THE RELATIONSHIP BETWEEN CORPORATE FINANCING CHOICE AND TAX RATE REDUCTION

AN EMPIRICAL RESEARCH BASED ON SWEDISH PRIVATE FIRMS

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The Relationship between Corporate Financing Choice and Tax Rate Reduction: An empirical research based on Swedish private firms

Abstract:

This study aims to find out whether Swedish private company changes its financial structure facing a corporate tax cut. Furthermore, it studies the influence of the decrease of interest rate corresponded with tax reduction on the association between tax cuts and firms' leverage. Focusing on the two corporate tax cuts in Sweden in 2009 and 2013, we use AREG regression model, difference in difference method, and an interrupted time series analysis model to research the impact from tax cuts on leverage. The data sample consists of 2,898 private companies in the period from 1999 to 2016. Our result shows that firms have a lower financial leverage after the tax cuts. The tax reduction in 2009 gives the leverage an increase developing trend in long term and the tax reduction in 2013 gives a decrease trend. When it comes to firm heavily depending on long-term debt, the decrease of interest rate slightly weakens the effect of tax cuts on leverage.

Keywords:

Corporate capital structure, Interest rate, Leverage, Quasi-experiment, Tax policy

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1. Introduction

1.1. Motivation: why the topic is interesting

Since Modigliani & Miller discovered the correlation between corporate optimal financing structure and tax rate, it has become a staple to research their interaction in the subject of accounting, finance and management. Outside of the academic field, it also has the attraction: on one hand, entrepreneurs want optimizes their firms' structure to cope with tax policy; on the other hand, governments also try to comprehend how tax policy works and how to achieve their goals.

From the perspective of entrepreneur, setting a reasonable financing structure to maximize shareholder value is of great important nowadays, especially after the mature of financial market since last century. By using a financial leverage borrowing debt or funds rather than fresh equity in the purchase of an asset, a company can multiple its size and gains that cannot be achieved due to the limitation of money. Even though financial leverage may increase the risk of business failure due to the difficulty to repay debt, it may also allow a company to earn a disproportionate amount of return on its original equity.

Besides enhancing earning, another primary advantage for financing leverage is the favorable tax treatment. As in many tax jurisdictions, interest expense is tax deductible, which reduces its net cost to the borrower. While the diversification of investment puts forward the choice between debt and stock for investor, the entrepreneur is also facing the trade-off theory of capital structure for their company. The trade-off theory of capital structure claims that firms tradeoff the benefits of raising external capital from debt holders against the costs of having such fixed obligations. The primary benefit of issuing debt is hypothesized to arise from the fact that interest paid to debt holders is deducted before corporate income taxes are calculated, whereas payments to equity holders do not receive a tax deduction. (Faulkender & Smith, 2016)

As a result, the level of tax rate becomes an important determining factor for company financing policy. A simple numerical example serves to illustrate the intuition. Suppose there are two companies (A and B) with the same amount of asset and operation condition and two equally likely fund sources debt and equity that all claim a capital cost of 10% per year. Company A has a leverage of one with 40M SEK in both debt and equity; Company B chooses to hold 80M SEK equity but zero debt with a leverage of zero. Absent taxes, the expected capital cost for each company is 8M SEK and so the manager will be indifferent between the companies. Now suppose the tax rate increases from zero to 30%. This requires the same amount of tax payment from operating profit for both companies, but company A is more affected as it has a tax deduction of 1.2M SEK from the interest paid to debt. B's financial cost keeps at 8M SEK while A's real capital cost

falls to only 6.8M SEK. The great reduction (of 1.2M SEK) in company A's real capital cost stems from the fact that interest payment to debt holder is tax deductible but not for the dividend payment to equity holder. Given this difference, the manager will now prefer the company with high leverage to a low one. Generalizing from the example, we predict that managers should respond to a tax increase by using a high leverage and thereby reducing the real capital cost the company takes.

From the perspective of society, debt financing is much more dangerous than equity financing. Equity can absorb the loss of asset value and sustain corporation operating. Firstly, it can save intangible assets like experience, network, etc; secondly, it can maintain output. In the contrary, if company can't make good of debt obligation and go bankruptcy, the lengthy liquidation process will lose all intangible assets and leave tangible assets in idle. Hence, governments sometimes will take some actions like tax reduction to discourage debt financing.

The higher the corporate tax rate, the larger the tax deduction. Company faces a large amount of benefit from using a high leverage with a large amount of tax deduction. Theoretically, high corporate tax rate is related to higher degree of leverage, since interest is tax-deductible and equity income is not. A low corporate tax rate with less tax deduction ratio should have an adverse effect on leverage. But the reality may not be the ideal world.

According to the research by some scholars (Heider & Ljungqvist, 2014; Schandlbauer, 2017), firm's leverage ratio rises following tax increase, but does not decline following tax decrease. This asymmetry is worth of the further research about the universality and potential reason behind it.

The uncertain reaction from companies may bring some trouble to government's policy decision. As mentioned above, taxation is an important part in government function system and one of the most important tools government use to influence the economy. In order to optimize the effect of taxation, the government needs to understand the reaction from firms facing tax change and how to achieve their original intention.

Since 2009, Sweden has commenced a series of tax reforms which decreasing corporate tax from 28% to 22%. Furthermore, on 14 June 2018, The Swedish Parliament passed a law on major changes to the Swedish regulations on corporate income taxation and the new law provides a decrease of the corporate income tax rate in two steps from 22 percent to 21.4 percent from 1 January 2019 and to 20.6 percent from 1 January 2021.

According to the announcement from Parliament, the purpose of corporate tax reduction in 2009 is to improve the conditions for locating companies to Sweden, for investments in Sweden, and for accounting for income in Sweden, thereby strengthening Swedish tax base. The rules for company and company regulations on withdrawal taxation of certain real estate services are also improved. The tax reduction in 2013 is about infrastructure

and research, as well as improvements to corporate conditions and the functioning of the housing market. Noticing that the increase in employment has slowed down in the Swedish labor market, and the labor market continues to develop weakly, the Parliament intends to get more people into work and to counteract unemployment.

Apparently, the tax adjustment in Sweden is set to stimulate company operation and encourage the economic growth. The reaction of company facing the tax change catches the attention from the government. It is interesting to research on the company's financing policy following the tax cuts to see the connection between government policy to company and the eligibility of tax control method.

The research on the relationship between corporate financing choice and tax rate adjustment not only has great value in academic field, but also provides practical advice on entrepreneurs and governments. A series of tax decrease policy in Sweden offers an ideal opportunity to research on the relation between financial leverage change and tax adjustment. In addition, the abundant statistics and reachable data in Sweden make the research feasible.

1.2. Gap in current research

The work from Heider and Ljungqvist (2014) leads the research of asymmetric reaction from leverage rate facing tax adjustment. Consistent with dynamic tradeoff theory, the effect of tax change is asymmetric that leverage does not respond to tax cuts. The opinion of asymmetry is supported by the other works like Schandlbauer (2017), Ljungqvist, Zhang, and Zuo (2017).

The asymmetry notion effectively challenges traditional conception that leverage responds tax rate change in time. Still, many scholars have conviction on MM-theorem and their research indeed proves that the original mechanism is working well (Faulkender & Smith, 2016) (Schepens, 2016). Safely to say, a consensus is far from reached. Furthermore, when researchers try to explain the cause of asymmetry, they fail to convince readers in an universal ground. There are a lot of explanations in the town, but not so many have been confirmed by peer research as of now.

Another limitation is regarding sample selection. In geographic perspective, the majority of study puts attention on North America, due to the market in US is the most ripe one and has most data. Other countries only get sporadic focus. As for Sweden, we can hardly find any thesis regarding this topic (at least in English). From the perspective of capacity, such research mainly chooses public companies and financial institutions. The rationale behind it is that private companies may be too small to generate demand of borrowing debts, which is dubious. We'll explain this in the section below. Data insufficiency is another reason to ignore private entities. In many countries, it probably be the case, but not for Sweden.

1.3. How the thesis solves gap

In order to fill the blank and provide some new insights to this topic, we decide to use Swedish private firms as our samples. Thanks to Serrano database, we have enough information about them.,

There will have four regression model : normal AREG model, difference-in-difference model, interrupted time series analysis model which used to analysis the influence of tax rate change on corporation's leverage; and typical linear regression to exam one explanation for asymmetry: the change of interest rate moderates the influence of tax rate change.

This thesis consists of six main sections. Section 2 will introduce previous research of relation between tax and leverage, asymmetry theory and private firms financing strategy. Based on those literatures, we also put out our hypothesis and empirical question in the thesis. Section 3 will outline our research design and selection of variables and samples. Section 4 will present our gathered data in a descriptive way and show empirical results for four regression models: AREG model, difference-in-difference model, interrupted time series analysis model and normal linear model. We will interpret those results with a sense of reality. After that, it includes additional tests like robustness analysis. In Section 5 we discuss the differences of different model and which aspects are ascribed to those differences and empirical results. Section 6 summarizes our contribution to this topic, limitations of this thesis and suggestions for future research.

2. Literature Review and Theory

In the following section, we aim to examine previous literature related to our research question. We start from the cornerstone article initiating the capital structure topic. Through the development of research on corporate financing strategy, we review the influential factors and focus on the discussion between tax rate adjustment to leverage change. We then refine the potential reason behind the relationship between tax rate and leverage. For our study, it is also interesting to find out the different reaction of private firms comparing to the public, which is the main target to examine by most scholars. In the end, we propose our hypotheses.

2.1. The cornerstone article

The foundation of the relationship between corporate leverage and tax rate is laid by Modigliani and Miller. In their initial book (Modigliani & Miller, 1958), through mathematical derivation under strict assumptions, Modigliani-Miller model was formed. The main proposition of this model states that in the absence of taxes, bankruptcy costs, agency costs, and asymmetric information, and in an efficient market, the value of a firm is unaffected by how that a firm is financed. Five years later, they published a new article (Modigliani & Miller, 1963) in which a correction was introduced. After loosening initial assumptions and considering corporate taxes, the article argues the value of company increases in proportion to the amount of debt used and the source of additional value is due to the amount of taxes saved by issuing debt instead of equity. Since then, a lot of studies regarding capital structure have been made. Even though MM-model becomes the cornerstone of capital structure, it implies the optimal structure is all debt corporate which is hard to be observed in the real world. To reconcile the difference between theory and reality, many researchers put up with own explanations.

2.2. The factors that affect the corporate financing strategy

2.2.1. Information asymmetries

Information asymmetries is a major point that scholars made as an explanation. Rendleman (1980) believes information asymmetries result under- or overvaluation of the firm's value when investors assess investment opportunities and risks. He finds that undervalued firms will typically prefer debt and high leverage. Myers and Majluf (1984) agree on the reason but argue corporates will issue debts as long as they can, regardless of over- or under-valuation. In addition, they notice firms which have more tangible assets have higher leverage than those have more intangible assets because the property rights associated with tangible assets enable greater securitization.

