Taxation Preference, Earning Management and R&D Expense -- A Empirical Analysis

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Abstract

Both of the R&D expenses 1.5X pre-tax deduction and the relative flexibility in R&D accounting made R&D investments the most favorite instrument of companies to avoid corporate taxation. On the other side, the exogenous certification for HNTE offers good research opportunities to check how enterprises respond to tax rate changes by adjusting R&D investment. Using a data set from capital market during 2010 to 2012, empirical findings from DID analyses are consistent with the tax-induced R&D shifting. This paper enriches the research on R&D responses to tax rate changes by bringing evidences about R&D shifting behaviors in an important developing market. Furthermore, this study brings insights into the debates of R&D tax and accounting policies.

Keywords: *Taxation preference, earnings management, R&D expense, difference-in-difference model, pre-tax deduction*

I. Introduction

Tax preference policy is one of the most important public policies to boost the development of the economy and the companies' R&D investment. As one of the world's fastest-growing emerging markets, promoting R&D activities of enterprises is critical for China to foster economic growth and gain competitive advantages in global markets. China's Corporate Income Tax Law states that high-new technology enterprises (HNTEs) enjoy a preferential tax rate of 15%. Since 2008, HNTEs have to go through the certification process every three years to hold the preferential tax rate. Companies who failed in the review would have to bear a distinct tax rate increase from 15% to 25%. In addition, according to the *Corporate Income Tax Law Enforcement Regulation* of China, R&D expenses are 1.5X pre-tax deductible.

How did the taxation preference policies of China affect the behavior of R&D investment? some considered that there was an increase in the investments of targeting assets, some studies found that firms cut R&D to boost earnings [1]. Financial reporting incentives often conflict with tax incentives, because reductions in taxable income frequently result in lower book profits and/or equity, on the other side, increases in accounting income always drive up taxable income at the same time. These same direction changes force managers to balance book and tax costs in their decision making process. Typically, papers in this field employ a cross-sectional approach to check the correlation between an enterprise's R&D investments and its tax attributes. However, the cross-sectional approach might be inappropriate because it is difficult to make causal inferences. Looking for exogenous changes in tax rates, and checking how enterprises respond to tax rate changes by adjusting R&D investment could overcome this problem effectively. The exogenous certification policy for high-new technology companies in China offers a good research opportunity. This study investigates whether companies shift their R&D expenses over time in anticipation of a distinct tax rate increase brought by the certification process.

Hanlon & Heitzman encourage accounting researchers to increasingly leverage the comparative advantages to examine ''real'' corporate decisions, issues important in tax policy debates, and the incentive structures involved in corporate tax reporting [2]. This study actually makes an attempt in this direction. Using a data set from Shenzhen and Shanghai Stock Exchanges during 2010 to 2012, all the findings of this study are consistent with the tax-

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induced R&D shifting under the given regulatory incentive structure in China. Specifically, the results indicate that companies with an actual tax rate increase from 15% to 25% shifted R&D expenses from 2010 to 2011 and 2012 to save taxation in the high tax rate periods; companies with a stable preferential 15% tax rate also shifted R&D expenses from the year facing the distinct tax rate increase to following certification periods to meet the prerequisite of keeping the 15% tax rate. This study provides useful implications for taxation policymakers and accounting standards setters. In addition, investors and financial analysts of the capital market, external auditors are all concerned about companies' short-term income shifting behavior across periods.

The remainder of the study is organized as follows. Part 2 reviews relevant literature that investigating the influence of tax rate changes on corporate "real" investment decisions. Part 3 provides institutional background. Part 4 is theoretical analysis. In Part 5, the empirical design is explained and specific hypotheses are proposed.Part 6 shows empirical analysis results. Part 7 gives conclusions and directions for future research.

II. Literature Review

In the case of exogenous tax rate changes, researchers may overcome the problem associated with the cross-sectional approach, and better explore whether and to what extent enterprises respond to the changes in tax rates by adjusting R&D investment to save taxation. Slemrod found that the timing of economic transactions in response to tax rate changes was likely most responsive to tax incentives, which economists and accounting researchers have both studied to a limit extent [3]. Related results enrich the studies on earnings management for tax avoidance and provide some reference to reforms in tax policy and government controls.

Boynton et al. found that firms affected by the U.S. corporate alternative minimum tax (AMT) managed their earnings to reduce tax burden [4]. Dhaliwal et al. found that in order to minimize the AMT tax burden, companies would transfer earnings cross periods [5]. Scholes et al. also provided evidence that firms deferred revenue recognition and/or accelerated expense recognition in anticipation of these declining tax rates and discussed cross-sectional differences in firms' propensities to shift income [6]. Guenther found that companies managed accounting income from a high tax rate period to a low tax rate period through accruals [7].

In China, Wang et al. found that companies facing tax rate decreases deferred earnings obviously from 2007 to 2008; but companies with increasing tax rate didn't [8]. Li & Zheng found that methods of earnings management vary with respect to directions of tax rate changes. Companies facing increasing tax rates mainly manipulate real activities, and companies with decreasing tax rates mainly carry out accrual management [9].

Testing the income shifting behaviors through R&D expenses of Chinese companies around the certification for HNTEs in 2011, this study makes several contributions to the research community and brings some beneficial enlightenment to tax and accounting policy makers. Firstly, this study contributes to the literature investigating the effectiveness of R&D tax incentives and brings insights into the R&D tax policy debate in important ways. Secondly, this study extends the related literature on tax induced earnings management:(1) with R&D investment as real instrument, or (2) with the decision to expense or capitalize R&D spending as accounting instrument, therefore brings insights into the disputing on R&D accounting policies. Finally, this paper enriches the research on R&D responses to tax rate changes by bringing evidences from developing markets. As it can be seen from the literature review, most of the evidences in this field come from the U. S. In the context of Chinese certification for high-new technology companies, this study verifies R&D shifting behaviors in response to tax rate increases in an important developing market.

III. Institutional Background in China

R&D tax incentives vary widely among countries. As one of the world's fastest-growing developing countries, Chinese government encourages and R&D activities of enterprises through both taxation regulation and accounting standard.

3.1 Certification and tax rate changes

From the early 1990s, China adopted a dual corporate income tax policy: one was for Chinese domestic companies and another was for foreign investment companies. In order to encourage the foreign investment, foreign investment companies had preferential tax treatments compared to domestic companies. And in 2007, China passed a new Corporate Income Tax Law (CIT) (implemented in 2008) which unified the corporate income tax rate for foreign invested companies and domestic companies. So the domestic companies' tax rate have been reduced from 33% to 25% since 2008. Most of the firms' tax rate, which had been at 15%, gradually increased,18% for 2008, 20% for 2009, 22% for 2010, 24% for 2011, 25% for 2012 respectively. Only two kinds of companies still enjoyed the 15% preferential tax rate: companies with high-new technology status and companies in the western under-developed regions of China.

According to the 28th provision of China's CIT Law, high-new technology companies may enjoy a preferential tax rate of 15%. A HNTE certificate is valid for three years from the date of issue, and is eligible for renewal through a re-assessment procedure three months prior to its expiration since 2008. Companies who pass through the re-assessment process would continue to have the preferential 15% tax rate, while companies which fail the re-assessment would have to bear a distinct tax rate increase from 15% to 25%. This exogenous certification policy for HNTE offers good research opportunities to check how enterprises respond to tax rate changes by adjusting R&D investment.

According to *High Technology Enterprise Certification Administrative Measures*, R&D activities are activities taken by companies to obtain scientific and technological (not including the humanities, social sciences) new knowledge, to realize creative uses of science and technology, or to improve technologies and products (services) substantially. An enterprise should satisfy some conditions simultaneously to be recognized as HNTE. For example, companies should have independent intellectual property rights for the core technology of its main products (services); its products (services) should be in the *High and New Technology Field with National Key Support*; the number of scientific and technical personnel with a college degree or above should account for more than 30% of the total personnel of the enterprise; R&D personnel should account for 10% of the total personnel of the enterprise; the annual revenue of its high-tech products (services) should account for more than 60% of the total revenue of the year.

