The Impact of Tax Burden on Enterprises' Innovation Input—An Empirical Analysis Based on Tax Avoidance Incentives

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Abstract. This paper studies the impact of corporate tax burden on the next level of innovation input. Taking the listed companies in China's GEM from 2009 to 2017 as the research object, this paper finds that the tax burden of enterprises has an incentive effect on the next innovation input level. Further research finds that, compared with state-owned enterprises, the tax burden of non-state-owned enterprises has a stronger incentive effect on the next innovation input level.

1. Introduction
In order to encourage enterprises to step up innovation efforts, the state has formulated a series of preferential tax policies for innovation activities. However, in the case of information asymmetry, it is difficult to define research and development costs and non-research and development costs. The judgment space provided by specific accounting standards in the research and development stages, expense and capitalization provides conditions for enterprises to use innovation input to avoid tax. In the current tax environment in China, enterprises generally have a strong motivation to reduce the tax burden. Will companies use tax incentives to increase their level of innovation to avoid tax (and possibly deviate from the real level)? In addition, due to different property rights, state-owned enterprises and non-state-owned enterprises often have differences in political asylum and innovation environment. Will the above differences affect the relationship between enterprise tax burden and enterprise innovation input?

Specifically speaking, this paper mainly studies two issues: first, whether corporate tax sharing will have incentive effect on the level of innovation input; Second, whether there are differences between the above incentive effects of state-owned enterprises and non-state-owned enterprises.

The main contributions found in this study are as follows: first, in the traditional concept of study, the enterprise tax burden cause outflows, and depend on internal financing, investment in innovation, therefore the innovation of the enterprise tax burden to the enterprise current input levels exist inhibitory effect, this article from a new Angle in the early period of the research enterprise tax burden's influence on the later innovation investment level, to improve the limitations of the traditional thinking. Second, from the angle of the state-owned enterprises and non-state-owned enterprises, enterprise tax burden and further study the relationship between the enterprise innovation input levels, tries to put forward suggestions to enterprises innovation and reasonable tax avoidance, and the preferential tax policy on enterprise innovation.
2. Theoretical analysis and research hypothesis
In China, previous studies have shown that enterprises take advantage of tax incentives [1], earnings management [2], related party transactions and other forms of tax evasion. This indicates that in the current tax environment of China, enterprises generally have a strong motivation to reduce the tax burden.

The complexity of r&d expenditure projects and the difficulty in defining r&d expenditure provide enterprises with more tax avoidance opportunities, tax avoidance space and tax avoidance gains. Griffith et al. (1995) argue that a very important problem of tax incentive policies is that enterprises will include the costs of other activities into the r&d activities, and the ambiguity of the definition of r&d activities exacerbates this problem [3].

Tassey (1996) argues that the difficulty in defining the calculation basis of tax incentive policies will distort the classification of enterprises' r&d expenditure and increase the cost of tax administration [4]. These factors will greatly reduce the possibility of companies being penalized for using research and development expenses to avoid tax, thereby reducing the cost of tax avoidance.

To sum up, when enterprises have a heavy tax burden, they often have a strong incentive to avoid tax. The preferential tax policies on enterprise innovation formulated by the state, the complexity of r&d expenditure projects, the difficulty in defining r&d expenditure and the increase of supervision cost of tax authorities and external audit institutions have provided the possibility for enterprises to conduct reasonable tax avoidance. Thus hypothesis 1 is proposed:

H1: Tax burden of enterprises has incentive effect on the level of innovation input of enterprises in the next phase;

Compared with state-owned enterprises, non-state-owned enterprises are more competitive. Innovation theory points out that enterprises' r&d innovation investment is closely related to the level of market competition in their industry. These factors often lead to higher enthusiasm for innovation input of non-state-owned enterprises. Therefore, compared with non-state-owned enterprises, state-owned enterprises often have lower enthusiasm for innovation input. Thus hypothesis 2 is proposed:

H2: Compared with state-owned enterprises, the tax burden of non-state-owned enterprises has a stronger incentive effect on the level of innovation input in the next phase.

3. Research design

3.1. Sample selection and data sources
In this paper, China's gem listed companies from 2009 to 2017 are selected as the initial samples, and then further screening is carried out according to the following conditions: (1) ST companies are excluded. (2) excluding listed companies in the financial industry. (3) eliminate companies with incomplete financial data. The financial data used in constructing variables in this paper come from CSMAR database, WIND database and flush database.

3.2. Variable definition

3.2.1. Explained variable -- enterprise innovation input (Rd): Based on the practices of Zhao Jing and Meng Weixuan (2016), this article measures the level of enterprise innovation in terms of R&D input. Due to the large gap in R&D input of enterprises of different sizes and types, Li Chuntao and Song Min (2010) and Lu Tong and Danyin (2014) are taken as references to measure the technological innovation level of enterprises by standardizing their R&D input with ending assets, that is, R&D input after standardization of ending assets = R&D/ending assets.

