1. INTRODUCTION

With the rapid development of emerging industries such as new materials, new energy, cloud computing, the Internet of Things, artificial intelligence, integrated circuits, sharing economy, biopharma and 5G technology, R&D and corporate innovation have increasingly become the fundamental driving forces leading the sustainable development and high-speed growth of enterprises in the future. The global-oriented strategy of innovation-driven development was proposed on the 18th National Congress of Chinese Communist Party. In order to speed up the implementation of the strategy, the CPC Central Committee and the State Council issued "Outlines on National Strategy for Innovation-driven Development (on May 19, 2016)", emphasizing that the innovation-driven is the destiny of a country and the trend of the world.

However, different from ordinary investment activities, enterprise R&D activities embody three key characteristics. The first key characteristic is "uncertainty". First of all, due to the non-exclusivity of knowledge, R&D activities are generally not disclosed as trade secrets in order to prevent information leakage, so it is difficult for external investors to obtain accurate information related to R&D. Secondly, as R&D output is an intangible asset, which is mainly dependent on the human capital of innovation personnel, it is difficult for external investors to supervise the efforts of innovation personnel, so R&D

output is difficult to be accurately measured. The second key characteristic is "risk". First of all, the intangible assets or "new knowledge" created by R&D activities, lacking physical form, are controlled by R&D personnel. Once the R&D personnel are lost, such knowledge and intangible assets will be separated from the enterprise, and the investment of the enterprise cannot be recovered. Secondly, the probability of R&D failure is large, and R&D failure often indicates that the early R&D investment becomes sunk cost. The third key characteristic is "longevity". The commercialization process of "new knowledge" is long, and the return of investment cannot be accurately measured in the short term. Therefore, the continuous supply of R&D funds is needed. Once the capital chain is broken, the R&D process is interrupted, and the R&D personnel are lost, the enterprise will suffer huge losses. In a word, the key characteristics of enterprise R&D determine the high demand on financing and the high constraint of financing [1–2].

Tax expenditure will directly lead to the outflow of corporate cash [3], bringing liquidity pressure to enterprises, so the incentive for enterprises to avoid tax is widespread. According to the traditional theory, the most direct impact of tax avoidance is the reduction of cash expenditure and the savings of enterprise cash flow, which leads to the increase of cash holding level. Cai & Liu [4] found that competitive pressure drives enterprises to evade tax in order to accumulate capital, carry out investment and better participate in market competition. Hassan et al.

[5] confirmed that due to the differences in investment levels and cash flow levels at various stages of enterprise life cycle, the degree of corporate tax avoidance is u-shaped as a whole. Therefore, the cash saved by tax evasion eases the financing constraints of companies, improves the speed of companies' response to investment opportunities, and helps to fill the funding gap of enterprises.

The characteristics of R&D activities and corporate tax avoidance behaviours are exactly complementary. High tax burden tends to squeeze out the cash flow used for innovation and inhibit enterprises' R&D activities [6]. As a legal means to effectively reduce cash outflow, improve cash holdings and increase working capital, reasonable tax avoidance often becomes an important financial strategy to support enterprises' technological innovation [7]. However, is the above research on tax avoidance and innovation which holds that tax avoidance can help reduce occupation of cash flow required for R&D activities fully established? Undeniably, some studies have confirmed that tax avoidance has a positive impact on cash holdings [8], but there is also a non-significant relationship or even a negative correlation between tax avoidance and corporate cash holdings [9].

Tax avoidance reduces the outflow of cash flow and enhances the level of cash holdings. At the same time, it also provides room for management and large shareholders to seek rent. Entrenchment effect of management and major shareholders obviously will not only reduce the cash enterprises save through the tax avoidance behaviours, but also reduce the fund enterprises access to through channels of external financing because of the tax avoidance behaviours' signalling effect. As a result, it weakens and limits the enterprise's innovation activities. To sum up, the core research question of this paper is put forward: in the overall effect of corporate tax avoidance on R&D activities, what proportion of the effect does rent-seeking by management and major shareholders contribute?