2.2.2. Personal tax

Another reason is the existence of personal tax. Miller (1977) further relaxes the assumptions in MM-model and introduces personal tax. In the article, he predicts personal taxes reduce the theoretical tax advantage of corporate borrowing due to dividend clientele, i.e., high-dividend stocks will be held by low marginal tax rate investors.

Following Miller, some latest studies corroborate the function of personal tax. Based on ex-post observed summary statistics, Faccio and Xu (2015) find that across OECD countries both corporate and personal income taxes to be significant determinants of capital structure. The results are stronger among corporate taxpayers, dividend payers, and companies that are more likely to have an individual as the marginal investor. Additionally, the value of debt tax savings is greater among top taxpayers, among highly profitable firms, and in countries where tax laws are more strongly enforced (Faccio and Xu, 2018).

2.2.3. Debt substitution effect

Alternative tax shields are another reason referred frequently. DeAngelo and Masulis (1980) believe in some companies, depreciation somewhat replaces debt interest as the origin of tax reduction and call it debt substitution effect. Following up, Dhaliwal, Trezevant, and Wang (1992) test 1045 banks drawn from the COMPUSTAT Primary, Secondary, and Tertiary files from 1972 to 1986 and corroborate there is a negative association between non-debt and debt tax shields. Examining the Economic Recovery Tax Act of 1981, whose major provision with regard to corporations involve liberalized investment tax shield write-offs, Trezevant (1992) gets the same conclusion to support debt substitution effect.

Concerning the tax benefit realized from the exercise of stock options, Kahle and Shastri (2005) find that both long- and short-term debt ratios are negatively related to the size of tax benefits from option exercise. Firms with option-related tax benefits, a non-debt tax shield, tend to issue equity to have lower leverage, vice versa, with the net amount of equity issued an increasing function of these tax benefits.

Schepens (2016) and Panier, Perez-Gonzales, and Villanueva (2015) depicted the influence of the introduction of a tax shield for equity on banks in Belgium (NID, the notional interest deduction). As the introduction reduces the relative tax advantage of debt funding, it has led to a positive impact on bank equity ratios. The researches show that capital structure significantly responds to changing tax incentives, by mainly higher equity levels than a reduction in other liabilities. The intuition behind it is that banks then have more incentives to use equity because of a relatively bigger tax shield.

The first batch of studies in early times are just theoretical induction and mathematical derivation without association with reality. The studies after that are best described as

faithful documentation of facts but lack of explanation and understanding. They treat tax rate as a fixed exogenous variable and companies all try to increase leverage as much as possible just limited by different factors they study. Only until the recent studies, more quasi-experimental methods and empirical data are applied.

2.3. The relationship between tax change and leverage

Taxes are important to corporate structure and companies should follow up the fluctuation of the tax rate as it tied with the optimal corporate decisions. Scholes et al. (1990) report that among banks, those with net operating loss carryforwards are more likely to raise capital through equity with non-deductible dividends than through capital notes with deductible interest. Graham (1996a) adds that a firm's marginal tax rate is positively associated with its issuance of new debt. Engel et al. (1999) conclude that the tax benefits of leverage are large in their Trust Preferred Stock (TRUPS) study. The benefits of the net tax savings are averages 28% of the size of trust preferred stock issued (approximately 80% of estimated upper bound on average). Their setting is particularly powerful because they compare securities that are nearly identical, except taxes, enabling them to exclude potentially confounding effects, such as risk, signaling, and agency costs. Graham et al (2017) research on the economic consequences of deviating from the theoretically preferred tax rate and find that firms using inaccurate tax rate input for investment decisions are less responsive to investment opportunities. Using a "quasi-natural experiment" on a group of Canadian publicly traded firms, Doidge and Dyck (2015) state that tax incentives have a potentially significant effect on corporate policies and affect investment. Firms adjust leverage, payout, cash holdings, and investment in response to changing tax incentives.

Some works have examined relations between corporate leverage behavior and changes in tax rates. Some of them show that companies, both financial and non-financial, rise the leverage with tax rise and do not decline with tax reductions. Some, researching on multinational companies and banks, state that companies will have low leverages when facing relatively less debt tax shield incentives.

Heider and Ljungqvist (2014) examine the influence of state level changes in corporate tax income rates. With a difference-in-difference approach that exploits the effect of 121 changes in corporate income tax rates on nonfinancial and non-utility U.S. public companies over the period 1989-2011, the result shows that leverage ratios rise following increases in the firm's home state corporate income tax rate (40 basis points for every percentage-point tax increase), but that leverage ratios do not decline following state corporate income tax rate reductions. The findings of the asymmetry in tax sensitivity support dynamic tradeoff models, implying that leverage is sticky on the downside, in the sense that tax increases ratchet up leverage permanently while tax cuts do not subsequently reduce it.

Schandlbauer (2017) empirically researches on the role and significance of taxes for the capital and structure decisions of financial companies of banks. The analysis highlights banks alter both their financing and their operating (lending) decisions once they are exposed to a corporate tax increase, and a bank's capital structure adjustments are profoundly influenced by its existing financial situation that whether the bank is better or worse capitalized. The main focus of the paper lies on banks' reactions to tax increases, but Schandlbauer also examines the role of tax cuts for banks by analyzing 18 tax-decreases that occurred in the U.S. The result, similar to the findings of non-financial firms (Heider and Ljungqvist, 2015), shows that banks fail to promptly adjust their leverage downwards upon tax cuts. Banks neither adjust their leverage nor their lending, in the years surrounding a tax decrease, which means leverage exhibits hysteresis.

Faulkender and Smith (2016) investigate the impact of the tax rate change on the leverage ratios of multinational companies. It provides empirical support to the trade-off theory of capital structure. Variation in tax rates is of first-order importance in explaining leverage. By using data of US multinational companies with the country-specific tax rate, they find that firms do have higher leverage ratios and lower interest coverage ratios when they operate in countries with higher tax rates. The paper also shows that multinational firms confronting lower tax rates use less debt with statistically significant.

2.4. Reason behind the asymmetry when tax changes

The reaction of the company's risk-taking decisions to tax rate change can be a potential explanation to support the asymmetric reaction of the leverage ratio. Ljungqvist, Zhang, and Zuo (2017) study the effect of tax rules on firm risk-taking decisions. Their paper uses U.S. state tax rules and concludes that firms reduce risk in response to tax increases and do not respond much to tax cuts, as the government shares in a firm's upside expected profits but not in its downside loss. They trace the asymmetry back to constraints on risk-taking imposed by creditors, which may be analogous to the asymmetry reaction of leverage that there is restriction from existing creditors.

The reasons for the asymmetry can also be explained by resistance from stakeholders, described by some existing researches on both financial and non-financial firms. According to Heider and Ljungqvist (2014), the potential reasons behind this asymmetry are that first, deleveraging reduce the default option value of shareholders and spark resistance from them; second, the debts remaining will appreciate since buyback decrease the risk of bankruptcy, debt holders tend to keep it and take freeride. The explanation from Schandlbauer (2017) for banks not adjusting leverage in the years surrounding tax decrease is the so-called leverage ratchet effect. Agency costs of debt, which are the result of prior inefficient capital structure choices, can bias shareholders against voluntary leverage reductions.

The tax rate reduction cannot bring enough tax shield incentive to the company may be another explanation to the asymmetry when tax rate moves downside. Faulkender and Smith (2016) and Schepens (2016) both show that the company will use less debt or more equity in corporate structure when facing incentives from a relatively less tax shield on debt. Unlike companies facing the dynamic change in tax rate policy, the sample of their studies are companies confronting lower tax countries and a special policy introducing tax shield for equity. Because their researches claim that the company will react to both higher or lower tax shield incentive, the reason of asymmetry may attribute to the disconnection between tax rate cutting and enough tax shield incentive.

2.5. Study connecting to private firms

In the field of tax and capital structure, private firms usually are ignored due to data accessibility and concern of company sizes (maybe too small to require debt financing). However, there are still some papers showing the important sense to research private firms.

One paper that discusses the difference between private and public firms responding to finance incentives is Asker, Farre-Mensa, and Ljungqvist (2014). They show that compared with private firms, public firms invest substantially less and are less responsive to changes in investment opportunities, especially in industries in which stock prices are most sensitive to earnings news. This is due to that private firms suffer from fewer agency problems and are subject to fewer short-termist pressure than their listed counterparts. The result shows that private firms' investment decisions are around four times more responsive to changes in investment opportunities than those of public firms.

2.6. Hypothesis

The existed articles have different results in the change trend of leverage related to tax rate alteration. Some show that companies rise the leverage when the tax rate increases, and do not decline the leverage in a tax rate decline. The others state that the leverage changes together with the tax rate symmetrically. This paper researches on this topic and has the first related hypothesis:

> **Hypothesis 1.** There is no reaction in firms' leverage when tax cuts occur.

The disconnection between tax rate cutting and enough tax shield incentive may affect the leverage reaction. The tax rate downtrend leads to the decrease of interest rate (we will research on the correlation later), which then results in the reduction of financing cost. As a result, even though the leverage keeps unchanged, the tax shield deductible part will become smaller conforming to the lower financing cost. So there is no incentive to alter the leverage. If the creditors of the company's debt are the company's

shareholders, those shareholders may not want to see the leverage moving downwards, which lessens their nontaxable interest income. Moreover, they may have incentives to require the company to increase the leverage, as the interest income becomes less due to the interest rate alteration.

There is not an unanimously agreed reason behind the asymmetry of leverage. The existing articles state some acceptable explanation, but this paper targets on the effect of the interest rate that may be another potential reason. Even if the asymmetry of leverage does not appear in our research, study the influence of interest rate on tax effect is still of great value for the interactive connection between interest rate and tax. So it comes to the second hypothesis:

> **Hypothesis 2.** The decrease of interest rate corresponded with tax reduction moderates the association between tax cuts and firms' leverage.

Asker, Farre-Mensa, and Ljungqvist (2014) claim that private firms' investment decisions are more responsive to changes in investment opportunities than those of public firms. Correspondingly, there may be a possibility that private firms are more active to changes in financing opportunities, considering they are already more active for the investment. If this assumption exists, targeting on the group of private firms may have a relatively clear and obvious reflection of leverage ratio on tax rate change, so this paper chooses private firms as the research sample.

The private firm is different from the public firm, with less source of capital either from owners or the bank. It may be more flexible in financing. As a result, this paper also tends to find out the difference between private and public firms in the aspect of sensitivity towards the financing strategy.

3. Method

3.1. Research design

We conduct a quantitative study based on panel data containing Swedish private firms' corporate tax rate, leverage ratios, interest rate of debt, and controlled factors such as profitability, tangibility, depreciation ratio and firm size over the years 1998 to 2016, which covering the recent two corporate tax rate decreasing adjustment. After 1993, the corporate tax rate in Sweden has been stabilizing at 28% for a long time before the government decreased the rate to 26.3% in 2009 and further to 22% in 2013. The period chosen is long enough for the stable period before tax rate reduction, which is beneficial for our trend analysis regression and the comparison. We start our sample in year 1998 to provide sufficient years to estimate the baseline effect for each firm and end in 2016 due to the data source limitation.