3.2.2. Explanatory variable – Tax: This paper uses the income tax burden to measure the tax burden of enterprises. The income tax burden variable is constructed by using the information of balance sheet and income statement, that is, income tax burden = (income tax expense + deferred income tax asset -
deferred income tax liability)/operating income, which is used to measure the actual income tax expense paid by unit income.

3.2.3. Control variables: Based on existing research literature, this paper introduces necessary control variables into the model, as shown in Table 1 below.

Table 1. Variable definitions

| Variable | The variable name | Variable definitions |
|----------|------------------|----------------------|
| Rd       | R&d investment intensity | R&D input / ending assets |
| Tax      | Income tax burden | (income tax expense + deferred income tax asset - deferred income tax liability)/operating income |
| Size     | The company size | The natural logarithm of total assets at the end of the year |
| Lev      | Financial leverage | Asset-liability ratio |
| Ppe      | Capital intensity | Total fixed assets at the end of the year divided by total assets at the end of the year |
| Ocf      | Operating cash flow | Ratio of net cash flow from operating activities to operating income at the end of the year |
| ROA      | Return on total assets | Net profit/total assets |
| Age      | Company establishment age | The number of years from the establishment of the company to the current year |
| Year     | Year | Annual dummy variable |
| Indu     | Industry | Industry dummy variable |
| Soe      | Property rights | If the ultimate controller of a listed company is a government organ, institution or state-owned enterprise, the listed company is defined as a listed company with state-owned property right and Soe is 1. In other cases, Soe is 0 |

3.3. Model design

Model (1): \( R_d = \beta_0 + \beta_1 Tax_t + \beta_2 Tax_{t-1} + \beta_3 Tax_t * Tax_{t-1} + \beta_4 Size_t + \beta_5 Lev_t + \beta_6 Ppe_t + \beta_7 Ocf_t + \beta_8 ROA_t + \beta_9 Age_t + \beta_{10} \sum Indu + \beta_{11} \sum Year + \epsilon_t \)

If \( \beta_3 \) is significantly greater than 0, it indicates that, the higher the tax burden of the previous period, the higher the innovation input level of the next period, supporting H1.

Model (2): \( R_d = \beta_0 + \beta_1 Tax_t + \beta_2 Tax_{t-1} + \beta_3 Tax_t * Tax_{t-1} + \beta_4 Tax_t * Tax_{t-1} * Soe_t + \beta_5 Soe_t + \beta_6 Size_t + \beta_7 Lev_t + \beta_8 Ppe_t + \beta_9 Ocf_t + \beta_{10} ROA_t + \beta_{11} Age_t + \beta_{12} \sum Indu + \beta_{13} \sum Year + \epsilon_t \)

If the sign of \( \beta_4 \) is significantly negative, it indicates that, compared with state-owned enterprises, the tax burden of non-state-owned enterprises has a stronger incentive effect on the level of innovation input in the next phase, supporting H2.

4. Empirical test

4.1. Descriptive statistics and correlation analysis

Descriptive statistical results are shown in Table 2. It can be seen that the minimum value of r&d investment (Rd) is 0 and the average value is 0.029872, indicating that the r&d investment level of gem listed companies is not high as a whole and needs to be further improved.
Table 2. Descriptive statistics of main variables

| Variable | Average | A quarter of the quantile | Median | Three-quarters of quantile | Three-quarters of quantile | Min | Max | Standard deviation |
|----------|---------|---------------------------|--------|---------------------------|---------------------------|-----|-----|-------------------|
| Rd       | 0.029872| 0.015312                  | 0.023008| 0.03647                  | 0.03647                  | 0   | 0.479695 | 0.025409 |
| Tax      | 0.033454| 0.018818                  | 0.030386| 0.043919                  | 0.043919                  | -0.37638 | 0.651353 | 0.031206 |
| Size     | 20.87028| 20.30736                  | 20.87004| 21.51636                  | 21.51636                  | 17.72996 | 24.54398 | 1.00439 |
| Lev      | 28.70366| 14.5618                   | 26.33   | 40.5596                   | 40.5596                   | 1.1034  | 103.7239 | 17.16244 |
| Ppe      | 0.1577  | 0.067037                  | 0.131659| 0.22199                   | 0.22199                   | 0      | 0.684926 | 0.118628 |
| Ocf      | 8.484188| 0.2084                    | 8.9728  | 18.584                    | 18.584                    | -553.782 | 386.0932 | 27.33569 |
| Roa      | 8.25338 | 3.4659                    | 6.6518  | 10.9575                   | 10.9575                   | -72.5465 | 67.089   | 8.560764 |
| Age      | 2.475505| 2.302585                  | 2.484907| 2.772589                  | 2.772589                  | 0      | 3.401197 | 0.383504 |
| Soe      | 0.135879| 0.0          | 0.0      | 0                         | 0                        | 1      | 0.342719 | 0.342719 |

The correlation analysis results are shown in table 3.