Previous studies on corporate tax avoidance have focused on the impact of tax avoidance on corporate investment [10], but R&D as a part of enterprise investment also attracts academic interest. However, research on the tax avoidance and the tax incentives on innovation only confirmed the existence of direct effect and the existence of moderating effect [7, 11], but did not explore the influence path of tax avoidance on innovation input, nor did they pay attention to the agency conflict caused by tax avoidance. This paper analyses the path of the causal effect between tax avoidance and R&D through the structural equation model. The main novel contributions of this paper are as follow: Different from traditional research analysing the relation between tax avoidance and innovation, this article decomposes the effect into positive effect and negative effect, proving the perks of management and the tunnelling of controlling shareholder induced by tax avoidance behaviours damage the corporate R&D in a certain extent. This paper helps to clarify the actual effect and acting path of tax avoidance on enterprise R&D and innovation, prove the influence of agency conflict caused by tax avoidance on enterprises' R&D

investment, at the same time, provide important enlightenment for enterprises to carry out tax avoidance rationally, strengthen internal and external governance, balance interests of all parties, and implement innovation activities.

2. HYPOTHESIS

Corporate tax avoidance has increased the internal and external financing capacity from the following two aspects. First, according to the effect of cash inflow, reasonable tax avoidance reduces the tax burden of enterprises, saves additional net cash flow for enterprises, and thus increases the internal capital accumulation for enterprises to invest in R&D. Secondly, according to the signalling theory, tax avoidance increases the net cash flow and after-tax net profit of enterprises, reduces the uncertainty of enterprise cash flow and maximizes the value of the firm [12-13], thus delivering good market signals to financial institutions such as banks or venture capitalists, and providing opportunities for enterprises to obtain financing channels through the external capital market. The opening of enterprises' internal financing and external financing channels helps enterprises to more conveniently obtain funds needed for R&D, which overcomes difficulties of R&D, such as asymmetric information, high risk, long cycle and large capital demand, and alleviates the financing constraints of innovation activities [14]. To sum up, corporate tax avoidance provides sufficient funds for enterprises, so it has a positive effect on the R&D investment.

However, the overall effect of tax avoidance on R&D in enterprises consists of not only the positive effect of filling the R&D funding gap, but also the mixed effect of management and controlling shareholders' private benefit expropriation.

First, from the perspective of management's self-interest behaviours, management misappropriates the capital needed by the company for high-risk R&D investment, resulting in insufficient investment in enterprise innovation and negative effect on the relation between tax avoidance and innovation. To be specific, enterprises cover up their tax avoidance behaviours through complex and opaque transactions, which increases the complexity and ambiguity of their business activities and financial activities [15-16]. As a result, the information transparency of the enterprise is reduced, and the information asymmetry between the principal and the agent is increased, providing convenience for the management to carry out hidden perks and inefficient investment activities, which was not conducive to the enterprise to increase long-term investment in R&D activities.

Second, from the perspective of controlling shareholders' self-interest behaviours, the cash saved by enterprises' tax avoidance could be appropriated by the controlling shareholder, leading to the fact that cash is quickly transferred from the enterprise to the controlling shareholders and their related parties. Then, there is a decrease in the level of cash holdings and a shortage of

funds on R&D investment, which has a negative effect on the causal relation between tax avoidance and R&D. Specifically, according to the tunnelling hypothesis, controlling shareholders, for their own benefits, would tunnel listed companies by means of related party transactions or high dividend, etc., which reduces the company's cash holdings [17]. When corporate tax avoidance activities lead to increased cash inflows, the controlling shareholders' motivation and ability to tunnel the listed companies are further amplified, which harms the company's ability to invest on R&D.