In the certification process, R&D expense indicators always suffer the most of attention. The percentage of total R&D expenses on total revenue of the last three years should in accordance with the following requirements:

(1) The proportion of total R&D expenses on total revenue of the last three years should be more than 6% for an enterprise, whose revenue for the last year was less than 50 million RMBs (Chinese currency unit);

(2) The proportion of total R&D expenses on total revenue of the last three years should be more than 4% for an enterprise, whose revenue for the last year was between 50 million and 200 million RMBs;

(3) The proportion of total R&D expenses on total revenue of the last three years should be more than 3% for an enterprise, whose revenue for the last year was more than 200 million RMBs.

Because *High Technology Enterprise Certification Administrative Measures* took effect on Jan. 1st 2008, most of Chinese high-new technology enterprises have been recognized in 2008. These enterprises should again make their applications for recognition in 2011.

3.2 Pre-tax super deduction

To encourage R&D investment and enhance Chinese companies' capacity for independent innovation, the 29th

provision of the *CIT Law Enforcement Regulation* has pointed out the150% pre-tax super deduction on qualified R&D expenditures incurred during the year. Specifically, *Enterprise R&D Expense Tax Deductible Administrative Measures* regulated that, actual R&D expense itself plus its 50% can be immediately deducted from annual taxable income. Besides, the cost of intangible assets, which is capitalized from R&D activities, should also be amortized with 1.5X before tax over a period longer than 10 years. This period begins from the moment the outcome (product or process) is ready to be used. For example, when the actual R&D expense for the current year is 100, the taxable income can be deducted by 150. Relative to other expenses, R&D expenses can save more taxation, or have relative smaller negative effects on accounting earnings on the other side. R&D expense becomes the first choice of enterprise to engage in tax avoiding earnings management.

3.3 R&D accounting

Some researchers have stressed that the effect of tax policy on investment decisions does not depend solely on the statutory tax rate, but also on the timing of deductions from taxable income. Accordingly, accounting rules for expensing or capitalizing R&D expenditures, for the amortization of intangible assets also impact R&D investments to a great extent.

Chinese R&D accounting regulations are substantially consistent with IAS No. 38 “Intangible Assets”. Specifically, according to Article 7 of the Chinese ASBE No. 6 “Intangible Assets", which was issued in February 2006 by MoF, expenditures for internal research and development projects of an enterprise shall be classified into research expenditures and development expenditures. The term "research" refers to the creative and planned investigation to acquire and understand new scientific or technological knowledge. The term "development" refers to the application of research achievements and other knowledge to a certain plan or design, prior to the commercial production or use, so as to produce any new material, device or product, or substantially improved material, device and product.

Concerning development expenditures, ASBE No. 6 allows companies to capitalize them under certain conditions. Specifically, Article 9 states that development expenditures for internal research and development projects of an enterprise may be confirmed as intangible assets when they satisfy the following conditions simultaneously: (1) It is technically feasible to finish the intangible assets for use or sale; (2) It is intended to finish and use or sell the intangible assets; (3) The usefulness of methods for intangible assets to generate economic benefits shall be proven, including being able to prove that there is a potential market for the products manufactured by applying the intangible assets or there is a potential market for the intangible assets itself or the intangible assets will be used internally; (4) It is able to finish the development of the intangible assets, and able to use or sell the intangible assets, with the support of sufficient technologies, financial resources and other resources; and (5) The development expenditures of the intangible assets can be reliably measured.

In practice, R&D activities are of diversity. The division into the research or the development phase has strong industrial characteristics, and is affected by subjective judgment to a great extent. In addition, management can also exercise discretion in deciding whether the conditions of Article 9 have been satisfied to capitalize development expenditures. The Chinese accounting standard for intangible assets gives management considerable flexibility regarding the treatment of R&D expenditures.

Ⅳ. Hypothesis Proposal and Model Construction

4.1 Sample and data

The sample selection begins with all firm-year observations of A-share Chinese firms that were listed on the Shenzhen and Shanghai stock exchanges during 2010 to 2012. The exogenous certification policy for high technology companies in China offers powerful research settings to investigate enterprises’ responses to tax rate changes. Taking 2010-2012 as the observation period, this study basically avoids the impacts of the Global

Financial Crisis and the implementation of ASBEs, and provides more persuasive conclusions. while excluding the following firm-year observations:

(1) AB-share and AH-share companies, because both H-share market and B-share market are subject to better legal environments for investor protection, more strict market restriction and disclosure requirement than domestic A-share market.

(2) ST and PT companies during 2010 to 2012;

(3) Companies who initially public offered or delisted after the end of 2009;

(4) Financial industry companies;

(5) Observations with missing values;

(6) Firm-year observations, with tax rate alterations of subsidiary companies opposite to the tax rate changing direction of the parent company. The tax rate for every company group is mainly decided by the tax rate of the listed parent company. But tax rate alterations of subsidiary companies have also been considered to eliminate negative influences on the tax rate change of parent company.

So far 1896 firm-year observations with tax rate data have been collected.

To concentrate on the R&D shifting behavior and to construct a difference in difference model, following firm-year observations which can not be allocated in one of the tax groups defined in Table 1 have further been deleted from the dataset.

(1) Companies with a stable 25% nominal tax rate, corresponding to 486 firm-year observations;

(2) Companies with a decreasing nominal tax rate, corresponding to 33 observations;

(3) Companies, whose nominal tax rate has increased gradually during the research period, namely 22% in 2010, 24% in 2011 and 25% in 2012. This consists of 72 observations;

(4) Companies, whose tax rate firstly increased and then decreased, or the other way round. This includes 33 observations;

(5) Companies with a stable 15% nominal tax rate, but their certification year was 2010 (18 observations) or 2012 (150 observations);

(6) Companies whose nominal tax rate increased from 15% to 25%, but their certification year was 2010 (0 observations) or 2012 (33 observations).

Finally, the sample consists of 1071 firm-year observations with a stable 15% nominal tax rate, or with a distinct tax rate increase from 15% to 25%.The data analysis is completed through Stata12.0.

Specific sample construction is showed in Table 1.

Table 1 Sample constitution by groups

Group	Nominal tax rate	Year of certification	Number of observations
1	increasing from 15% to 25%	2011	84

2	stable 15%	2011	846
3	stable 15%	no certification	141

Group1 stands for companies, which have not passed through the certification process in 2011 and hence had a distinct tax rate increase from 15% in 2010 to 25% in 2011 and 2012. Binary variable In1112 is representative of group1.

Group2 includes high-new technology companies with a stable 15% tax rate from 2010 to 2012. These companies have all passed through the certification process in 2011. Binary variable HighTech is used to represent group2.

Group3 includes companies, who had the stable preferential 15% tax rate during the research period, but did not have to go through the certification process. This group is used as a control group in the difference-in-difference analysis.

Companies in Group3 are enterprises under the catalogue of encouraged industries in the western regions of China, which can also enjoy the 15% preferential tax rate. According to the Circular of the State Council concerning Several Policies on Carrying out the Development of China's Vast Western Regions in 2000, with regard to enterprises with domestic investment or foreign investment of industries encouraged by the state, which are established in the western regions, business income tax shall be levied upon 15%. This policy applies to years 2001 to 2010. As clarified in the Announcement of State Administration of Taxation on Issues of Corporation Income Tax Concerning In-depth Implementation of Western Development Strategy, which was issued by the State Administration of Taxation on April 6, 2012, enterprises under the catalogue of encouraged industries in the western regions of China can still enjoy the reduced CIT rate of 15% for the period from January 1, 2011 to December 31, 2020.

The sample data was collected from the CCER database and has been compared to the CSMAR database in order to ensure the greatest degree of accuracy. When the related information from the database is not sufficient, for example, to find out the specific tax rate of the parent company or subsidiary companies for every year of the research period, or to make sure the year of certification for high technology companies, notes of related annual reports have also been checked.

4.2 Variables

R&D expenses included in the subsidiary account of Administrative Expenses would be directly deducted from revenues to get the total profit in the income statement and be deducted with 1.5X to get the taxable income of listed Chinese companies. Listed companies should disclose expensed R&D expenditures in the notes of administrative expenses account in their annual reports. But for the research period from 2010 to 2012, only few company have disclosed detailed administrative expenses of the parent company. Consequently, RDExpense, which is R&D Expense of the corporate group disclosed in the notes of consolidated financial statements, and RDRatio, which is RDExpense divided by the beginning asset, are used as dependent variables.