We use a panel of leverage-firm-years to test whether reduction of tax rate on firm has real effects on firms' financing policy and test the influence of interest rate. We, thus, use four regression models consisting of corporate tax rate, leverage ratios, interest rate, and other controlled variables.

3.1.1. AREG model

The first is an AREG regression with panel data for firms. It reflects the influence of tax rate change on firms' leverage. We estimate OLS regressions of the following form:

$$L_{it} = \beta_0 + \beta_1 T_{it} + \beta_{2j} C_{jit} + \varepsilon_t \quad (1)$$

where i and t index firms and years. The outcome variables L_{it} are measured at time point t in company i, which means the leverage among observed company i in our case. We have five sets of independent variables. T_{it} is one of them, meaning tax rate for company i at time point t. The other four sets of independent variables are described in the following: $\beta_1 Y_{1it}$; $\beta_1 Y_{2it}$; $\beta_1 Y_{1it} + \beta_3 Y_{2it}$; $\beta_1 Y_{2it} + \beta_3 Y_{3it}$. Y_{1it} is a dummy variable (0 in the pre tax adjustment period before 2009, otherwise 1) representing the first tax reduction in 2009; Y_{2it} is a dummy variable (0 before 2013, otherwise 1) representing the second tax reduction in 2013; Y_{3it} is a dummy variable (1 between 2009-2012, otherwise 0) represents the period after the first tax reduction and before the second tax reduction. C_{jit} is the collection of control variables, which we will state in detail in the next part of variable.

β_0 represents the interception and the beginning level of the leverage. β_1 represents the influence of tax on leverage. Concerning the other sets of dependent variables, β_1 represents the difference in the level of leverage that occurs after the first tax reduction in 2009 compared to the former period in the set of $\beta_1 Y_{1it}$, reflecting the impact of the first

tax reduction on leverage. In the set of $\beta_1 Y_{2it}$, β_1 represents the difference of the leverage since 2013 compared with the former period, capturing the effect of tax rate adjustment on company leverage in the period since 2013. In the set of $\beta_1 Y_{1it} + \beta_3 Y_{2it}$, β_1 represents the difference of the leverage since 2009 and β_3 represents the difference of the leverage since 2013. In the set of $\beta_1 Y_{2it} + \beta_3 Y_{3it}$, β_1 is the leverage difference since 2013 and β_3 is the leverage difference between year 2009 and 2012.

3.1.2. Diff-in-diff model

The second model uses differences-in-differences (diff-in-diff) approach to examine the impact of tax rate change. Our treated group includes firms that have long-term debt during the research period. A control group consisted of firms with no long-term debt is to compare with our treated group. As the deductible tax shield effect happens only on firms with debt, the firm with no long-term debt can be treated as a control group as they will not react strongly to tax rate change out of tax shield reason. Therefore, the differences we observe between treatment and control groups can be attributed to direct effect of the incentive from the tax rate reduction and perhaps to some potential secondary action interacted with the change of tax policy. We estimate OLS regressions of the following form:

$$L_{it} = \beta_0 + \beta_1 T_{it} + \beta_{2j} D_{it} + \beta_3 T_{it} \times D_{it} + \beta_{4j} C_{jit} + \varepsilon_t \qquad (2)$$

Similar with the formula in the first model, i and t index firms and years in the panel data. L_{it} the dependent variable measured the leverage of company i at time t. We have five sets of independent variables: $\beta_1 T_{it} + \beta_2 D_{it} + \beta_3 T_{it} D_{it}$; $\beta_1 Y_{1it} + \beta_2 D_{it} + \beta_3 Y_{1it} \times D_{it}$; $\beta_1 Y_{2it} + \beta_2 D_{it} + \beta_3 Y_{1it} \times D_{it}$; $\beta_1 Y_{1it} + \beta_2 D_{it} + \beta_3 Y_{1it} \times D_{it} + \beta_5 Y_{2it} + \beta_6 Y_{2it} \times D_{it}$; $\beta_1 Y_{2it} + \beta_2 D_{it} + \beta_3 Y_{2it} \times D_{it} + \beta_5 Y_{3it} + \beta_6 Y_{3it} \times D_{it}$. The meaning of variables is almost the same as what listed in model 1. T_{it} represents the tax rate of company i at time t. Y_{1it} (0 before 2009, otherwise 1), Y_{2it} (0 before 2013, otherwise 1), and Y_{3it} (1 between 2009-2012, otherwise 0) are all dummy variables, representing the period after the first tax reduction, the period after the second tax reduction, and the period between these two tax reduction respectively. D_{it} (1 for treated group, otherwise 0) is a dummy variable measuring the treated group, in which firms have long-term debt comparing to those in control group. $T_{it} \times D_{it}$, $Y_{1it} \times D_{it}$, $Y_{2it} \times D_{it}$, and $Y_{3it} \times D_{it}$ are the interaction item that reflects the core result in diff-in-diff model. Like the first model, C_{jit} is the collection of control variables, which we will state in detail in the next part of variable.

Concerning the meaning of coefficient, β_0 represents the interception and the beginning level of the leverage. β_{4j} shows the effect of the control variable j on the leverage. The coefficient meaning of the five sets independent variables is presented in the following table:

Table 1. List of independent variables

Set of independent variables	Coefficient	Meaning represented
$\beta_1 T_{it} + \beta_2 D_{it} + \beta_3 T_{it} \times D_{it}$	β_1	Capture the effect from the tax rate
	β_2	Capture the effect from the treated group
	β_3	Diff-in-diff estimator, showing the effect of the tax on leverage compared to the control group
$\beta_1 Y_{1it} + \beta_2 D_{it} + \beta_3 Y_{1it} \times D_{it}$	β_1	Capture the effect from the period since 2009
	β_2	Capture the effect from the treated group
	β_3	Diff-in-diff estimator, showing the effect of the treatment on leverage from the first tax reduction from 28% to 26.3% since 2009 compared to the control group
$\beta_1 Y_{2it} + \beta_2 D_{it} + \beta_3 Y_{2it} \times D_{it}$	β_1	Capture the effect from the period since 2013
	β_2	Capture the effect from the treated group
	β_3	Diff-in-diff estimator, showing the effect of the treatment on leverage from the first tax reduction from 26.3% to 22% since 2013 compared to the control group
$\beta_1 Y_{1it} + \beta_2 D_{it} + \beta_3 Y_{1it} \times D_{it} + \beta_5 Y_{2it} + \beta_6 Y_{2it} \times D_{it}$	β_1	Capture the effect from the period since 2009
	β_2	Capture the effect from the treated group
	β_3	Diff-in-diff estimator, showing the effect of the treatment on leverage from the first tax reduction from 28% to 26.3% since 2009 compared to the control group
	β_5	Capture the effect from the period since 2013
	β_6	Diff-in-diff estimator, showing the effect of the treatment on leverage from the first tax reduction from 26.3% to 22% since 2013 compared to the control group
$\beta_1 Y_{2it} + \beta_2 D_{it} + \beta_3 Y_{2it} \times D_{it} + \beta_5 Y_{3it} + \beta_6 Y_{3it} \times D_{it}$	β_1	Capture the effect from the period since 2013
	β_2	Capture the effect from the treated group
	β_3	Diff-in-diff estimator, showing the effect of the treatment on leverage from the first tax reduction from 26.3% to 22% since 2013 compared to the control group
	β_5	Capture the effect from the period 2009 to 2012
	β_6	Diff-in-diff estimator, showing the effect of the treatment on leverage from the first tax reduction from 26.3% to 22% between 2009 to 2012 compared to the control group

This is an advanced model for comparison on the base of the first model. However, as the control group selected may not be perfect, there is the possibility of not showing the real effect of tax reduction on leverage. A causal interpretation of the observed sensitivity of

leverage to tax reduction depends on the plausibility of the parallel-trends assumption, which means before the treatment, treated group and control group should have similar trends for the leverage. We did an AREG regression on our panel data with control group and research group for the period before 2009, the first tax adjustment. The result for the treated group is not significant even at 10% level (two-sided). We can say that the parallel-trends assumption is valid, as both groups are of no significant difference concerning the leverage change.

In addition, the first and second model can only show the module comparison due to the method limitation. It means that data are compared between the whole pretreatment period and the after-treatment period. The difference inside of the period and the trend cannot be clearly reflected from these two models. As a result, a third model is introduced for trend analysis.

3.1.3. Interrupted time series analysis model

The third model uses interrupted time series analysis (ITSA). ITSA is frequently used in the situation of considering the impact of large-scale interventions. If multiple observations on an outcome variable of interest in the preintervention and postintervention periods can be obtained, an interrupted time series analysis offers a quasi-experimental research design with a potential of high degree of internal validity (Shadish, Cook and Campbell, 2002).

Many subjects of study have already used ITSA as a common tool, such as public policy (Muller, 2004), regulatory actions (Briesacher et al., 2013) and medicine trial (Riley et al., 2013). However, it is rare for economists to apply this analysis. Until very recently, some researchers try to use it to analyze the effect of economic policies. We choose this model because it shows a straight-forward difference before and after the implementation of policy, includes both long-term and short-term influence. Furthermore, it requires no control group. Since there is no real control group, the standard interrupted time series analysis regression model is shown as (Linden and Adams, 2011):

$$Y_t = \beta_0 + \beta_1 T_t + \beta_2 X_{t1} + \beta_3 X_{t1} \times T_t + \beta_4 X_{t2} + \beta_5 X_{t2} \times T_t + \varepsilon_t \qquad (3)$$

Y_t is the aggregated outcome variable measured at each equally spaced time point t, which means average leverage among observed companies in our case. T_t is the starting point of the studying period, which is 1998. X_t is a dummy variable (0 in preintervention periods, otherwise 1) representing the intervention, tax rate reduction in this case. X_{t1} represents the first tax reduction, which is 0 before 2009 and be 1 thereafter, X_{t2} represents the second tax reduction, which is 0 before 2013 or is 1 otherwise. $X_t \times T_t$ is the interaction item.

β_0 represents the interception and the beginning level of average leverage. β_1 is the slope of average leverage in the preintervention period, representing the trend of leverage

before tax reduction. β_2 represents the change in the level of leverage that occurs in the period immediately following the introduction of first tax reduction. β_3 represents the change in the slope of leverage between pre- and post- first tax reduction. Thus, we can treat significant β_2 as short-term effect of tax reduction while β_3 as long-term effect. Likewise, β_4 and β_5 represents short- and long-term effect of second tax reduction, respectively.

It is worth mentioning that such formula means we assume that the influence of first tax reduction can last till the very end of our observation period, which may not be the case in reality. For example, given the intensity of the second tax reduction, firms may not react to the first reduction any longer. However, we justify it since the observation window we chose is relatively narrow.