Third, management's perk is an erosion of the tunnelling of controlling shareholders, and tunnelling behaviour of controlling shareholders is a restraint to the perks of management. Eventually, there is a negative relation between the controlling shareholder's tunnelling behaviour and the management's opportunistic behaviour, which plays a positive effect on the causal relationship between tax avoidance and R&D. To be specific, according to the free cash flow hypothesis, the cash accumulated from corporate tax avoidance activities can increase the resources under the control of management, thus increasing agency costs, damaging corporate value and expropriating the interests of shareholders [18]. When the controlling shareholders transfer the resources of listed companies by means of "tunnelling", the controlling shareholders' self-interested behaviour competes with the management's self-interested behaviour. This counterbalance makes the resources obtained through tax avoidance activities directly invest in the R&D activities that increase the long-term value of enterprises.

Previous studies have confirmed the positive effect of tax avoidance on enterprises' R&D activities [7]. However, whether management and major shareholders influence the relation between tax avoidance and enterprises' R&D activities has not been empirically tested. Combined with theoretical analysis, the research hypothesis used for empirical testing in this paper is proposed:

Hypothesis: In the overall effect of tax avoidance on R&D, there is a negative effect formed by self-interested behaviours of management and controlling shareholders.

3. RESEARCH DESIGN

The initial samples of this paper were selected from the data of A-share listed companies in Shanghai and Shenzhen stock exchanges from 2010 to 2018, and then preliminary screening was conducted :(1) Excluding ST/PT or delisting samples; (2) Excluding listed financial companies; (3) Excluding samples with missing data, and a total of 27,872 observed values were obtained. In order to avoid the influence of extreme values, all of the continuous variables are winsorized at the 1st and 99th percentiles, and then used to construct the structural equation model. The sample was obtained from The IFinD database and CSMAR database. The data cleansing was completed by Stata 15.1 software, and the SEM were built by Amos 21 software. In this paper, a total of 11 observable variables were selected to construct the

structural equation model for empirical test. The detailed variables are shown in the following table.

Table 1 Variable definitions

| Variable types | Variable names | Variable definitions |
|----------------------|----------------|---|
| Endogenous Variables | rd | the ratio of R&D investment to revenue |
| | tunneling | (other receivables at the end of the year - other receivables at the beginning of the year) / total assets at the end of the year |
| | cashhold | (cash and cash equivalents + trading securities) / total assets |
| | perk | (overhead expense - wages and benefits - depreciation and amortization - research and development expenses - taxes) / revenue |
| Exogenous Variables | ratediff | nominal tax rate - current income tax expense / pretax profit |
| | hhi | herfindahl-hirschman index |
| | roa | current year net income scaled by book value of assets |
| | lev | debt-to-assets ratio |
| | grow | the growth rate of revenue |
| | industry | numerical variable, representing a range of industries |
| | year | numerical variable, representing a range of years |

In this paper, the structural equation model is constructed to test the above hypothesis, and the estimation method is the maximum likelihood method. If the hypothesis is true, the path coefficients in the SEM are significant, and the sum of the path coefficients is negative.

4. EMPIRICAL RESULTS

Table 2 shows the descriptive statistical analysis of the main variables. The mean value of ratediff is 0.00139 and the standard deviation is 0.135, indicating that the degree of tax avoidance varies greatly among companies. The average value of rd is 3.532, indicating that the company's average annual R&D investment is more than 3 times its operating revenue. The average of tunneling is 0.00173, which indicates that the scale of tunneling through other accounts receivable is only 0.17% of the total assets, indicating significant achievements of CSRC supervision and corporate governance. Variable perk has a mean value

of 0.044 and a median value of 0.026. The average percentage of management perk is 4.4% of operating revenue. The mean value of cashhold is 0.198, and the maximum value is 0.707. The cash holding level of listed companies is generally high.