Y10 is a time dummy indicating the year 2010. Similarly, dummy variable Y1112 is respective of year 2011 and year 2012. Because group1 and group2 companies all went through the certification process in 2011, Y10 also stands for the year preceding the certification, and Y1112 means two years following the certification for the treatment groups (group1 and group2). To test the R&D shifting effect, these variables are necessary to construct interactions of concern.

To mitigate the concern that correlated omitted variables may explain the results, a set of control variables affecting R&D expensing and R&D shifting are also taken into the model. Shackelford & Shevlin [10] looked forward more papers to investigate the influences of potential cross-sectional differences on the willingness or

ability of firms to avoid taxes. The research models to test R&D shifting behavior in this study also enable us to examine the effect of some firm-specific variables on the extent of their tax aggressiveness.

Dummy variable stands for the type of company's ultimate ownership. The ultimate owner is defined as the final controlling shareholder of the first major shareholder of a listed company. Accordingly, the ultimate owner of a state-owned company is the state. The ultimate owner of a private-owned company is individual. The variable State is included in some models of this study to control the effect of the ultimate ownership on R&D expenses. According to the agency theory, private-owned companies are more willing to invest in R&D activities to obtain long-term investment returns. Li and Xia found that the R&D intensity of non-state-controlled high-new technology firms is significantly higher than that of state-controlled firms. On the other side, state-owned firms might enjoy more favorable treatments and policies from the government and can therefore spend more money on R&D activities [11]. Consequently, we do not expect specific direction of the coefficient of State in the model.

State and its interactions with R&D shifting variables are also included in some of the models to control the effect of different ultimate owners on company's R&D shifting behavior.Prominent researchers, such as Scholes, Wolfson, Erickson, Maydew, and Shevlin called for more research to examine tax aggressiveness within an agency context [12]. In their review of the empirical tax literature, Shackelford and Shevlin pointed out that insider control and other organizational factors, such as ownership structure, are important, but understudied, determinants of tax aggressiveness [10]. The agency conflicts in state-owned versus private-owned Chinese companies are different because of the "absence of owner" and the "insider control" phenomena in state-owned companies. Wang et al. found that, state-owned firms have been less sensitive to the change in the debt tax shield than non-state-owned firms since the 2008 CIT Law. Especially, it is expected that, compared to state-owned companies, private-owned companies are more likely to incorporate firm value maximization in their decision making process and are more aggressive to engage the R&D shifting behavior to avoid tax [8].

SME&GEM is a dummy variable to control influences from different levels of Chinese capital market. The Chinese capital market has three different levels: main board, small and medium-sized enterprises board (SMEB) and growth enterprise market (GEM). Main board is the stock market in the traditional sense and comprises the most important part of Chinese capital market. Main board market includes Shanghai Stock Exchange (SHSE) with the market code beginning with 600 or 60, and the Shenzhen Stock Exchange (SZSE), with the market code 000 or 001 at the beginning. With security code beginning with 002, SMEB offers listing and financing services for small and medium enterprises. SMEB is a unique product of China and was established in June 2004 on Shenzhen Stock Exchange. With the security code beginning with 300. It was established in October 2009 on the SZSE. Compared to main board companies, SMEs and companies on GEM have relatively smaller size, stronger innovation ability, and more stringent disclosure requirements. Accordingly, it is assumed that SME&GEM companies have relatively smaller R&D expenditure numbers, but relatively higher R&D ratios. Because of the relatively complete information disclosures about total R&D expenditures and R&D expenses, some further analyses are also done specifically for SME&GEM companies.

ManagStock, the percentage of shares that corporate management owns, is included to control the influence of management holding on R&D investments and R&D shifting for tax avoidance. Firstly, the management stock can reduce conflicts between managers and owners, and bring managers to make decisions on behalf of owners, such as R&D investment decision. Using insider ownership concentration as a proxy for reduced capital market pressure, Klassen found that firms with larger inside ownership concentration take larger losses (smaller gains) to save taxes when they are highly taxable, because the financial reporting cost is generally lower for these firms [13]. It is expected in this study that ManagStock has a positive influence on R&D expenditures and R&D shifting in response of a distinct tax rate increase.

To accurately capture the tax avoiding earnings management through R&D investments, other earnings management incentives such as income smoothing and debt agreements are also included in the models. Income-smoothing has usually been characterized as increasing or decreasing reported earnings when earnings of current

period are below or above the level of prior years. Markarian et al. has explained the motives for income smoothing in two ways. On the one side, earnings smoothing is a signaling instrument to deliver private information about company's profitability to the market, because current earnings in the income statement are used as a predictor for future earnings. Another primary motivation for earnings smoothing is to reduce perceived risk by investors, because earnings variability is interpreted as an important measure of the overall risk of a firm [14]. Consistent with earlier studies, EPS (earnings per share) is used to control the earnings management incentives to smooth earnings. When EPS increases, R&D expenses are also increased to decrease EPS; when EPS decreases, R&D expenses are decreased to increase EPS. It is expected that *EPS* has a positive influence on R&D expenses and would not influence the R&D shifting.

According to the agency theory, contracts between debt holders and owner-managers contain covenants restricting management behavior. Such covenants usually rely on accounting numbers. Within the elastic space of accounting standards, managers are expected to make asset- and income-increasing accounting choices to avoid violating debt covenants. Consistent with prior studies [15-18], a variable DebtRatio, computed as total debt divided by the total beginning asset, is used to proxy the earnings management incentives based on debt agreements. It is expected that companies with a high DebtRatio would tend to capitalize R&D expenditures instead of expensing. That means, DebtRatio has a negative influence on R&D expenses and would not influence the R&D expense shifting.

R&D investments exhibit significant variation across industries. In addition, there are different preferential tax policies directed against special activities of different industries. For example, according to the CIT Law, income from the project of agriculture, forestry, animal husbandry and fishery can be exempted or reduced; enterprises engaged in wastewater treatment also enjoy tax deduction and exemption. Managers of competitive industries pay more attention to reduce the tax burden and save cash flow. A series of categorial variables are therefore included to control the influence of industry on the relationship between taxation and R&D investment. Categorial variables Industry A – Industry S indicate the one-digit industry category, to which an enterprise belongs.

All variables in regression models are summarized in Table 2.

Table 2 Variable definitions

Variable name	Variable definition
Dependent variables	
$RDExpense_{i, t}$	RDExpense is the amount of R&D Expense included in the subsidiary account of Administrative Expenses of corporate i for year t, which is disclosed in the notes of consolidated financial statements.
$RDRatio_{i, t}$	RDRatio equals R&D expense of corporate i for year t divided by its total asset at the end of year t-1 in percentage points.
$RDExpenditure_{i, t}$	RDExpenditure is the total amount of R&D related payments of the current period disclosed in the Board of Director's Report of the annual report of corporate i for year t, which includes R&D expense and the capitalized R&D expenditure.
Test variables	
$In1112_{i, t}$	Dummy variable In1112 equals 1 for all three firm-year observations, when parent corporate i did not pass through the certification process in 2011 and had a distinct tax rate increase from 15% to 25% from year 2010 to 2011 and 2012, equals 0 otherwise. In1112 is representative of group1.
$HighTech_{i, t}$	Dummy variable HighTech equals 1 for all three firm-year observations, when the parent corporate i was re-certificated as high technology enterprise in 2011 and had the preferential 15% tax rate from year 2010 to 2012, equals 0 otherwise. HighTech is used to represent group2.
Year10	Dummy variable Year10 equals 1, when the observation is in year 2010; equals 0, when the observation is in year 2011 or 2012.

Year1112	Dummy variable Year1112 equals 1, when the observation is in year 2011 or 2012; equals 0, when the observation is in year 2010.
$Rev_{i, t}$	Operation revenue of corporate i for year t
$RevRatio_{i, t}$	Operation revenue of corporate i for year t divided by total asset at the end of year t-1 in percentage points.
$AssetBeg_{i, t}$	Total asset of corporate i at the end of year t-1
Control variables	
$State_{i, t}$	Dummy variable State equals 1, when the final controlling shareholder of the first major shareholder of the listed company i for year t is the state, equals 0 otherwise.
$SME\&GEM_{i, t}$	Dummy variable SME&GEM equals 1, when company i was listed on the Small and Medium-sized Enterprise Board (SMEB) or Growth Enterprise Market (GEM) of Shenzhen Stock Exchange in China in year t, equals 0 otherwise.
$EPS_{i, t}$	Earnings per Share of corporate i for year t
$ManagStock_{i, t}$	Percentage of shares owned by the management of corporate i in year t
$DebtRatio_{i, t}$	Total debt of corporate i for year t divided by total asset at the end of year t-1 in percentage points, that is DebtRatio = (the beginning debt/AssetBeg)*100.
Industry A-S	Categorial variables Industry A – S indicate the one-digit industry code according to Industry Classification Index of Listed Company published in 2001 by China Securities Regulatory Commission (CSRC).