3.1.4. Regression model regarding interest rate

The fourth model is also a linear regression to test the mitigation effect of interest rate on the effect of tax rate change on leverage. This regression is in the following form:

$$L_{it} = \beta_0 + \beta_1 T_{it} + \beta_2 I_{it} + \beta_3 T_{it} \times I_{it} + \beta_{4j} C_{jit} + \varepsilon_t \quad (4)$$

where i and t index companies and years. L_{it} measures the leverage for company i at time point t. T_{it} stands for tax. I_{it} stands for the interest rate. $I_{it} \times T_{it}$ is the interaction item that reflects the interactive effect. As the first two models, C_{jit} is the collection of control variables.

β_1 and β_2 do not have the clear meaning for measurement because of the existence of interaction. The presence of a significant interaction indicates that the effect of one predictor variable on the response variable is different at different values of the other predictor variable. The coefficient of the interaction of interest rate and tax rate, β_3, is what we focus in this regression to measure the marginal effect of tax or interest rate on leverage. As we use this regression to check our second hypothesis, we use β_3 to measure the influence of interest rate to the function of tax rate on leverage. Let's rearrange the formula and focus on the function of tax rate on leverage:

$$L_{it} = \beta_0 + (\beta_1 + \beta_3 I_{it}) \times T_{it} + \beta_2 I_{it} + \beta_{4j} C_{jit} + \varepsilon_t \quad (5)$$

where $(\beta_1 + \beta_3 I_{it})$ measures the marginal effect of tax rate on leverage and the marginal effect is not a constant. When β_1 and β_3 is determined as constant, the change of interest rate can lead to the change of the effect of tax rate. β_3 measures the marginal effect of this change of interest rate.

So, in this formula, the impact of interest rate on the function of tax rate change are measured. The coefficient of the interaction, β_3, measures the mitigation effect of interest rate on tax and examines our second hypothesize.

3.2. Variable

In all the four models, leverage ratios are used as dependent variable. The leverage ratio is measured by debt divided by equity, which is calculated by:

$$\text{Leverage ratio} = \text{debt/equity ratio} = \text{Adjusted total liability} / \text{Adjusted equity}$$

The independent variables are different in our four models.

In the first model, independent variables consist of four sets of one or two dummy variables for the time measuring treatment and one set of a variable for the tax rate. The dummy variables are used that takes the value of one if the year is after the tax rate adjustment in 2009 or 2013, or the year is in the first adjustment period between 2009 to 2012. It represents the change of the tax rate that the firm face, 28% before 2009, 26.3% between 2009 to 2012, and 22% since 2013.

The second model uses a diff-in-diff approach, so the independent variables include several dummy variables to indicate the time, the group exposed to the treatment, and the interaction between time and treated. The variables indicate for time are similar with the first model and they take the value of one if the year is within certain period. The treated dummy variable has the value of one when the firm is within treated group. The variable of interaction is the result of time dummy variable multiplying treated variable, which means the firm is within treated group and certain period, indicating the difference compared to the control group and period before treatment. As the tax rate was decreased for two times in 2009 and 2013, we use five sets to examine the different result.

The third model, interrupted time series analysis, has quite different variables than other models. Since it is a time series model and majorly focus on aggregated level effect, dependent variable 'levcon' represents average leverage of all Swedish private firms every year in the observation period. _t represents the dependent variable's time path, or in other words, endogenous trend. _x2009 and _x2013 are both dummy variables, representing two intervention events, namely, tax reduction in 2009 and 2013. Before 2009, _x2009=0 and _x2013=0; between 2009 and 2013, _x2009=0 while _x2013=1; after 2013, _x2009=1 and _x2013=1. Given those two items can only change formula's intercept other than slope, the coefficients of them are the instant effects of those events. _x_t2009 and _x_t2013 are interaction variables which can change the slope of the formula and that's why they represent long-term effect of interventions.

The fourth model incorporates the influence of interest rate. The independent variables include tax rate, interest rate, and an interaction between tax and interest rate. The interest rate is measured by financial costs divided by total liabilities, which is calculated by:

$$\text{Interest rate on debt} = (\text{Financial costs} - \text{Financial expenses affecting comparability}) / \text{Adjusted total liabilities}$$

The tax rate is exactly the corporate tax that company faces. That is 28% before 2009, 26.3% between 2009 to 2012, 22% since 2013. The interaction is the result of tax rate multiplying interest rate.

We control for the standard firm-level variables commonly found in empirical models for debt (see, for example, Heider, Florian, and Alexander Ljungqvist, 2015). The controlled variables (the collection of C_{jit} in the research design part) include: profitability (return on assets), firm size (total assets), tangibility (the ratio of fixed to total assets), and depreciation condition (the ratio of depreciation and amortization to total assets) to capture depreciation tax shields. The detailed formulas of definition to define the control variables are listed below:

Return on Assets = Adjusted operating profit/loss after financial income / Total assets

Total Assets = The total amount of all of the business's assets (fixed assets and current assets) is recognized. The total amount should be just as big as Total equity and liabilities.

Tangibility = Tangible fixed assets / Total assets

Depreciation Ratio = Depreciation and amortization / Total assets

3.3. Sample

Our study covers Swedish private firms that register the financial statement data at the Swedish Companies Registration Office (Bolagsverket) or Statistics Sweden (SCB), which is available in the Serrano Database. The data we use covers most private firms with legal form in the Swedish business community. In order to improve comparison, only private firms formed before 1998 and operate continuously during 1998 to 2016 were selected (filter 10,800,286 observations to 4,166,871 observations).

In order to process the research accurately, we filter some companies from the database we used. For our sample, we use a size criterion where the top 10% largest firms, with a total equity higher than 5000, were included (drop 2,440,971 observations). It is because the size of private firms in Sweden has a long tail distribution and those firms with insufficient amount of equity are not appropriate to be researched in the aspect of financial leverage policy. In addition, firm with any non-current liabilities to group companies and associated companies is dropped (58,577 observations), as we believe that this kind of associated liability affects the accuracy of the financial leverage presented from the firm's substantial financing policy. We also drop firm with missing total equity (1,612,128 observations) or missing return on assets (ROA) (114 observations) or missing tangible fixed assets (19 observations).

While selecting the target research group, we filter out firm without non-current liability (long-term debt) and set those filtered out as controlled group in our diff-in-diff regression, because the amount of the tax shield deductible part is related to the long-term debt and firm without long-term debt has no sensitivity to the tax rate change for tax shield deduction reason. In our study, there are two criteria to select firm with non-current liability, which leads to a normal research group and a strict one. We will present the research result of both groups in the latter parts. In the normal research group, firm with non-current liability means that the firm's non-current liability is different from zero in at least one year during the 19 years of research period. In the strict research group, the standard is tight, and firm's non-current liability should be different from zero in all the 19 years during research period.

The difference in these two research groups is beneficial for our study in stating firms with different level of tendency on tax shield. As it shows in the data table, the normal group consists of 1993 companies (37,867 observations) while the strict group includes only 501 companies (9,519 observation) because of the tighter standard. Except for all the 501 companies in the strict group, the normal group also includes the other 1,492 companies that once have non-current liability but not hold it for the whole research period. It means in some years, these 1,492 companies may have zero non-current liability because of their financial strategy. In average, these companies have zero non-current liability in 43.36% of the research period. As a result, compared to the strict group, the normal group may have a weaker sensitivity on tax shield deductible effect because of less dependency on non-current liability.

We select companies with zero non-current liability as our controlled group in our second model, which uses the approach of diff-in-diff. The controlled group has 905 companies (17,195 observations). They are from the same source as the research group and they do not have any non-current liability in any one year of the whole research period. As these companies lacks the non-current liability, they do not react to tax rate change for the reason of tax shield on debt and can be our ideal controlled group to study.

Table 2 presents summary statistics for the normal and strict research treated firms, control firms, and all firms (control firms and research treated firms) in our sample over the 1998-2016 period. It states variables data from four groups involved in our study. The average leverage for all the firms is 1.583, while for treated group is 1.795 and for control group is 1.117. However, in order to avoid outlier, the 50th percentile (median) in the sample is more appropriate to describe the leverage. The median leverage for all the firms is 0.577, while for treated group is 0.842 and 0.325 for control group. An obvious lower leverage ensures the eligibility of control groups, whose leverage only caused by current liability that is not sensible to tax shield deduction.

Table 2. Statistics

	All firm all firm-years (N=55,062)					Research group all firm-years (N=37,867)				
			Percentile					Percentile		
	Mean	S.D.	25th	50th	75th	Mean	S.D.	25th	50th	75th
Firm leverage	1.583	5.456	0.187	0.577	1.556	1.795	6.162	0.267	0.723	1.785
Total non-current liabilities (SEK th)	164.9	5E+06	0	0	4.912	239.8	6E+06	0	0.842	13.1
Interest rate to debt (%)	149.7	15287	0.118	1.225	3.382	79.0	6281.6	0.385	1.816	3.762
Firm characteristics										
ROA	0.089	0.160	0.022	0.069	0.140	0.087	0.151	0.024	0.066	0.133
Firm size (total assets, SEK th)	535.3	9E+06	26.6	56.3	150.8	665.8	1E+07	29.4	62.6	172.2
Tangibility	0.213	0.274	0.006	0.084	0.324	0.263	0.299	0.014	0.143	0.427
Depreciation ratio	0.024	0.038	0.002	0.013	0.033	0.027	0.039	0.004	0.016	0.037

	Control group all firm-years (N=17,195)					Strict group all firm-years (N=9,519)				
			Percentile					Percentile		
	Mean	S.D.	25th	50th	75th	Mean	S.D.	25th	50th	75th
Firm leverage	1.117	3.373	0.088	0.325	0.984	3.486	11.073	0.747	1.647	3.803
Total non-current liabilities (SEK th)	0	0	0	0	0	181.1	599016	6.826	23.7	121.9
Interest rate to debt (%)	305.5	25717	0.005	0.244	1.635	4.496	33.551	1.921	3.055	4.282
Firm characteristics										
ROA	0.095	0.178	0.019	0.079	0.159	0.062	0.074	0.028	0.051	0.088
Firm size (total assets, SEK th)	247.8	2E+06	21.5	44.3	112.3	351.7	1E+06	39.0	90.9	261.2
Tangibility	0.101	0.161	0.001	0.025	0.137	0.499	0.353	0.150	0.500	0.870
Depreciation ratio	0.018	0.036	0.0001	0.007	0.023	0.030	0.029	0.010	0.022	0.040