Table 2 Descriptive statistics

| Vaname | Obs | Mean | SD | Min | Max |
|-----------|-------|--------|-------|--------|--------|
| Ratediff | 27872 | .00139 | .135 | -.649 | .293 |
| Rd | 27872 | 3.532 | 4.091 | 0 | 23.090 |
| Tunneling | 27872 | .00173 | .016 | -.071 | .080 |
| Perk | 27872 | .044 | .051 | .00275 | .385 |
| Cashhold | 27872 | .198 | .145 | .016 | .707 |
| Hhi | 27872 | .292 | .128 | .204 | .829 |
| Roa | 27872 | .064 | .059 | -.091 | .290 |
| Lev | 27872 | .423 | .207 | .050 | .905 |
| Grow | 27872 | .214 | .432 | -.499 | 2.885 |
| Year | 27872 | 2014 | 2.506 | 2010 | 2018 |
| Industry | 27872 | 6.856 | 4.215 | 1 | 22 |

FIG. 1 shows the estimation values of path coefficients and the goodness-of-fit indexes. GFI is greater than 0.9, which is the ideal value; AGFI is greater than 0.8, which is acceptable; SRMR is less than 0.08, which is acceptable, too. Therefore, the goodness-of-fit indexes are generally acceptable.

Table 3 shows the effect paths of corporate tax avoidance on corporate R&D. The impact of tax avoidance on can be decomposed into the direct impact through cash holding and the indirect impact through embezzlement. Combined with Figure 1 and Table 3, the results show that the total effect of tax avoidance on corporate R&D is 0.2287, that is, the difference between the nominal tax rate and the actual tax rate increases by 1%, and the ratio of R&D investment to revenue increases by 0.2287%. According to the above theoretical analysis, the effect decomposition is further carried out, and the results show that the direct impact of cash holding is 0.2755, and the indirect impact of embezzlement is -0.0467, so the research hypothesis is established.

To sum up, the overall effect of tax avoidance on R&D is positive, that is, tax avoidance can significantly increase enterprises' investment on R&D, but to a certain extent, agency conflicts between management and shareholders, and agency conflicts between large shareholders and small and medium shareholders weaken the positive impact of tax avoidance on R&D.

5. CONCLUSION

With the rapid development of Chinese society, technological innovation has gradually become the main driving force of social and economic development. In addition, with the intensification of competition among enterprises and the acceleration of technological upgrading, the technological innovation of enterprises has become a key factor for their survival and development. An important factor restricting the technological innovation activities of enterprises is capital. Sufficient cash flow is the foundation supporting enterprises to carry out R&D. Reasonable tax avoidance of enterprises, through cash flow saving effect and signaling effect, helps to make up the capital gap of enterprises' R&D investment, and finally encourages enterprises to carry out R&D activities. In this article, through the construction of a structural equation model, I found that the overall effect of tax avoidance on R&D is positive, and this effect can be decomposed into the part of direct effect through cash holdings and the part of indirect effect through benefit expropriation. Namely, tax avoidance activities promote the enterprise innovation through cash accumulation, and tax avoidance activities damage the enterprise innovation through the agency conflict. This paper proves that the agency conflicts between management and shareholders and between major shareholders and small and medium shareholders weaken the positive effect of tax avoidance on R&D, which provides enlightening significance for enterprises to strengthen the construction of internal and external governance mechanism.