Table 3. Correlation analysis of major variables

|          | Rd | Tax | Size | Lev | Ppe | Ocf | Roa | Age | Soe |
|----------|----|-----|------|-----|-----|-----|-----|-----|-----|
| Rd       | 1.0000 |     |      |     |     |     |     |     |     |
| Tax      | -0.0230 | 0.2204 | 1.0000 |     |     |     |     |     |     |
| Size     | -0.333*** | 0.0000 | -0.066*** | 1.0000 |     |     |     |     |     |
| Lev      | -0.0150 | 0.4181 | -0.173*** | 0.142*** | 1.0000 |     |     |     |     |
| Ppe      | -0.097*** | 0.0000 | -0.128*** | 0.154*** | 0.0000 | 1.0000 |     |     |     |
| Ocf      | 0.109*** | 0.063*** | -0.167*** | -0.157*** | 0.102*** | 0.0000 | 1.0000 |     |     |
| Roa      | 0.353*** | 0.146*** | -0.516*** | -0.050*** | -0.072*** | 0.268*** | 0.0000 | 1.0000 |     |
| Age      | -0.108*** | 0.0000 | -0.073*** | 0.453*** | 0.077*** | 0.0290 | -0.085*** | 0.0000 | 1.0000 |
| Soe      | -0.0050 | 0.7726 | -0.047*** | 0.0230 | 0.0110 | 0.035* | -0.0140 | -0.041** | 0.0960 |

4.2. Regression analysis

In the regression analysis section, all proportion variables were winsorized (p=0.01) to eliminate the influence of outliers.

The regression results of model (1) are shown in table 4 (1), and the regression coefficient of the intersection term (Tax_t * Tax_{t-1}) is significantly positive at the statistical level of 1%, indicating that the early tax burden of an enterprise will change the relationship between the tax burden of the current period and the r&d investment level of the current period. Empirical results support H1.
Table 4. Regression results of model (1) & (2)

| The independent variables | The dependent variable- $Rd_t$ | The dependent variable- $Rd_t$ |
|---------------------------|-------------------------------|-------------------------------|
| $Tax_t$                   | -0.155***                    | -0.152***                    |
|                           | (-5.73)                      | (-5.59)                      |
| $Tax_{t-1}$               | -0.101***                    | -0.0951***                   |
|                           | (-3.74)                      | (-3.50)                      |
| $Tax_t * Tax_{t-1}$       | 1.441***                     | 1.470***                     |
|                           | (4.51)                       | (4.61)                       |
| $Tax_t * Tax_{t-1} * Soe_t$ | -1.527**                  | -1.527**                     |
|                           | (-2.31)                      | (-2.31)                      |
| $Soe_t$                   | 0.00370***                   |                               |
|                           | (2.93)                       |                               |
| $Size_t$                  | -0.00553***                  | -0.00546***                  |
|                           | (-10.61)                     | (-10.46)                     |
| $Lev_t$                   | 0.00000521                   | 0.00000626                   |
|                           | (0.23)                       | (0.27)                       |
| $Ppe_t$                   | -0.0157***                   | -0.0157***                   |
|                           | (-4.67)                      | (-4.67)                      |
| $Ocf_t$                   | 0.0000421*                   | 0.0000453**                  |
|                           | (1.96)                       | (2.10)                       |
| $ROA_t$                   | 0.000843***                  | 0.000854***                  |
|                           | (13.11)                      | (13.26)                      |
| $Age_t$                   | 0.00397***                   | 0.00409***                   |
|                           | (3.38)                       | (3.48)                       |
| _cons                     | 0.123***                     | 0.120***                     |
|                           | (10.90)                      | (10.57)                      |

***, ** and * represent significant levels of 1%, 5% and 10% respectively.

Model (2) the regression results as shown in table 4 (2) of the column, the current tax burden and lag issue of tax burden by item ($Tax_t * Tax_{t-1}$) the regression coefficients of significant for level is around 1%, and the current tax burden and the lag issue of tax burden as well as the property nature of virtual variable pay by item ($Tax_t * Soe_t * Tax_{t-1}$) the regression coefficient on the 5% level of statistical significant negative, that when the Soe value is 1 (state-owned property rights) will change the previous tax burden of current innovation investment level of positive incentive. Empirical results support H2.

5. Research conclusions and Suggestions

5.1. Research findings
The empirical results show that the tax burden of enterprises has an incentive effect on the level of innovation input in the next phase, and compared with state-owned enterprises, the tax burden of non-state-owned enterprises has a stronger incentive effect on the level of innovation input in the next phase.
5.2. 

**Suggestions**

This paper put forward the following Suggestions: support the innovative activities of tax preferential policies formulated by the state needs to be from the incentive to encourage innovation, r&d inputs such as tax incentives linked with high and new product sales revenue growth, with the introduction of market forces so stimulate enterprises to research and development resources into social need of innovation activities, so as to improve the resource utilization efficiency of r&d activities, improve the efficiency of social resource allocation, promote social welfare.

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