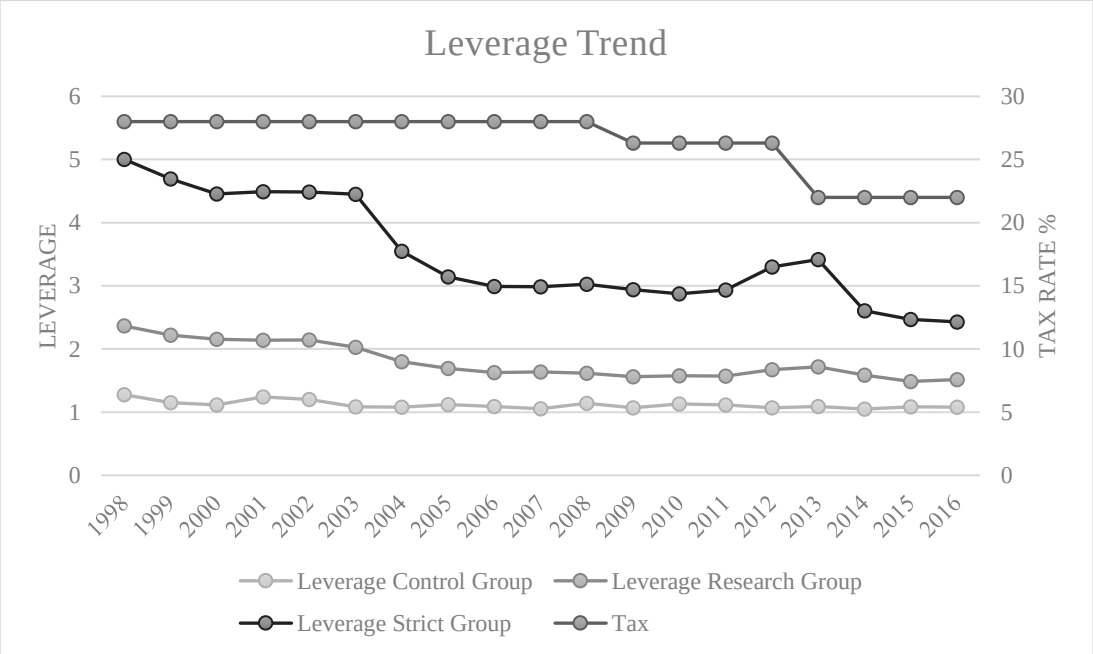
Concerning the interest rate, one important element in our hypothesize 2 and model 4, the mean value cannot describe this item due to the existence of outlier. From the percentiles, we can find that strict group has the highest interest rate to debt among the other groups, while control group has the lowest. It is reasonable because firms from treated group have more liability and control group may even not face a interest expenditure in their account in some year. Strict treated firms have the highest leverage and highest overall interest rate, so they are the most sensible group considering the tax or interest change and should have more active policy adjustment.

Treated firms are larger than control firms by size. For example, the average treated firm in research group has assets of 665.8 thousand SEK, tangible fixed assets proportion of 26.3%, and depreciation ratio of 2.7% as compared to 247.8 thousand SEK in assets, 10.1% in tangibility, and 1.8% in depreciation ratio. We cannot claim the causality of firm size, tangibility, depreciation ratio, and leverage at this moment. However, firms are similar in terms of their profitability. The average ROA is 8.7% in the treated groups and 9.5% in the control groups. The difference is small and means the similarity of the firm's characteristics in operation and making money.

Firms in strict group have long-term debt in every year of our research period. So it is natural that they have the highest leverage among the other groups. They have a relatively lower ROA of 6.2% due to the leverage they endure. They are smaller than firms in research group in total average assets, which is probably the result of outlier. Considering the highest percentage of long-term debt that they possess, firms in strict group are larger in general condition and have more assets than others in every percentile. The large tangibility conforms with the high leverage in strict group, as the large portion of debt usually points to a high amount of property, plant, and equipment.

In addition to the data listed in the table 1, tax is an important element in our study. According to the decision from Sveriges Riksdag, new provisions for tax rate reduction in 2009 and 2013 were all proposed to enter into force on January 1st of the year. We set the tax rate in unit of percentage in our study for easy processing and comparing. As a result, the tax rate in our dataset is 28 from 1998 to 2008, 26.3 from 2009 to 2012, and 22 from 2013 to 2016.

Graph 1. Leverage trend



Graph 1 shows the leverage trend for control group, research treated group, and strict treated group together with the change of tax rate in our sample. In the tax stationary period before 2009, even though the absolute value of leverage is different between control and treated group, the fluctuation trend is similar in the two groups. Generally, the leverage rates are decreasing slightly, and both groups experienced a higher leverage around 2002. After the tax adjustment, treated group has a more active changing trend than the control group, especially in 2013. An assumption of parallel trend between treated group and control group before the tax reduction starts is needed in order to

interpret the causality we find in the later part. Strict treated group has the highest leverage rate in our sample, so the volatility is also higher. The decreasing trend is obvious in strict group and the reaction is so strong in 2013 when the second tax rate adjustment happens. From the graph, we can see firm with higher leverage may be more sensible to the change of external environment. More detailed research of the trend will be discussed in our ITSA model in the latter part.

4. Analysis

4.1. Description of data

4.1.1. AREG Regression

We begin by using an AREG regression to examine whether reduction of tax rate after new regulation influences the firm's leverage. In table 3, we estimate the leverage change after tax adjustment on our research group with panel data. According to the result of a Hausman test we did, we control for firm fixed effect to absorb the firm diversity.

Table 3. AREG Regression Research Group

	(1) Leverage	(2) Leverage	(3) Leverage	(4) Leverage	(5) Leverage
Year since 2009	-0.329***		-0.332***		
	(-7.136)		(-5.772)		
Year since 2013		-0.233***	0.005	-0.326***	
		(-4.195)	(0.078)	(-5.640)	
Year 2009 to 2013				-0.332***	
				(-5.772)	
Tax					0.055***
					(5.668)
ROA	-1.067***	-1.007***	-1.067***	-1.067***	-1.032***
	(-5.414)	(-5.115)	(-5.414)	(-5.414)	(-5.238)
Total Assets	0.000	0.000	0.000	0.000	0.000
	(0.349)	(0.138)	(0.349)	(0.349)	(0.245)
Tangibility	1.980***	2.083***	1.981***	1.981***	2.023***
	(8.529)	(8.984)	(8.524)	(8.524)	(8.712)
Depreciation Ratio	-2.426***	-2.235**	-2.425***	-2.425***	-2.335***
	(-2.767)	(-2.550)	(-2.766)	(-2.766)	(-2.664)
_cons	1.567***	1.441***	1.567***	1.567***	-0.030
	(21.414)	(20.602)	(21.395)	(21.395)	(-0.120)
N	37867	37867	37867	37867	37867
R^2	0.524	0.524	0.524	0.524	0.524
Firm FE	Yes	Yes	Yes	Yes	Yes

Notes: The table presents the regression result from the research group. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively

The column 1 and 2 use one dummy variable to indicate the period difference for each tax rate reduction. We observe that there is a negative effect on leverage ratio after the two adjustment of tax rate, which means the reduction of tax rate in 2009 (28% to 26.3%) and 2013 (26.3% to 22%) leads to a result that compared to the whole period before, firms' leverage ratio is 0.329 lower since 2009 and 0.233 lower since 2013. The column 3 and 4 shows the result of using two dummy variables to measure the tax difference. As both variables in column 4 are statistically significant at 1% level, it indicates that in both period after tax adjustments, the firm's leverage is affected compared with the period prior to the adjustments in 2009. However, as the effect of the dummy variable "year after 2013" is not significant in column 3, the real impact of the second tax rate reduction on

the basis of the first one is unclear. We should not ignore the impact from the first tax rate adjustment on the period after 2013, so it is not easy to conclude the marginal effect of the second tax rate adjustment from the result of this linear regression. We will use other approach to examine it later. The column 5 measures the result caused by tax directly and states that one percent of tax rate reduction leads to a reduction of 0.055 in firm's leverage ratio.

Table 4 shows the result of the same regression exerted on the strict group. The coefficients of the variables from strict group are in the same direction (either positive or negative) with that in research group, with difference existing only in the absolute value, in other words the influence level.

Table 4. AREG Regression Strict Group

	(1) Leverage	(2) Leverage	(3) Leverage	(4) Leverage	(5) Leverage
Year since 2009	-0.848*** (-5.042)		-0.766*** (-3.675)		
Year since 2013		-0.707*** (-3.513)	-0.165 (-0.663)	-0.931*** (-4.430)	
Year 2009 to 2013				-0.766*** (-3.675)	
Tax					0.155*** (4.418)
ROA	-1.508 (-1.141)	-0.961 (-0.731)	-1.495 (-1.132)	-1.495 (-1.132)	-1.204 (-0.914)
Total Assets	-0.000*** (-3.224)	-0.000*** (-3.441)	-0.000*** (-3.204)	-0.000*** (-3.204)	-0.000*** (-3.300)
Tangibility	7.730*** (8.289)	8.040*** (8.648)	7.701*** (8.249)	7.701*** (8.249)	7.836*** (8.405)
Depreciation Ratio	-24.118*** (-3.768)	-23.332*** (-3.645)	-24.136*** (-3.771)	-24.136*** (-3.771)	-23.749*** (-3.710)
_cons	0.891* (1.786)	0.477 (0.982)	0.905* (1.813)	0.905* (1.813)	-3.632*** (-3.763)
N	9519	9519	9519	9519	9519
R^2	0.520	0.519	0.520	0.520	0.520
Firm FE	Yes	Yes	Yes	Yes	Yes

Notes: The table presents the regression result from the strict group. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively

Compared to the firms in research group, these firms, which have long-term debt in every year of the 19-year research period, have a stronger reaction to the tax rate reduction. From the column 4, we can see that firms in strict group decrease their leverage ratio with 0.766 and 0.931 respectively in the period after tax reduction in 2009 and 2013 compared with the period before 2009. The second tax rate adjustment from 26.3% to 22% has an obvious impact on leverage in strict group even if we take than the first adjustment into account. The result in column 5 shows that leverage rate changes with tax rate in 0.155 time, which means one percentage of tax rate reduction leads to 0.155 decrease in leverage rate. The degree of leverage reduction of strict group firms is two to three times to the research group firms, which have long-term debt but not hold it in every year during

the research period. We can say that the influence from the tax rate adjustment on leverage is in proportion to the original leverage a firm has. A firm with a higher leverage, with a higher dependence on leverage and long-term debt, will be more sensitive and have a higher level of decrease in leverage rate corresponding to the tax rate reduction.

From the result of table 3 and 4 we can see the relationship between the control variables and leverage ratio. ROA and depreciation ratio are negative correlated to the leverage rate, which means a firm with high leverage rate may have a relatively lower ROA and depreciation ratio. Tangibility has a positive correlation with the leverage rate, which means a firm with high leverage may have more tangible fixed assets. Total assets has a different side of correlation with the leverage in research group and strict group, so it may be hard to state the relationship.