4.3 Hypotheses development

According to the analysis, both of the tax and accounting rules in China make R&D investment becoming the most favorite instrument in response to the income tax rate increase from 15% to 25%. If managers attempt to minimize the tax expense of the firm, this distinct tax rate increase provides a substantial incentive to decrease taxable income.

Relative to other expenses, enterprises with higher tax rates tend to expense R&D expenditures firstly, because R&D expenses can be 1.5X deducted from current taxable income, but with the same negative effect on accounting income. Specifically, compared to companies with the 15% preferential tax rate but did not go through certification process (control group), companies with an actual tax rate increase from 15% to 25% in 2011 (group1) would shift R&D expenses from 2010 in anticipation of a distinct tax rate increase to following certification periods to save taxation in the higher tax rate periods.

Because an HNTE certificate is valid for three years from the date of issue. And for a company with revenue of the last year more than 200 million RMB to be recognized as high-tech enterprise again, the ratio of total R&D expense on total revenue of the latest three years should be more than 3%. Compared to companies with the 15% preferential tax rate but did not go through certification process (control group), companies with a stable preferential 15% tax rate from 2010 to 2012 (group2) would also shift R&D expenses from 2010 as facing the risk of a distinct tax rate increase to post-certification periods to meet the prerequisites of keeping the 15% tax rate. The following hypotheses will be tested in the DID analysis:

H1: Compared to control group companies, companies with an actual tax rate increase from 15% to 25% in 2011 (group1) would shift R&D expenses from 2010 to post-certification periods.

H2: Compared to control group companies, companies with a stable preferential 15% tax rate from 2010 to 2012 (group2) would shift R&D expenses from 2010 to post-certification periods.

H3: Compared to control group companies, companies with an actual tax rate increase from 15% to 25% in 2011

(group1) would shift R&D expenses to save taxation in the high tax rate periods.

H4: Compared to control group companies, companies with a stable preferential 15% tax rate from 2010 to 2012 (group2) would shift R&D expenses to meet the prerequisites of keeping the 15% tax rate.

4.4 Difference-in-Difference Models

Econometrically, difference-in-difference (DID) models are constructed to examine the R&D shifting effect, namely, whether listed Chinese companies defer R&D Expense facing the risk of a distinct tax rate increase.

Group1 and group2 are treatment groups in the DID analysis. Group1 includes high technology companies that passed through the re-certification in 2011 and had a constant 15% tax rate from 2010 to 2012. Group2 includes companies that failed in the re-certification process and had a distinct tax rate increase from 15% to 25% in 2011. The control group companies were under the catalogue of encouraged industries in the western regions of China and encouraged with a 15% preferential tax rate from 2010 to 2012 without certification. Because control group companies also enjoy the 15% preferential tax rate and also belong to encouraged industries, it is assumed that the control group can reproduce the counterfactual outcome trajectory that treated groups would have experienced in the absence of the certification. DID model (1) to model (6) are constructed as follows:

$$\begin{aligned}\mathrm{RDExpense}_{i,t} &= \beta_0 + \beta_1 \mathrm{Ln1112}_{i,t} + \beta_2 (\mathrm{In1112}*\mathrm{Y1112})_{i,t} + \beta_3 \mathrm{HighTech}_{i,t} \\ &+ \beta_4 (\mathrm{HighTech}*\mathrm{Y1112})_{i,t} + \beta_5 \mathrm{Y1112}_{i,t} + \beta_6 \mathrm{Rev}_{i,t} + \beta_7 \mathrm{State}_{i,t} + \beta_8 \mathrm{SME\&GEM}_{i,t} \\ &+ \beta_9 \mathrm{ManagStock}_{i,t} + \beta_{10} \mathrm{EPS}_{i,t} + \beta_{11} \mathrm{DebtRatio}_{i,t} + \beta_{11+j} \sum_{j=1}^{14} \mathrm{Industry}_j + \varepsilon\end{aligned} \quad (1)$$

$$\begin{aligned}\mathrm{RDRatio}_{i,t} &= \beta_0 + \beta_1 \mathrm{Ln1112}_{i,t} + \beta_2 (\mathrm{In1112}*\mathrm{Y1112})_{i,t} + \beta_3 \mathrm{HighTech}_{i,t} \\ &+ \beta_4 (\mathrm{HighTech}*\mathrm{Y1112})_{i,t} + \beta_5 \mathrm{Y1112}_{i,t} + \beta_6 \mathrm{RevRatio}_{i,t} + \beta_7 \mathrm{State}_{i,t} + \beta_8 \mathrm{SME\&GEM}_{i,t} \\ &+ \beta_9 \mathrm{ManagStock}_{i,t} + \beta_{10} \mathrm{EPS}_{i,t} + \beta_{11} \mathrm{DebtRatio}_{i,t} + \beta_{11+j} \sum_{j=1}^{14} \mathrm{Industry}_j + \varepsilon\end{aligned} \quad (2)$$

$$\begin{aligned}\mathrm{RDExpense}_{i,t} &= \beta_0 + \beta_1 \mathrm{Ln1112}_{i,t} + \beta_2 (\mathrm{In1112}*\mathrm{Y1112})_{i,t} + \beta_3 (\mathrm{Ln1112}*\mathrm{Y1112}*\mathrm{Rev})_{i,t} \\ &+ \beta_4 \mathrm{HighTech}_{i,t} + \beta_5 (\mathrm{HighTech}*\mathrm{Y1112})_{i,t} + \beta_6 (\mathrm{HighTech}*\mathrm{Y1112}*\mathrm{Re}v)_{i,t} + \beta_7 \mathrm{Y1112}_{i,t} \\ &+ \beta_8 \mathrm{Rev}_{i,t} + \beta_9 \mathrm{State}_{i,t} + \beta_{10} \mathrm{SME\&GEM}_{i,t} + \beta_{11} \mathrm{ManagStock}_{i,t} + \beta_{12} \mathrm{EPS}_{i,t} + \beta_{13} \mathrm{DebtRatio}_{i,t} \\ &+ \beta_{13+j} \sum_{j=1}^{14} \mathrm{Industry}_j + \varepsilon\end{aligned} \quad (3)$$

$$\begin{aligned}\mathrm{RDRatio}_{i,t} &= \beta_0 + \beta_1 \mathrm{Ln1112}_{i,t} + \beta_2 (\mathrm{In1112}*\mathrm{Y1112})_{i,t} + \beta_3 (\mathrm{Ln1112}*\mathrm{Y1112}*\mathrm{RevRatio})_{i,t} \\ &+ \beta_4 \mathrm{HighTech}_{i,t} + \beta_5 (\mathrm{HighTech}*\mathrm{Y1112})_{i,t} + \beta_6 (\mathrm{HighTech}*\mathrm{Y1112}*\mathrm{Re}vRatio)_{i,t} + \beta_7 \mathrm{Y1112}_{i,t} \\ &+ \beta_8 \mathrm{RevRatio}_{i,t} + \beta_9 \mathrm{State}_{i,t} + \beta_{10} \mathrm{SME\&GEM}_{i,t} + \beta_{11} \mathrm{ManagStock}_{i,t} + \beta_{12} \mathrm{EPS}_{i,t} + \beta_{13} \mathrm{DebtRatio}_{i,t} \\ &+ \beta_{13+j} \sum_{j=1}^{14} \mathrm{Industry}_j + \varepsilon\end{aligned} \quad (4)$$