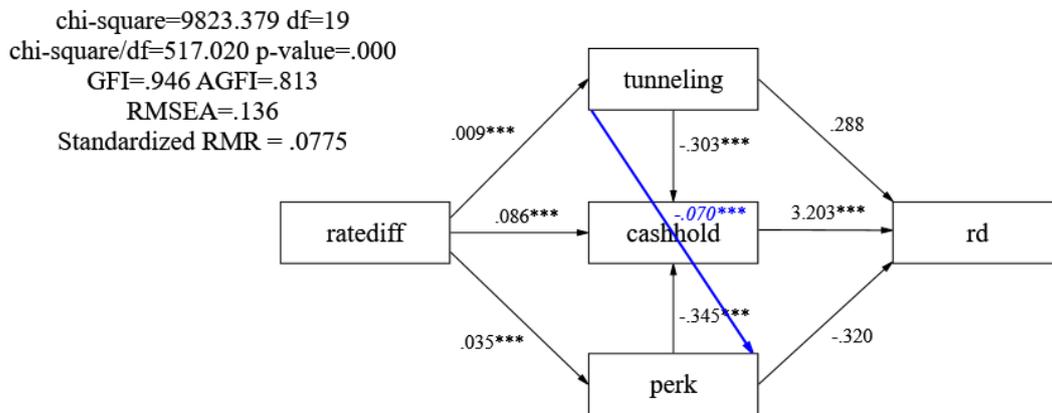


Figure 1 Parameter estimation of SEM

Table 3 The effect decomposition of tax avoidance on R&D

| Effect decomposition | Effect path | Path coefficient | Calculation of effect | Total |
|---|-------------------------------------|--|------------------------------|---------------|
| The impact of tax avoidance on R&D | ratediff→cashhold→rd | ratediff→cashhold:0.086 cashhold→rd:3.203 | 0.2755 | 0.2755 |
| The influence of management and major shareholders' embezzlement on tax avoidance - R&D | ratediff→tunneling→rd | ratediff→tunneling:0.009 tunneling→rd:0.288(statistically insignificant) | 0.0000 | -0.0467 |
| | ratediff→tunneling→cashhold→rd | ratediff→tunneling:0.009 tunneling→cashhold:-0.303 cashhold→rd:3.203 | -0.0087 | |
| | ratediff→perk→rd | ratediff→perk:0.035 perk→rd:-0.32(statistically insignificant) | 0.0000 | |
| | ratediff→perk→cashhold→rd | ratediff→perk:0.035 perk→cashhold:-0.345 cashhold→rd:3.203 | -0.0387 | |
| | ratediff→tunneling→perk→rd | ratediff→tunneling:0.009 tunneling→perk:-0.07 perk→rd:-0.32(statistically insignificant) | 0.0000 | |
| | ratediff→tunneling→perk→cashhold→rd | ratediff→tunneling:0.009 tunneling→perk:-0.07 perk→cashhold:-0.345 cashhold→rd:3.203 | 0.0007 | |
| Total effect | (The Sum of All Paths) | | 0.2287 | 0.2287 |

REFERENCES

- [1]B. H. Hall, The financing of research and development, *OXFORD REVIEW OF ECONOMIC POLICY*, SSCI, vol. 18, 2002, pp. 35-51. DOI: <https://doi.org/10.1093/oxrep/18.1.35>
- [2]K. Chang, Y. Zeng, W. Wang, X. Wu, The effects of credit policy and financial constraints on tangible and research & development investment: Firm-level evidence from China's renewable energy industry, *ENERGY POLICY*, SCIE;SSCI;EI, vol. 130, 2019, pp. 438-47. DOI: <https://doi.org/10.1016/j.enpol.2019.04.005>
- [3]M. Hanlon, S. Heitzman, A review of tax research, *Journal of Accounting and Economics*, SSCI, vol. 50, 2010, pp. 127-78. DOI: <https://doi.org/10.1016/j.jacceco.2010.09.002>
- [4]H. Cai, Q. Liu, Competition and corporate tax avoidance: Evidence from Chinese industrial firms, *ECONOMIC JOURNAL*, SSCI, vol. 119, 2009, pp. 764-795. DOI: <https://doi.org/10.1111/j.1468-0297.2009.02217.x>
- [5]M. M. Hasan, A. Al-Hadi, G. Taylor, G. Richardson, Does a firm's life cycle explain its propensity to engage in corporate tax avoidance?, *European Accounting Review*, SSCI, vol. 26, 2017, pp. 469-501. DOI: <https://doi.org/10.1080/09638180.2016.1194220>
- [6]A. Mukherjee, M. Singh, A. žaldokas, Do corporate taxes hinder innovation? *JOURNAL OF FINANCIAL ECONOMICS*, SSCI, vol. 124, 2017, pp. 195-221. DOI: <https://doi.org/10.1016/j.jfineco.2017.01.004>
- [7]F. Lan, W. Wang, Q. Cao, Tax cuts and enterprises' R&D intensity: Evidence from a natural experiment in China, *ECONOMIC MODELLING*, SSCI, vol.2019, pp. 304-314. DOI: <https://doi.org/10.1016/j.econmod.2019.10.031>
- [8]L. Wang, Tax enforcement, corporate tax aggressiveness, and cash holdings, *China Finance Review International*, vol. 5, 2015, pp. 339-70. DOI: <https://doi.org/10.1108/CFRI-12-2014-0099>
- [9]M. I. Kurniawan, S. Nuryanah, The Effect of Corporate Tax Avoidance on the Level of Corporate Cash Holdings: Evidence from Indonesian Public Listed Companies, *Australasian Accounting, Business*