4.1.2. Diff-in-diff regression

What is the real impact from tax rate reduction on firm leverage ratio? To address this question in a clearer method, the difference in difference regression helps to study the differential effect of the treatment of tax rate. The results in this part present the effect of the tax reduction on leverage change by comparing the average change over time in leverage for our research and strict treatment group, compared to the average change over time for our control group. We did a Hausman test on the regression, the result of which states that a fixed effect control is more suitable to the model. As a result, we use a firm fixed effect to control the difference in firms and the result with the year fixed effect is also stated in the table. The result controlled by firm and year fixed effect is what we empathize. These methods help us to absorb a lot of unobserved variation by including the fixed effect control. The dummy variable of treated group is omitted, which is a natural condition in a fixed effect model for panel diff-in-diff data.

Table 5 presents the diff-in-diff regression result of leverage for research group. Different dummy variables are used for the time period, treated group, and the interaction between time and treated. Leverage is checked at the firm level to account for differences in firm characteristics in the two groups of firms. Tax rate decreases in both the treated and control group, irrespective of their condition, but firms in control group ideally do not respond to the tax change due to their zero long-term debt. In the column 1 to 4, we can see the result of interaction variables are statistically significant. Firms with long-term debt have a lower leverage of 0.287 and 0.205 since 2009 and 2013 compared to their financial condition when they face a 28% tax rate before 2009. In the column 5 and 6, only the interaction between treated and year since 2009 is significant (but not the one with year after 2013), so it can only prove the influence from the first tax rate adjustment in 2009, while the marginal effect from the second adjustment in 2013 is still unclear. From the column 7 and 8, we can see that the tax reduction increases the leverage, but the second tax adjustment does not reach the same level of the effect as the first one. The leverage decrease level in the second after adjustment period (0.283) is even lower than

the one in the first after adjustment period (0.291). The column 9 and 10 shows that one percent of tax rate reduction leads to a reduction of 0.048 in leverage, which is like the result from the AREG regression above.

Table 5. Diff-in-diff Regression Research Group

Notes: The table presents the diff-in-diff regression result from the research group. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively. The coefficients of the year fixed effect items are neglected in the table.

	(1) Leverage	(2) Leverage	(3) Leverage	(4) Leverage	(5) Leverage	(6) Leverage	(7) Leverage	(8) Leverage	(9) Leverage	(10) Leverage
Year since 2009	-0.047	-0.419***			-0.044	-0.334***				
	(-0.782)	(-3.642)			(-0.577)	(-2.756)				
Treated	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
Treated × Year since 2009	-0.285***	-0.287***			-0.290***	-0.291***				
	(-3.901)	(-3.925)			(-3.154)	(-3.170)				
Year since 2013			-0.037	-0.475***	-0.007	-0.088	-0.051	-0.422***		
			(-0.502)	(-3.955)	(-0.076)	(-0.685)	(-0.668)	(-3.480)		
Treated × Year since 2013			-0.202**	-0.205**	0.009	0.008	-0.281***	-0.283***		
			(-2.282)	(-2.316)	(0.080)	(0.074)	(-3.056)	(-3.079)		
Year 2009 to 2012							-0.044	-0.334***		
							(-0.577)	(-2.756)		
Treated × Year 2009 to 2012							-0.290***	-0.291***		
							(-3.154)	(-3.170)		
Tax									0.008	0.070***
									(0.657)	(3.457)
Treated × Tax									0.047***	0.048***
									(3.089)	(3.119)
ROA	-0.876***	-0.885***	-0.835***	-0.889***	-0.876***	-0.885***	-0.876***	-0.885***	-0.852***	-0.888***
	(-6.295)	(-6.340)	(-6.009)	(-6.370)	(-6.294)	(-6.340)	(-6.294)	(-6.340)	(-6.128)	(-6.361)
Total Assets	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.852)	(1.039)	(0.626)	(0.981)	(0.852)	(1.038)	(0.852)	(1.038)	(0.742)	(1.008)
Tangibility	1.705***	1.600***	1.789***	1.608***	1.705***	1.600***	1.705***	1.600***	1.740***	1.602***
	(9.201)	(8.610)	(9.671)	(8.655)	(9.194)	(8.610)	(9.194)	(8.610)	(9.388)	(8.623)
Depreciation Ratio	-1.767***	-2.006***	-1.633**	-2.001***	-1.768***	-2.007***	-1.768***	-2.007***	-1.705***	-1.999***
	(-2.714)	(-3.079)	(-2.508)	(-3.071)	(-2.714)	(-3.080)	(-2.714)	(-3.080)	(-2.618)	(-3.068)
_cons	1.441***	1.804***	1.352***	1.803***	1.441***	1.804***	1.441***	1.804***	0.249	-1.071**
	(29.333)	(20.765)	(28.967)	(20.745)	(29.315)	(20.764)	(29.315)	(20.764)	(1.319)	(-2.474)
N	55062	55062	55062	55062	55062	55062	55062	55062	55062	55062
R^2	0.510	0.511	0.510	0.511	0.510	0.511	0.510	0.511	0.510	0.511
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Table 6. Diff-in-diff Regression Strict Group

Notes: The table presents the diff-in-diff regression result from the research group. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively. The coefficients of the year fixed effect items are neglected in the table.

	(1) Leverage	(2) Leverage	(3) Leverage	(4) Leverage	(5) Leverage	(6) Leverage	(7) Leverage	(8) Leverage	(9) Leverage	(10) Leverage
Year since 2009	-0.021	-0.632***			-0.020	-0.398*				
	(-0.255)	(-3.122)			(-0.199)	(-1.939)				
Treated	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
Treated × Year since 2009	-0.948***	-0.950***			-0.833***	-0.835***				
	(-7.050)	(-7.070)			(-4.936)	(-4.949)				
Year 2013			-0.012	-0.670***	-0.002	-0.193	-0.022	-0.591***		
			(-0.127)	(-3.264)	(-0.012)	(-0.922)	(-0.213)	(-2.874)		
Treated × Year since 2013			-0.839***	-0.842***	-0.230	-0.231	-1.064***	-1.066***		
			(-5.147)	(-5.172)	(-1.127)	(-1.130)	(-6.293)	(-6.310)		
Year 2009 to 2012							-0.020	-0.398*		
							(-0.199)	(-1.939)		
Treated × Year 2009 to 2012							-0.833***	-0.835***		
							(-4.936)	(-4.949)		
Tax									0.003	0.098***
									(0.195)	(2.855)
Treated × Tax									0.179***	0.179***
									(6.342)	(6.364)
ROA	-0.710**	-0.739***	-0.642**	-0.752***	-0.708**	-0.740***	-0.708**	-0.740***	-0.672**	-0.748***
	(-2.517)	(-2.612)	(-2.281)	(-2.657)	(-2.510)	(-2.616)	(-2.510)	(-2.616)	(-2.388)	(-2.641)
Total Assets	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(-0.687)	(-0.532)	(-0.814)	(-0.604)	(-0.671)	(-0.531)	(-0.671)	(-0.531)	(-0.726)	(-0.566)
Tangibility	3.597***	3.400***	3.748***	3.442***	3.579***	3.392***	3.579***	3.392***	3.643***	3.408***
	(8.955)	(8.443)	(9.349)	(8.544)	(8.904)	(8.421)	(8.904)	(8.421)	(9.073)	(8.460)
Depreciation Ratio	-3.864***	-4.368***	-3.787***	-4.428***	-3.860***	-4.338***	-3.860***	-4.338***	-3.821***	-4.351***
	(-2.689)	(-3.037)	(-2.634)	(-3.076)	(-2.686)	(-3.015)	(-2.686)	(-3.015)	(-2.658)	(-3.024)
_cons	1.388***	1.918***	1.259***	1.910***	1.392***	1.919***	1.392***	1.919***	-0.545	-2.611***
	(12.347)	(10.809)	(11.668)	(10.762)	(12.379)	(10.817)	(12.379)	(10.817)	(-1.508)	(-3.175)
N	26714	26714	26714	26714	26714	26714	26714	26714	26714	26714
R^2	0.512	0.513	0.512	0.513	0.512	0.513	0.512	0.513	0.512	0.513
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Table 6 shows the result of diff-in-diff regression on strict group. Like the condition in our first model, the result in strict group is in the same direction with that in research group and has a higher absolute value about 3 to 4 times larger. The significance condition is also similar with the result from the research group. It proves that tax rate adjustment has a severe effect on firms with higher leverage.

The coefficients for the control variables are similar with the result from our first model, while leverage ratio is negative correlated to ROA and depreciation ratio and positive correlated to tangibility and total assets.

4.1.3. Interrupted time series analysis regression

Interrupted time series analysis helps us detect the influence of tax policy in an aggregated level. Resorting Stata, we use ITSA to assess the impact of both tax reductions in 2009 and 2013 in changing the level and trend of Swedish private companies' leverage.

First, we use OLS regression with two lags in the interrupted time series analysis model and get the result:

Graph 2. ITSA model result

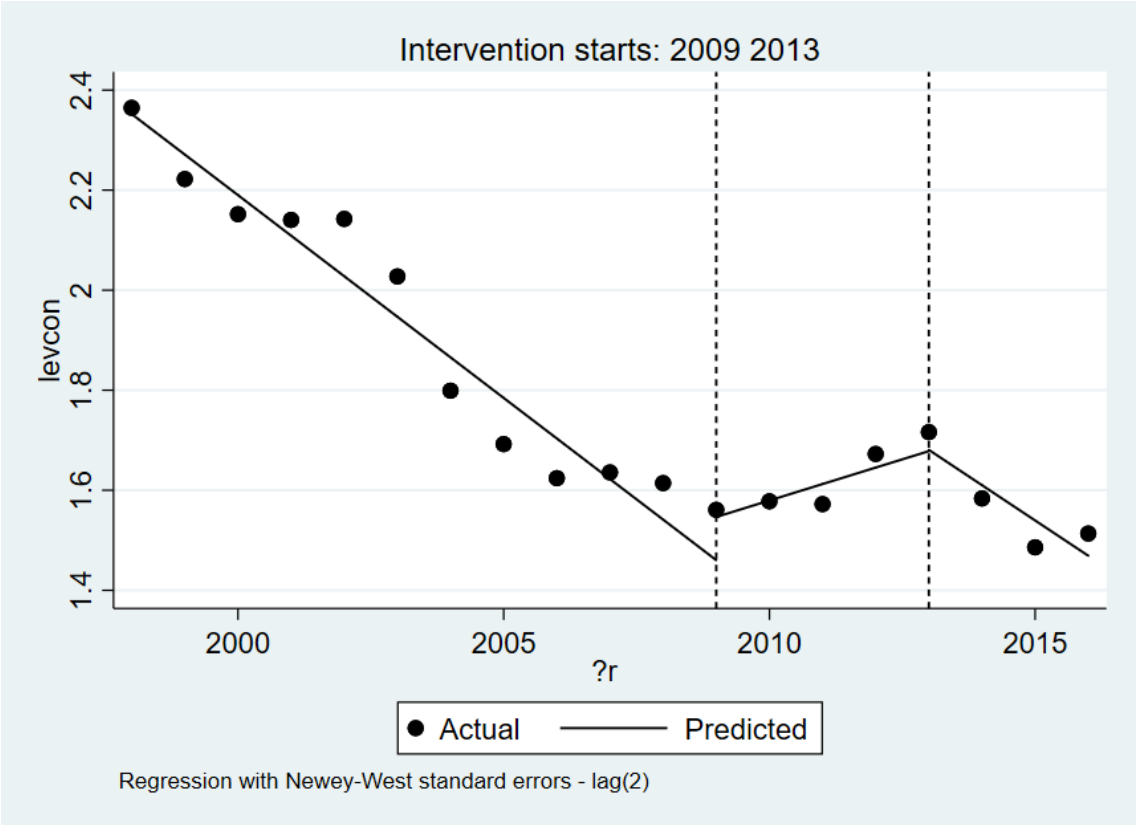


Table 7. ITSA model result

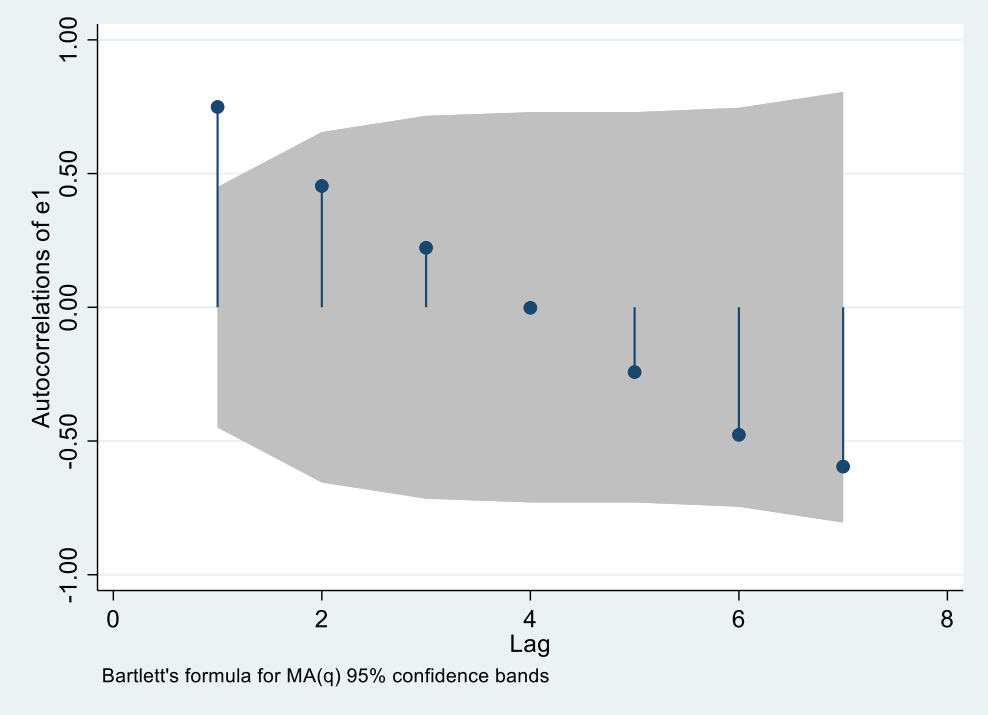
	(1) lev
_t	-0.081***
	(-12.825)
_x2009	0.086
	(1.693)
_x_t2009	0.114***
	(8.749)
_x2013	0.002
	(0.072)
_x_t2013	-0.103***
	(-4.395)
_cons	2.352***
	(69.014)
N	19

Notes: We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

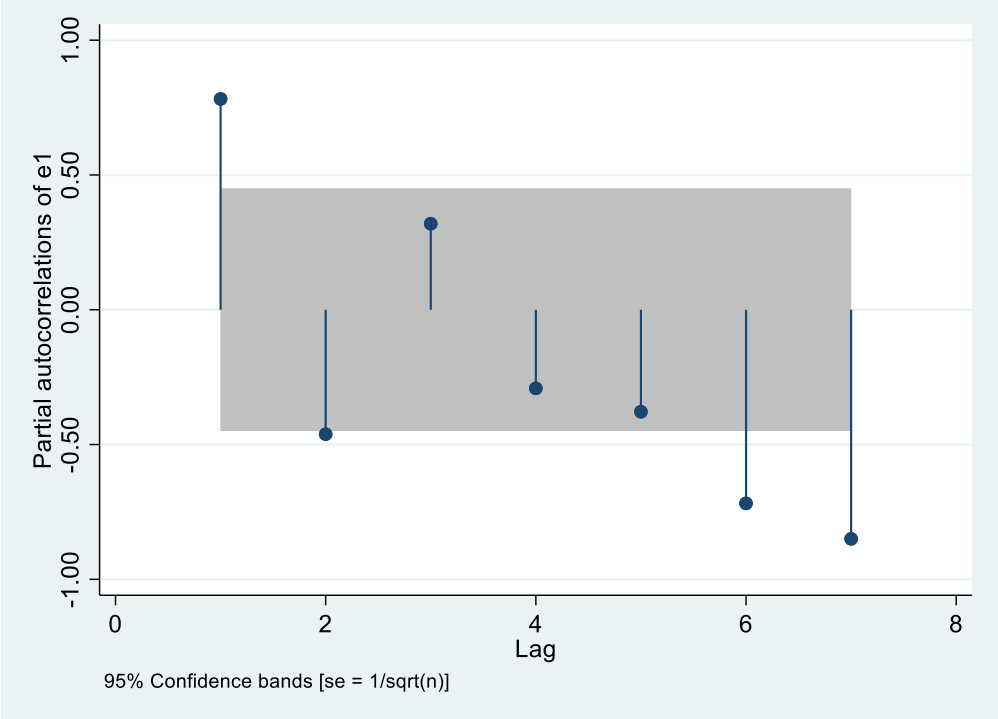
We can reach a conclusion from the graph and table that a downturn in leverage had already existed even before corporation tax reduction, just like _t is significantly negative related with leverage. However, both _x2009 and _x2013 are not statistically significant, which means both tax reductions did not affect private firms' short-term financing behavior. However, _x_t2009 significantly proves that the tax reduction occurred in 2009 increased the leverage in the long run. This is superficially contradictory with existing theories and deserves further research and discussion. Another long-term effect agent _x_t2013 does more conform to common sense. It proves that tax reduction happened in 2013 in the long-term decreased Swedish private firms' leverage. In the end, after two tax reduction, the trend of leverage finally recovered to the one before the reduction.

The second step we need to ensure that the autocorrelation structure embedded in the model is correct. Observing correlogram and partial correlogram, we suspect residuals have second-order autocorrelation (first lag clearly reaches out of shadow). With following Ljung-Box Q test, we can approximately confirm there has second-order autocorrelation.

Graph 2. Correlogram



Graph 3. Partial correlogram



The P-value in Ljung-Box Q test is 0.0259, and the null hypothesis: no second-order autocorrelation can be rejected in the significance level of 5%. In other words, there is autocorrelation between residuals in the model.

Table 8. Results of Q test for autocorrelation in STATA

Portmanteau test for white noise	
Portmanteau (Q) statistic	7.3042
Prob>chi2(7)	0.0259

Thus, our interrupted time series analysis model specifying lags(2) should correctly account for this autocorrelation.

4.1.4. Regression regarding interest rate

Our fourth model examines the impact of interest rate on leverage and whether the existence of interest rate corresponded with tax reduction moderates the association between tax cuts and firms' leverage. Table 9 and 10 presents the correlation condition for the research group and strict group. It states the correlation between tax rate and interest rate, which supports our analysis about the impact from interest rate.

Because the tax and interest rate in our dataset are not in normal distribution and have uncertainty for the data itself, Spearman's rank correlation can describe the relationship more accurately. From the upper-triangular cells of table 9, we can find the interest rate and tax rate are positively correlated (0.163), which conforms with our expectation about the relationship between tax and interest. In our study, the tax rate downtrend leads to the decrease of interest rate, which then results in the reduction of financing cost and exerts the function of interest rate discussed in section 2.

Table 9. Correlation Coefficient Research Group

	Leverage	Tax	Interest Rate	ROA	Total Assets	Tangibility	Depreciation Ratio
Leverage	1	0.079*	0.146*	-0.028*	0.412*	0.364*	0.327*
Tax	0.024*	1	0.163*	0.102*	-0.114*	0.082*	0.092*
Interest Rate	-0.003	0.001	1	-0.072*	0.075*	0.128*	-0.037*
ROA	-0.044*	0.026*	-0.000	1	0.008	-0.026*	0.063*
Total Assets	0.149*	-0.018*	0.001	-0.020*	1	0.056*	0.019*
Tangibility	0.174*	0.047*	-0.011*	-0.098*	-0.027*	1	0.702*
Depreciation Ratio	0.013*	0.055*	-0.008	-0.052*	-0.022*	0.327*	1

Notes: Lower-triangular cells report Pearson's correlation coefficients, upper-triangular cells are Spearman's rank correlation. *p<0.05

Similar to the correlation of research group, Table 10 states the result of that in strict group and the interest rate and tax rate are also positively correlated but with higher coefficient (0.372), which may be owing to the fact that firms in strict group are more dependent on long term debt and more sensible and picky to financial cost and interest

rate. Facing the change of tax rate, firms in strict group may change their financing policy concerning financial cost and interest rate undertaken, so the tax rate has a stronger correlation on interest rate to debt from the strict group.

Table 10. Correlation Coefficient Strict Group

	Leverage	Tax	Interest Rate	ROA	Total Assets	Tangibility	Depreciation Ratio
Leverage	1	0.065*	0.183*	-0.142*	0.576*	0.547*	0.127*
Tax	0.043*	1	0.372*	0.134*	-0.124*	0.047*	0.018
Interest Rate	-0.001	-0.016	1	0.048*	0.047*	0.131*	-0.159*
ROA	-0.057*	0.063*	-0.000	1	-0.056*	-0.153*	-0.026*
Total Assets	0.109*	-0.059*	-0.001	0.004	1	0.373*	0.014
Tangibility	0.189*	0.042*	-0.042*	-0.149*	0.057*	1	0.405*
Depreciation Ratio	-0.046*	0.033*	-0.040*	-0.054*	-0.063*	0.255*	1

Notes: Lower-triangular cells report Pearson's correlation coefficients, upper-triangular cells are Spearman's rank correlation. *p<0.05

We did the Hausman test for the two groups we put into regression and the research group is suitable for the random effect and the strict group is suitable for the fixed effect.[1] Table 11 states the result from research group with a random effect on panel data and strict group with fixed effect on firm and year.