$$\begin{aligned}RDExpense_{i,t} &= \beta_0 + \beta_1 Ln1112_{i,t} + \beta_2 (In1112*Y1112)_{i,t} + \beta_3 (Ln1112*Y1112*Rev)_{i,t} \\ &+ \beta_4 HighTech_{i,t} + \beta_5 (HighTech*Y1112)_{i,t} + \beta_6 (HighTech*Y1112*Rev)_{i,t} + \beta_7 Y1112_{i,t} \\ &+ \beta_8 Rev_{i,t} + \beta_9 State_{i,t} + \beta_{10} (In1112*Y1112*State)_{i,t} + \beta_{11} (HighTech*Y1112*State)_{i,t} \\ &\beta_{12} SME\&GEM_{i,t} + \beta_{13} (In1112*Y1112*SME\&GEM)_{i,t} + \beta_{14} (HighTech*Y1112*SME\&GEM)_{i,t} \\ &+ \beta_{15} ManagStock_{i,t} + \beta_{16} (In1112*Y1112*ManagStock)_{i,t} + \beta_{17} (HighTech*Y1112*ManagStock)_{i,t} \\ &+ \beta_{18} EPS_{i,t} + \beta_{19} (In1112*Y1112*EPS)_{i,t} + \beta_{20} (HighTech*Y1112*EPS)_{i,t} + \beta_{21} DebtRatio_{i,t} \\ &+ \beta_{22} (In1112*Y1112*DebtRatio)_{i,t} + \beta_{23} (HighTech*Y1112*DebtRatio)_{i,t} + \beta_{23+j} \sum_{j=1}^{14} Industry_j + \varepsilon\end{aligned} \quad (5)$$

$$\begin{aligned}RDRatio_{i,t} &= \beta_0 + \beta_1 Ln1112_{i,t} + \beta_2 (In1112*Y1112)_{i,t} + \beta_3 (Ln1112*Y1112*RevRatio)_{i,t} \\ &+ \beta_4 HighTech_{i,t} + \beta_5 (HighTech*Y1112)_{i,t} + \beta_6 (HighTech*Y1112*RevRatio)_{i,t} + \beta_7 Y1112_{i,t} \\ &+ \beta_8 RevRatio_{i,t} + \beta_9 State_{i,t} + \beta_{10} (In1112*Y1112*State)_{i,t} + \beta_{11} (HighTech*Y1112*State)_{i,t} \\ &\beta_{12} SME\&GEM_{i,t} + \beta_{13} (In1112*Y1112*SME\&GEM)_{i,t} + \beta_{14} (HighTech*Y1112*SME\&GEM)_{i,t} \\ &+ \beta_{15} ManagStock_{i,t} + \beta_{16} (In1112*Y1112*ManagStock)_{i,t} + \beta_{17} (HighTech*Y1112*ManagStock)_{i,t} \\ &+ \beta_{18} EPS_{i,t} + \beta_{19} (In1112*Y1112*EPS)_{i,t} + \beta_{20} (HighTech*Y1112*EPS)_{i,t} + \beta_{21} DebtRatio_{i,t} \\ &+ \beta_{22} (In1112*Y1112*DebtRatio)_{i,t} + \beta_{23} (HighTech*Y1112*DebtRatio)_{i,t} + \beta_{23+j} \sum_{j=1}^{14} Industry_j + \varepsilon\end{aligned} \quad (6)$$

To eliminate the potential collinearity problem of DID models, centering process has been done for all constitution variables of interaction terms, and post-centering variables are used to construct interaction terms. In addition, all of the numeric variables are transformed through winsorization at 1% level to eliminate effects of outliers.

Model (1) and model (2) are constructed to test Hypothesis 1 and 2. Model (1) uses the absolute amount RDExpense as dependent variable. Term $In1112*Y1112$ equals one when (1) company i failed the certification in 2011 and had a tax rate increase from 15% to 25% for the considered period, and (2) the observation is in 2011 or 2012; equals zero otherwise. Similarly, variable $HighTech*Y1112$ equals one when (1) company i passed through the certification in 2011 and had a stable 15% tax rate for the considered period, and (2) the observation is in 2011 or 2012; equals zero otherwise.

The coefficients of these two cross terms $In1112*Y1112$ and $HighTech*Y1112$, β_2 and β_4 give us the difference-in-differences estimates of the treatment effects, namely, the differences between treatment and control group in R&D Expenses preceding and following 2011. It is expected that β_2 and β_4 would be positive and statistically significant. In other words, it is expected that treatment groups would defer more R&D expenses than the control group.

Model (2) uses the relative amount RDRatio as dependent variable to eliminate the influence of corporate size. Similarly, the coefficients of the cross terms $In1112*Y1112$ and $HighTech*Y1112$, β_2 and β_4 give us the difference-in-difference estimates of the R&D shifting effects, namely, the differences between treatment and control group in R&D ratio before and after 2011. It is expected that β_2 and β_4 would be positive and statistically significant.

Furthermore, model (3) and model (4) are constructed to test Hypothesis 3 and 4, namely, the relationship between R&D shift and operating revenue. Model (3) uses absolute amounts of RD expenses and revenue, while model (4) uses relative amounts of RD expenses and revenue to eliminate the influence of corporate size.

Model (1) and model (3) includes two more terms, variable Ln1112*Y1112*Rev and HighTech*Y1112*Rev. The coefficient of Ln1112*Y1112*Rev, β_3 measures the relation between revenue and R&D expenses, when (1) company i failed the certification in 2011 and had an increasing tax rate from 15% to 25%, and (2) the observation is in 2011 or 2012. Similarly, the coefficient of HighTech*Y1112*Rev, β_6 measures the relation between revenue and R&D expenses, when (1) company i passed through the certification in 2011 and had a stable tax rate of 15%, and (2) the observation is in 2011 or 2012. In other words, β_3 and β_6, tell the extent that relative to the control group, R&D expenses was deferred in 2011 and 2012 by treatment companies to meet the certification prerequisites.

It is expected that the coefficient of HighTech*Y1112*Rev and β_6 would be significantly positive. As facing the risk of a distinct higher tax rate 25%, group2 companies would decrease R&D expenses in 2010 to increase taxable income. After the successful certification, they would increase R&D expenses in 2011 and 2012 to meet the prerequisite of certification. On the other side, it is expected that the coefficient of, Ln1112*Y1112*Rev and β_3 to be positive, but not significant. Group1companies had a distinct higher tax rate of 25% in 2011 and 2012 and would increase R&D expenses in 2011 and 2012 to 1.5X decrease taxable income.

It is expected to see the coefficient of HighTech*Y1112*RevRatio and β_6 in model (4) to be positive and significant, and coefficient of Ln1112*Y1112*RevRatio and β_3 in model (4) to be positive but not significant.

To further test the effects of firm-specific control variables and other earnings management incentives on R&D shifting, cross terms between R&D shifting variables and every control variable (except industry dummy variables) are included in model (5) and model (6). Model (5) uses absolute amount of RDExpense and Rev; model (6) includes relative amount RDRatio and RevRatio to eliminate the influence of corporate size.

Ⅴ. Empirical Results

5.1 Descriptive statistics

Some descriptive statistics are given to show the basic characteristics, trends and correlations of the variables in the data.

5.1.1 Summary statistics of R&D expense by year and group

Table 3 reports the summary statistics of dependent variables for every tax group by year. Results of RDExpense are shown in part1 and results of RDRatio in part2. The differences of means or medians for every group between 2011 and 2010, 2012 and 2010, have also been tested respectively. Because the means or medians of different years are based on observations of the same sample, paired sample t-test is conducted to test the differences of means, Wilcoxon signed rank test to examine the differences of medians between post- and pre-certification periods.