and Finance Journal, vol. 11, 2017, pp. 38-52. DOI:
<https://doi.org/10.14453/aabfj.v11i4.4>

[10]J. Bailing, J. Rui, The impact of tax avoidance on enterprise investment efficiency, Journal of Discrete Mathematical Sciences and Cryptography, vol. 21, 2018, pp. 1293-98. DOI:
<https://doi.org/10.1080/09720529.2018.1526404>

[11]J. Atanassov, X. Liu, Can corporate income tax cuts stimulate innovation? JOURNAL OF FINANCIAL AND QUANTITATIVE ANALYSIS, SSCI, vol.2019, pp. 1-51. DOI:
<https://doi.org/10.1017/S0022109019000152>

[12]R. J. Wilson, An examination of corporate tax shelter participants, The Accounting Review, vol. 84, 2009, pp. 969-99. DOI:
<https://doi.org/10.2308/accr.2009.84.3.969>

[13]T. Y. H. Tang, The value implications of tax avoidance across countries, Journal of Accounting, Auditing & Finance, vol. 34, 2018, pp. 615-38. DOI:
<https://doi.org/10.1177/0148558X17742821>

[14]S. S. Pal, Determinants of innovative behaviour: A firm's internal practices and its external environment edited by cees van beers, alfred kleinknecht, ronald ortt, and robert verburg, JOURNAL OF PRODUCT INNOVATION MANAGEMENT, SCI; SCIE; SSCI; EI, vol.2010, pp. 455-457. DOI:
https://doi.org/10.1111/j.1540-5885.2010.00727_2.x

[15]M. A. Desai, D. Dharmapala, Corporate tax avoidance and high-powered incentives, JOURNAL OF FINANCIAL ECONOMICS, SSCI, vol. 79, 2006, pp. 145-79. DOI:
<https://doi.org/10.1016/j.jfineco.2005.02.002>

[16]M. M. Frank, L. J. Lynch, S. O. Rego, Tax reporting aggressiveness and its relation to aggressive financial reporting, The Accounting Review, vol. 84, 2009, pp. 467-496. DOI:
<https://doi.org/10.2308/accr.2009.84.2.467>

[17]J. Chiou, Y. Chen, T. Huang, Assets Expropriation via Cash Dividends? Free Cash Flow or Tunneling, China Journal of Accounting Research, vol. 3, 2010, pp. 71-93. DOI: [https://doi.org/10.1016/S1755-3091\(13\)60020-9](https://doi.org/10.1016/S1755-3091(13)60020-9)

[18]T. Opler, L. Pinkowitz, R. Stulz, R. Williamson, The determinants and implications of corporate cash holdings, JOURNAL OF FINANCIAL ECONOMICS, SSCI, vol. 52, 1999, pp. 3-46. DOI:
[https://doi.org/10.1016/S0304-405X\(99\)00003-3](https://doi.org/10.1016/S0304-405X(99)00003-3)