Table 3 Summary statistics of RDExpense / RDRatio by year and group

Tax Group	Year	#Obs	Mean	Std. Dev.	Median	H_0: DIFF(2011 - 2010)=0 /H_0: DIFF(2012 - 2010)=0	
						T (P: T>T)	Z (P> |Z|)

Part1: RDExpense							
group1 (In1112=1)	2010	28	3.59e+07	4.44e+07	1.41e+07	3.41*** (0.001)	3.83*** (0.000)
	2011	28	4.94e+07	5.72e+07	1.83e+07		
	2012	28	7.90e+07	1.39e+08	2.56e+07	2.04** (0.025)	4.40*** (0.000)
	total	84	5.48e+07	9.10e+07	1.99e+07		
group2 (HighTech= 1)	2010	282	5.01e+07	9.60e+07	2.20e+07	8.99*** (0.000)	10.74*** (0.000)
	2011	282	6.25e+07	1.04e+08	3.20e+07		
	2012	282	7.33e+07	1.12e+08	4.01e+07	10.50*** (0.000)	11.98*** (0.000)
	total	846	6.20e+07	1.04e+08	3.03e+07		
group3 (control)	2010	47	1.69e+07	1.91e+07	8864016	1.09 (0.140)	1.41 (0.159)
	2011	47	1.86e+07	2.07e+07	1.20e+07		
	2012	47	2.72e+07	3.14e+07	1.46e+07	3.33*** (0.001)	3.03*** (0.002)
	total	141	2.09e+07	2.46e+07	1.12e+07		
total sample	2010	357	4.46e+07	8.72e+07	1.95e+07	9.50*** (0.000)	11.26*** (0.000)
	2011	357	5.57e+07	9.53e+07	2.63e+07		
	2012	357	6.77e+07	1.08e+08	3.42e+07	9.42*** (0.000)	13.14*** (0.000)
	total	1071	5.60e+07	9.76e+07	2.56e+07		
Part2: RDRatio							
group1 (In1112=1)	2010	28	2.14	2.47	0.98	1.58* (0.063)	1.67* (0.094)
	2011	28	2.50	2.48	1.89		
	2012	28	2.68	2.57	2.21	1.96** (0.030)	2.19** (0.029)
	total	84	2.44	2.49	1.76		
group2 (HighTech= 1)	2010	282	1.92	1.61	1.54	2.66*** (0.004)	3.08*** (0.002)
	2011	282	2.08	1.61	1.77		
	2012	282	2.08	1.62	1.86	2.29*** (0.011)	2.63*** (0.009)
	total	846	2.03	1.62	1.68		
group3 (control)	2010	47	1.25	2.31	0.41	-1.25 (0.891)	-0.59 (0.557)
	2011	47	0.92	1.61	0.44		
	2012	47	1.01	1.64	0.53	-1.00 (0.840)	0.86 (0.388)
	total	141	1.05	1.88	0.44		
total sample	2010	357	1.85	1.80	1.38	1.80** (0.037)	3.08*** (0.002)
	2011	357	1.96	1.74	1.56		
	2012	357	1.99	1.76	1.64	2.03** (0.021)	3.23*** (0.001)
	total	1071	1.93	1.77	1.52		

* t statistics come from paired (samples) t-test, z value is the result of the Wilcoxon signed rank test. RDExpense and RDRatio are both transformed through winsorization at 1% level to eliminate effects of outliers.

Table 3 shows that the means and medians of RDExpense or RDRatio in group1 and group2 are generally larger than corresponding means and medians in group3.

As shown in part1 of Table 3, RDExpense of 2011 or 2012 are significantly larger than that of 2010 for both group1 and group2. The differences of means and medians between 2011 and 2010, or 2012 and 2010 in group2 are much larger and more significant than differences in group1. The t-values and z-values in group2 are all larger than 9, and all significant at 0.1% level. In contrast, the t-values and z-values in group1 are all smaller than 4.5. For the control group, the differences of means (t = 0.72) and medians (z = 1.26) between 2011 and 2010 are both not significant, but the differences of means (t = 3.33) and medians (t = 3.03) between 2012 and 2010 are both significant at 1% level.

As shown in part2 of Table 3, RDRatio of 2011 or 2012 are significantly larger than that of 2010 for both group1 and group2. Similar to results in part1, the differences of means and medians between 2011 and 2010, or 2012 and 2010 in group2 are much larger and more significant than the differences in group1. The t-values and z-values in group2 are all significant at 1% level. In contrast, the t-value and z-value of differences between 2011 and 2010 in group1 are only significant at 10% level; the t-value and z-value of differences between 2012 and 2010 in group1 are only significant at 5% level. For the control group, the differences of means (t = -1.35) and medians (z = -0.80) of RDRatio between 2011 and 2010 are both negative and not significant, and the differences of means (t = -1.00) and medians (t = 0.86) between 2012 and 2010 are also not significant.

In a word, even these simple descriptive statistics show considerable differences in the trends of R&D investment between test and control groups from 2010 to 2012. Because descriptive analysis can neither statistically compare the trends among different groups, nor control influences of other factors, a more rigorous analysis will be given by means of the DID regression.

5.1.2 Summary statistics of main variables

Table 4 shows some summary statistics of numeric variables for the whole sample.

Table 4 Summary statistics of main variables

Variables	Mean	Std. Dev.	Smallest	Median	Largest
Rev	3.11e+09	5.31e+09	1.44e+08	1.43e+09	3.73e+10
Revratio	83.430	43.867	18.799	72.568	260.8
Eps	0.375	0.380	-0.512	0.31	1.83
Debtratio	42.04	18.78	5.33	42.88	80.44
Managstock	5.22	11.90	0	0.006	58.58

Variables are all transformed through winsorization at 1% level to eliminate effects of outliers.

As shown above, mean/median of Rev equals 3.11e+09 / 1.43e+09 respectively. Both of these two numbers are much larger than 2e+08, which is one of the benchmarks in certification prerequisites. Only the smallest value of Rev (1.43e+09) is smaller than 2e+08. More specifically, there are only 31 observations in the data with revenues smaller than 2e+08. Thus, according to High Technology Enterprise Certification Administrative Measures, the proportion of total R&D expenses on total revenue of the last three years should be more than 3% for most of the treatment companies to be recognized as high-new technology enterprises.

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proportion of total R&D expenses on total revenue of the last three years should be more than 3% for most of the treatment companies to be recognized as high-new technology enterprises.

5.2 Correlations of variables

Table 5 reports Pearson correlations of variables in the regression models.

Table 5 Pearson correlations of variables

	RDExpense	RDRatio	Rev	RevRatio	State	EPS	ManagStock	DebtRatio
RDExpense	1							
RDRatio	.426***	1						
Rev	.659***	-.017	1					
RevRatio	.245***	.212***	.41***	1				
State	.091***	-.18***	.21***	.078**	1			
EPS	.311***	.24***	.20***	.25***	-.0433	1		
ManagStock	-.083***	.184***	-.17***	-.10***	-.40***	.086***	1	
DebtRatio	.214***	-.14***	.37***	.255***	0.29***	-.15***	-.295***	1

* indicates p (0, 0.10], ** indicates p (0.10, 0.05], *** indicates p (0.05, 0.01]

Variables are all transformed through winsorization at 1% level to eliminate effects of outliers.
As can be seen from Table 5, all of the control variables have significant correlations with dependent variables in the model, namely, RDExpense or RDRatio. This means that control variables can effectively control other factors influencing R&D expenses of a company. In addition, there are no large correlations among control variables. All of these indicate that the models fit well.

5.3 Regression results

Table 6 R&D shifting preceding and following certification year 2011

	(1) RDExpense	(2) RDRatio	(3) RDExpense	(4) RDRatio	(5) RDExpense	(6) RDRatio
In1112	.212***	.205***	0.210***	.209***	.214***	.209***
	(7.63)	(5.77)	(7.55)	(5.88)	(7.57)	(5.81)
In1112*Y1112	0.045*	0.066*	0.048*	0.062*	0.049*	0.061*
	(1.69)	(1.95)	(1.70)	(1.81)	(1.70)	(1.71)
HighTech	.256***	.193***	.254***	.198***	.257***	.199***
	(9.13)	(5.37)	(9.05)	(5.51)	(9.06)	(5.53)
HighTech*Y1112	.043	.075*	.037	.067*	.038	.081*
	(1.37)	(1.87)	(1.16)	(1.67)	(1.14)	(1.89)
Year1112	.045	.028	.053*	.033	.048	.015
	(1.63)	(0.80)	(1.87)	(0.94)	(1.62)	(0.40)
Rev	.619***		.619***		.620***	
	(25.22)		(25.14)		(25.05)	
In1112*Y1112*Rev			.021		.022	
			(0.82)		(0.73)	
HighTech*Y1112*Rev			.030		.024	
			(1.29)		(0.91)	
RevRatio		.217***		.213***		.214***
		(7.18)		(7.06)		(7.06)
In1112*Y1112*RevRatio				.048		.052
				(1.56)		(1.49)

HighTech*Y1112*RevRatio				.07**		.07**
				(2.23)		(2.15)
State	-.037	-.020	-.037	-.022	-.036	-.021
	(-1.38)	(-0.60)	(-1.38)	(-0.65)	(-1.36)	(-0.62)
In1112*Y1112*State					.015	-.016
					(0.49)	(-0.38)
HighTech*Y1112*State					.002	-.017
					(0.07)	(-0.43)
SME&GEM	-.047*	.149***	-.047*	.150***	-.045	.150***
	(-1.70)	(4.21)	(-1.69)	(4.24)	(-1.60)	(4.24)
In1112*Y1112*SME&GEM					-.004	-.040
					(-0.11)	(-0.87)
HighTech*Y1112*SME&GEM					.004	.002
					(0.12)	(0.04)
ManagStock	-.006	.066**	-.007	.063**	-.006	.068**
	(-0.26)	(2.09)	(-0.29)	(1.99)	(-0.25)	(2.14)
In1112*Y1112*ManagStock					.026	.072
					(0.73)	(1.57)
HighTech*Y1112*ManagStock					.002	.026
					(0.08)	(0.66)
EPS	.181***	.169***	.181***	.170***	.180***	.166***
	(7.94)	(5.74)	(7.94)	(5.77)	(7.81)	(5.60)
In1112*Y1112*EPS					.019	-.035
					(0.65)	(-0.95)
HighTech*Y1112*EPS					.033	.009
					(1.26)	(0.28)
DebtRatio	.027	-.035	.027	-.032	.028	-.032
	(1.03)	(-1.05)	(1.02)	(-0.97)	(1.06)	(-0.97)
In1112*Y1112*DebtRatio					.010	-.019
					(0.31)	(-0.49)
HighTech*Y1112*DebtRatio					.006	-.016
					(0.21)	(-0.43)
Industry			controlled			
F	53.61	14.11	49.21	13.19	34.59	9.43
adj. R^2	0.520	0.212	0.520	0.215	0.516	0.211
N	1071	1071	1071	1071	1071	1071

* indicates p (0, 0.10], ** indicates p (0.10, 0.05], *** indicates p (0.05, 0.01]

Standardized coefficients in Model (1) to Model (6) are presented to eliminate dimension influence.

Regression results of model (1), which uses RDExpense as dependent variable, are reported in Column 1 of Table 6. F-value of mode (1) is 53.61, adjusted R^2 equals 52.0%. As expected, the standardized coefficient of In1112*Y1112 is positive, and significant at 10% level with t=1.69. This shows that relative to control group, companies who didn't pass through the certification shifted more R&D expenses from 2010 to 2011 and 2012, to have more taxable income in lower tax rate year and less taxable income in higher tax rate periods. The estimated coefficient of HighTech*Y1112 is positive, but not significant at 10% level (t=1.37). This implies that relative to control group, companies who passed through the certification also shifted R&D expenses from the year preceding certification (2010) to years following certification (2011 and 2012), to increase taxable income as facing the risk of a distinct tax rate increase. But the shifting effect is not so aggressive as companies who actually experienced an extinct tax rate increase. Estimation results of model (2), which uses RDRatio as dependent variable, are reported in Column 2 of Table 6. F-value of model (2) is 14.11, adjusted R^2 equals 21.2%. The estimated coefficient of In1112*Y1112 is positive, and almost significant at 5% level with t= 1.95. The estimated coefficient of HighTech *Y1112 is positive and significant at 10% level with t=1.87. Related results show that, after eliminating the influence of corporate size, our treatment effects, namely the R&D shifting behavior of group1 and group2

companies are both more significant. Results in model (1) and model (2) of independent variables support Hypothesis 1 and Hypothesis 2.

Three-cross interactions with Rev / RevRatio are included in model (3) to model (6) to examine exactly, whether companies shifted R&D expenses to save taxation or to meetthe revenue related requirement of certification.

Estimation results of model (3), which uses RDExpense as dependent variable, are reported in Column 3 of Table 6. F-value of model (3) is 49.21, adjusted R square equals 52.0%. After adding the interaction term In1112*Y1112*Rev in the model, relative to the results of model (1), the standardized coefficient of In1112*Y1112 increases from 0.045 to 0.048, and t-value increases from 1.69 to 1.70, the coefficient of In1112*Y1112*Re equals 0.021 but not significant, only with a t-value of 0.82. Related results in model (5) are similar. This indicates that, compared to the control group, the R&D shifting of group1 companies was not induced by revenue related requirements of certification, but incentives to save tax payment. On the other side, after adding the interaction term HighTech*Y1112*Rev in model (3), relative to the results of model (1), the standardized

coefficient of HighTech*Y1112 decreases from 0.043 to 0.037, related t-value decreases from 1.37 to 1.16, the coefficient of HighTech*Y1112*Rev is positive but not significant with t-value equals 1.29. Related results in model (5) are similar. This indicates that, compared to the control group, the R&D increase of group2 companies in 2011 and 2012 was partly induced by the revenue related certification requirements.

Using RDRatio as dependent variable, estimation results of model (4) are reported in Column 4 of Table 6. F-value of model (4) is 13.19, adjusted R^2 equals 21.5%. After adding the interaction term In1112*Y1112*RevRatio in model (4), relative to the results of model (2), the coefficient of In1112*Y1112 remains positive and significant at 10% level, the coefficient of In1112*Y1112*RevRatio equals 0.048 but not significant. Related results in model (6) are similar. This also indicates that, compared to the control group, the R&D shifting of group1 companies was mainly induced by the tax saving incentives. On the other side, relative to the results of model (2), the coefficient of HighTech*Y1112 in model (4) remains positive (0.067) and significant at 10% level, the coefficient of HighTech*Y1112*RevRatio in model (4) is positive (0.070) and significant at 5% level. Related results in model (6) are similar. This indicates that, compared to the control group, the R&D shifting of group2 companies from 2010 to 2011 and 2012 was mainly induced by revenue related certification requirements and partly induced by tax saving incentives because of the super pre-tax deduction policy. Above results in model (3) to model (6) of independent variables support Hypothesis 3 and Hypothesis 4. Turning to estimation results of control variables, the coefficients of dummy variable State are all negative but not significant in all of the six models. That is to say, compared to non-state-owned companies, state-owned companies in the sample recorded less R&D expenses. All of the three-cross interactions of State and In1112*Y1112 and HighTech*Y1112 are not significant, which indicates that the type of ultimate owners did not have significant influence on companies 'R&D shifting behavior of the research period.

The coefficients of SME&GEM in model (1), (3) and (5), which use RDExpense as the dependent variable, are all negative and significant at 10%. In contrast, the coefficients of SME&GEM in model (2), (4) and (6), which use RDRatio as the dependent variable, are all positive and significant at 1%. That is to say, relative to main board companies, SME and GEM companies have less R&D expenses and greater R&D ratio because of the smaller corporate size. These results are consistent with the expectation. The coefficients of three-cross interactions In1112*Y1112*SME&GEM and HighTech*Y1112*SME&GEM are not significant.

The coefficients of ManagStock are negative but not significant in model (1), (3) and (5), which use RDExpense as dependent variable, positive and significant at 5% levei in model (2), (4) and (6), which use RDRatio as dependent variable. Consistent with the expectation, this indicates that ManagStock has a positive influence on R&D expenses. The coefficients of In1112*Y1112*ManagStock and HighTech*Y1112 *ManagStock in model (5) and (6) are all positive. The coefficients of In1112*Y1112*ManagStock in model (6) equals 0.072 with t-value equals 1.57.

All of above results are consistent with the expectation in direction: companies with a higher percentage of management holding would be more aggressive in R&D shifting behavior in response of a distinct tax rate increase in order to save taxes.

The coefficients of variable EPS in model (1) to model (6) are all positive and significant at 1% level. Consistent with the expectation, this means that income smoothing incentive has significant positive influence on R&D expenses. But all of the coefficients of three-cross interactions In1112*Y1112*EPS and HighTech*Y1112*EPS are not significant, which indicates income smoothing has no significant influence on companies 'R&D shifting behavior.

The coefficients of DebtRatio are positive in model (1), (3) and (5), which use RDExpense as dependent variable, negative in model (2), (4) and (6), which use RDRatio as dependent variable. All of the coefficients are not significant, which means that debt ratio does not have important influence in R&D expenses in China. All of the coefficients of three-cross interactions In1112*Y1112*DebtRatio and HighTech*Y1112*DebtRatio are not significant, which indicates that DebtRatio do not influence companies' R&D shifting behavior.

To check the robustness and get better understanding of estimation results, a number of sensitivity and extensive analyses are undertaken in this section. To do this, the analysis is extended in four different ways. Firstly, it is examined if the results still hold for the manufacturing industry, which comprises more than half of the total Chinese listed companies. Secondly, the validity of the results is tested for companies listed on main board, which comprises the most important part of the Chinese capital market. Thirdly, The DID analysis is carried out for state-owned and private-owned companies respectively, to show the influence of the type of ultimate ownership on the R&D shifting. Finally, some extensive analyses have been done for SME and GEM companies, because of their particularity and more comprehensive disclosure of R&D related information. All of the above DID regression results of main board listed companies support hypothesis1 to hypothesis4.

Ⅵ. Conclusions

Both of the R&D expenses 1.5X pre-tax deduction and the relative flexibility in R&D accounting make R&D investments the most favorite instrument to avoid tax in China. On the other side, the exogenous certification for HNTE offers good research opportunities to check how enterprises respond to tax rate changes by adjusting R&D investment. Using a data set from Shenzhen and Shanghai Stock Exchanges during 2010 to 2012, empirical findings from DID analyses are consistent with the tax-induced R&D shifting, to save tax payment directly or to maintain the 15% preferential tax rate.

Therefore, it is concluded that under the given regulatory incentive structure in China, taxation plays an important role in company's R&D related earnings management decision. More specifically, results of DID model (1) and (2) provide evidence that group1 companies with an actual tax rate increase from 15% to 25% shifted R&D expenses from 2010 to 2011 and 2012 to save taxation in the high tax rate periods; high-new technology companies with a stable preferential 15% tax rate from 2010 to 2012 also shifted R&D expenses as facing the distinct tax rate increase. Results of DID model (3) and (4) indicate that companies with a distinct tax rate increase shifted R&D expenses in order to save taxation in high tax rate years. Group2 companies with a stable 15% tax rate shifted R&D expenses mainly to meet the certification requirement to keep the 15% tax rate. All results of independent variables support Hypothesis 1 to Hypothesis 4. Furthermore, the influences of some firm-specific factors on firms' propensities to shift R&D expenses have also been considered explicitly.

Respective regression results of manufacturing companies, of main board companies and of SME & GEM companies are all consistent with hypotheses. In addition, private-owned companies and full-expensed SME & GEM companies shifted R&D expenses more aggressively.

Examining whether firms opportunistically time their R&D spending in response to the certification for HNTEs in

2011, this study makes several contributions to the research community and brings some beneficial enlightenments to policy makers. Firstly, this study contributes to the literature that investigates the effectiveness of R&D tax incentives and brings insights into the R&D tax policy debate in important ways. Secondly, this study extends the related literature on tax induced earnings management: (1) with R&D investment as real instrument, or (2) with the decision to expense or capitalize R&D spending as accounting instrument. Therefore, this study brings insights into the disputing on R&D accounting policies. Finally, this paper enriches the research on R&D responses to tax rate changes by bringing evidences about R&D shifting behaviors in response to a tax rate increase in an important developing market.

However, some cautions should be paid as interpreting these results.

Firstly, the treatment or control groups have been divided according to the tax rate deviation of the listed parent companies, while the R&D expenses data comes from the notes of consolidated statements for whole enterprise groups because of the incomplete information disclosure during the research period. This mismatch between tax group division and R&D expenses data could influence the robustness of the conclusion, although the tax deviation directions of subsidiary companies have also been considered as dividing research groups. Since 2013, more and more Chinese listed companies have disclosed detailed R&D expenses information of listed parent company. Therefore, by extending the dataset to current period and collecting R&D expense data of listed parent company, tax rate and R&D data could be matched directly. This should be a possible direction to improve current study in the future.

Secondly, the R&D shifting effect cannot be interpreted exclusively as “real” R&D investment shifting or accrual earnings management by choosing expensing or capitalizing R&D expenditures. Further, the variation of R&D expenses could be the change of real R&D investments or the result of real earnings management. As stated in the review paper of Hanlon & Heitzman, the increase of targeting investment “could have come at the cost of lower investment in other types of assets, lower investment in the targeted assets in later periods, and could partially reflect mere changes in the accounting classification rather than real differences in purchases” [19]. To gain additional insights into this question, one should improve the measurement methods of R&D expenses. For example, following the thinking and methods in Roychowdhury [20], one can calculate normal and discretionary R&D expenses, and use discretionary R&D expenses stand for R&D related earnings management. But this method also need a longer research period with R&D data. In addition, related questions can also be further investigated as more and more companies disclose information not only about R&D expenses but also about the amount and amortization of R&D capitalization.

In conclusion, this study is restricted by the availability and variety of R&D related data for the research period. With listed Chinese companies disclosing more complete R&D related information, research in this field will possibly reach more interesting and significant conclusions. Despite these restrictions, however, this study has provided evidence about the tax-induced R&D shifting in China representing emerging economies.

References

[1] B.J. Bushee, “The influence of institutional investors on myopic R&D investment behavior,” The Accounting Review, vol. 73, no. 3, pp. 305–333, 1998.
[2] M. Hanlon, P. Heitzman, “A review of tax research,” Journal of Accounting and Economics, vol. 50, pp. 127–178, 2010.
[3] J. Slemrod, “Do taxes matter? Evidence from the 1980s,” American Economic Review, vol. 82, pp. 250–256, 1992.
[4] C.E. Boynton, P.S. Dobbins, G.A. Plesko, “Earnings management and the corporate alternative minimum tax,” Journal of Accounting Research, vol. 30, pp. 131-153, 1992.
[5] D. Dhaliwal, S.W. Wang, “The effect of book income adjustment in the 1986 alternative minimum tax on corporate financial reporting,” Journal of Accounting and Economics, vol. 15, pp. 7-26, 1992.

[6] M.S. Scholes, G.P. Wilson, M.A. Wolfson, “Firms' responses to anticipated reductions in tax rates: the Tax Reform Act of 1986,” Journal of Accounting Research, vol. 30, pp. 161-185, 1992.
[7] D.A. Guenther, “Earnings management in response to corporate tax rate changes: evidence from the 1986 Tax Reform Act,” The Accounting Review, vol. 69, pp. 230-243, 1994.
[8] Y. Wang, L. Wang, C. Gong, “Reform of enterprise income tax, earnings management and its economic consequences,” Economic Research, vol. 3, pp. 86–98, 2009.
[9] Z. Li, Y. Zheng, “Studying on the earnings management for tax avoidance based on manipulations of accruals and real activities,” Journal of Finance and Economics, vol. 36, pp. 80-89, 2010.
[10] D. Shackelford, T. Shevlin, “Empirical tax research in accounting,” Journal of Accounting and Economics, vol. 31, pp. 321–387, 2001.
[11] D. Li, L. Xia, “Nature of ownership, institutional environment and R&D intensity of listed Company,” Journal of Finance and Economics, vol. 4, pp. 93-104, 2008.
[12] S. Chen, X. Chen, Q. Cheng, T. Shevlin, “Are family firms more tax aggressive than non-family firms?” Journal of Financial Economics, vol. 95, pp. 41–61, 2010.
[13] K. Klassen, “The impact of inside ownership concentration on the tradeoff between financial and tax reporting,” Accounting Review, vol. 72, pp. 55–474, 1997.
[14] G. Markarian, L. Pozza, A. Prencipe, “Capitalization of R&D costs and earnings management: Evidence from Italian listed companies,” The International Journal of Accounting, vol. 43, pp. 46–267, 2009.
[15] H.G. Hunt, “Potential determinants of corporate inventory accounting decisions,” Journal of Accounting Research, vol. 23, no. 3, pp. 48−467, 1985.
[16] S. El-Gazzar, S. Lilien, V. Pastena, “Accounting for leasing by lessees,” Journal of Accounting and Economics, vol. 8, pp. 17−237, 1986.
[17] R. Watts, J. Zimmerman, “Positive Accounting Theory,” Prentice–Hall, 1986.
[18] M. Rusbarsky, “Motivations for discretionary accounting changes: the case of the switch from accelerated to straight-line depreciation,” Working Paper, Graduate School of Management, University of California, Riverside, CA, 1988.
[19] M. Hanlon, P. Heitzman, “A review of tax research,” Journal of Accounting and Economics, vol. 50, pp. 27–178, 2010.
[20] S. Roychowdhury, “Earnings management through real activities manipulation,” Working paper, Sloan School of Management, MIT, 2005