Table 11. Model 4 Regression

Notes: Column 1 is the result of regression from research group. Column 2 and 3 is from strict group. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	(1) Leverage	(2) Leverage	(3) Leverage
Tax	0.054***	0.118***	0.334***
	(5.584)	(3.202)	(3.940)
Interest Rate	-0.000	-0.185***	-0.158***
	(-0.384)	(-3.165)	(-2.695)
Interest Rate × Tax	0.000	0.008***	0.007***
	(0.378)	(3.199)	(2.723)
ROA	-1.046***	-1.325	-1.763
	(-5.414)	(-1.006)	(-1.328)
Total Assets	0.000***	-0.000***	-0.000***
	(5.610)	(-3.292)	(-2.919)
Tangibility	2.636***	7.791***	7.099***
	(13.656)	(8.360)	(7.581)
Depreciation Ratio	-3.100***	-23.530***	-24.829***
	(-3.637)	(-3.678)	(-3.882)
_cons	-0.164	-2.798***	-7.310***
	(-0.609)	(-2.795)	(-3.436)
N	37867	9519	9519
R^2	-	0.520	0.523
Firm FE	No	Yes	Yes
Year FE	No	No	Yes

[1] Even though we only present the result of research group with random effect here, we still did the regression and put the result of the regression of research group with fixed effect in the appendix.

Column 1 shows the condition in research group. As we analyses in the research design part, only the coefficient of the interaction has the meaning that measures the marginal effect of tax or interest rate on leverage. However, the interaction between interest rate and tax is not significant. It means that in research group, interest has no significant impact on the function of tax rate change exerting on leverage. The effect of tax rate is not affected by the existence of interest rate according to the result.

Column 2 and 3 describe the condition in strict group. All the independent variables in both column are significant. We focus on the result in column 3, which absorbs the variation of year by year fixed effect and has a better reflection of the impact of tax and interest rate. The coefficient for variable tax and interest rate are 0.334 and -0.158 respectively, but we need to consider the marginal effect from an overall perspective and take the interaction into account.

Concerning the interactive effect of tax and interest rate on leverage, the coefficient of 0.007 of the interaction in the regression explains the effect. From the rearranged formula (5) of the regression stated in research design part:

$$L_{it} = \beta_0 + (\beta_1 + \beta_3 I_{it}) \times T_{it} + \beta_2 I_{it} + \beta_{4j} C_{jit} + \varepsilon_t \qquad (5)$$

the whole marginal effect of tax on leverage is explained by $(\beta_1 + \beta_3 I_{it}) \times T_{it}$. β_1 is the coefficient of tax, 0.334 in our regression. β_3 is the coefficient of interaction, 0.007. So, the marginal effect of tax can be described like this:

$$\text{Marginal effect of tax rate on leverage} = (\beta_1 + \beta_3 I_{it})$$

$$= (0.334 + 0.007 I_{it})$$

Because β_3 (0.007) is positive, the marginal effect from tax to leverage increases as the increase of interest rate. Correspondingly, the marginal effect of tax on leverage decreases as the decrease of interest rate. The interactive effect between tax and interest rate is positive. These two items strengthen each other due to the positive of interaction coefficient 0.007.

In our study, the interest rate is positively correlated with tax rate. As the tax rate decreases in our research period, the interest rate also decreases. This will moderate the marginal effect of tax on leverage. For example, let's suppose the interest rate before the tax reduction is 4.282%[2]. If the interest rate decreases from 4.282% to 2% after the adjustment, the marginal effect of tax on leverage will change from 0.364[3] to 0.348[4]. The marginal effect of tax on leverage reduces in an amount of 0.016[5], which is the result of interest rate decrease. Since both tax and interest rate are continuous variables, it is not easy to measure the accurate extent of influence they exert on each other. We can only

[2] 75th percentile of the interest rate to debt in our sample for all years
[3] 0.364 = (0.334+0.007×4.282)
[4] 0.348 = (0.334+0.007×2)
[5] 0.016 = (0.364-0.348)

find that the influence is relatively small. In the example listed above, one percentage of interest rate decrease weakens only 1.9%[6] of the marginal effect of the tax on leverage.

From the result of regression in strict group, the decrease of interest rate weakens the marginal effect of tax cuts on leverage, which is in the same direction of our second hypothesis. But the influence level is quite small.

To sum up, interest rate and tax rate are positively correlated in both research and strict groups. The correlation coefficient in strict group is larger. In the research group, interest rate does not have a significant impact on the marginal effect of tax cuts on leverage. In the strict group, interest rate positively strengthens the marginal effect of tax on leverage. When the interest rate decreases, it weakens the marginal effect of tax reduction on firm's leverage.

4.2. Hypothesis testing

4.2.1. Hypothesis 1

The first three model in our study all examine the reaction from firm's leverage facing the tax cuts. According to the result we present, when a tax reduction happens, the private firms in Sweden do have reaction in their leverage. So the first hypothesis 1 is rejected.

The first and second model show that firms start a lower leverage ratio in the period following the tax reduction in 2009. The result is significant comparing with both their previous performance in an AREG regression and the condition in a control group in a diff-in-diff regression. The influence from the second tax reduction is not obvious, because we cannot clearly distinguish the influence of the second reduction from the effect of the first one. But the first two model all confirm that in period since 2009 and since 2013, firms have a significant lower leverage than the level before tax adjustment. In the ITSA model, even though there is not a significant short-term effect regarding corporate leverage in both two tax reductions, they all have long-term effects that tax reduction in 2009 increases the leverage and the reduction in 2013 decreases the leverage. As a result, the first hypothesis that there is no reaction in firms' leverage when tax cuts occur is rejected.

4.2.2. Hypothesis 2

According to the discussion about hypothesis 2, the existence of interest rate may be the reason of disconnection between tax rate cut and enough tax shield incentive, which leads to the change in leverage rate. To test our second hypothesis - the decrease of interest rate corresponded with tax reduction moderates the association between tax cuts and firms'

[6] 1.9% = (0.007÷0.364)

leverage - we run the regression on leverage against tax, interest rate, and interaction between tax and interest.

Our AREG regression on research group in the sample does not have a significant result. The result cannot support that the decrease of interest rate moderates the association.

In the regression on strict group, that the interactive effect between tax and interest rate is positive. When the interest rate decreases, the marginal effect of tax on leverage is weakened. The decrease of interest rate moderates the association between tax cuts and firms' leverage.

Consequently, the test of hypothesis 2 shows different result in our different sample groups. The hypothesis is rejected in the research group and is valid in the strict group. The sample of strict group is extracted from the research group with more stringent standard that firm should have long-term liability in all the year within research period. It claims that our result is not robust from another point of view.

4.3. Summary of findings

From the first model about the influence of tax reduction on leverage, we find that in the after-tax decrease period, company has a lower leverage than before. Overall company has a lower leverage of 0.329 after the tax cuts in 2009, but there is not a significant decrease in leverage after the second tax cuts in 2013. Measured in tax rate, the regression shows that one percent of tax cuts may lead to 0.055 in leverage decrease. The effect of tax cuts is deeper for those companies relying heavily on long-term debt. They have a lower leverage of around 0.848 after the tax cuts in 2009 and one percent of tax cut leads to a lower leverage of 0.155.

The deeper level of influence on company relying heavily on long-term debt is corresponding to their higher leverage described by median. These "strict" companies have a median leverage of 1.647 in our research period than the median leverage of 0.842 of overall research company.

The findings from the diff-in-diff model is like the first one. The first tax cut in 2009 does lower the leverage of company and the second tax cut in 2013 does not have a significant marginal effect. This is interesting as the tax cut level in 2013 from 26.3% to 22% (4.3%) is deeper than that in 2009 from 28% to 26.3% (1.7%). The levels of leverage decrease leaded by the first tax cut in overall company and strict company are 0.287 (34.09% of the median leverage for the group sample) and 0.950 respectively (57.68% of the average leverage). The effect of pre percentage point of tax cut on leverage is -0.048 (5.7% of median leverage) and -0.179 (10.87% of median leverage) for overall company and strict company. The different levels of influence on overall company and strict company also conform the difference in company's leverage. It means that the higher dependency a company has on long-term debt, the more sensible it is on leverage facing tax cut.

In the interrupted time series analysis model (ITSA), there are some interesting findings we should dig deeper. First, we find the leverage before tax reduction had already revealed a trend of downturn; second, we notice neither of tax reductions has any short-term effects regarding corporate leverage; Last but not least, the long-term effects of both tax reductions are statistically significant. However, they are totally reversed. Tax reduction in 2009 boosts debt-financing while the one in 2013 suppresses it.

From the regression related to interest rate, we find that interest rate decreases during our research period where tax rate decreases. The decrease of interest rate has a subtle alleviative influence on the marginal effect of tax cuts on leverage (one percentage point of interest rate decrease weakens around 1.9% of tax marginal effect on leverage) in company with long-term debt. The interest rate contributes to the disconnection between tax rate cut and enough tax shield incentive affecting the leverage in a slight way. The company influenced normally have a high leverage. The interest rate also has a negative impact on leverage in these companies.

For the company does not regard keeping long-term debt as its important strategy (those do not have long-term debt in every year), the mitigation effect of interest rate on the effect of tax is not obvious.

4.4. Robustness

The robustness of model 1 and model 2 is tested, as ITSA model is naturally robust, which does not need a robustness test, and model 4 does not show robust according to the result. To test the robustness, the following variables are substituted by similar items：

Leverage: in the regression researched, leverage is measured by debt divided by equity. In the robustness test, the leverage is measured by debt divided by total assets.

Return on Assets: return of equity is used in the robustness test.

Firm size: the size of company is measured by the total assets. In the robustness test, the size of company is measured by the total equity.

Tangibility: in the regressions above, tangibility is measured as tangible fixed assets divided by total assets. In the robustness test, it is measured by tangible fixed assets divided by total equity.

Depreciation Ratio: depreciation ratio is originally measured as depreciation and amortization divided by total assets. In the robustness test, it is measured by depreciation and amortization divided by total equity.

The result of robustness test is listed in the table in the appendix.

In the robustness test, the coefficients of variables are in the same state of positivity/negativity as the regressions in our study, which means the effect is similar.

The significant level is also similar with that in the original study. Considering that several variables are substituted by a similar item, especially the leverage, the most important variable in our study, is now measured by debt to asset instead of debt to equity, we can say that the result in model 1 and model 2 is robust.

5. Discussion

The first two models in this study all show that the leverage decreases following the tax cuts. It goes in the same direction as the tradition theory. Because the interest payment to debt is tax deductible while the payment to equity holders is not, a lower tax rate means a smaller tax-deductible part for having debt. The benefit of having debt is weakened. So, the company prefers less debt facing the tax cut and then receive a lower leverage before the tax reduction.

One abnormal point reflected through the first two models is that the second tax reduction happens in 2013, which has a larger level of 4.3 % in reduction from 26.3% to 22%, does not significantly decrease the firm leverage, while the first tax reduction of only 1.7% from 28% to 26.3% indeed decrease the leverage.

A potential reason for it may be that before the first tax reduction in 2009, tax rate has been stable for 15 years since 1994. The private firm in Sweden may have been familiar with the rate of 28%, so the first reduction in 2009 breaks the stationary state and private firms actively respond to it regarding it as a signal from the government. When the second tax reduction happens four years later, the short interval does not provide enough stimulation to firms for an even lower leverage.

Another potential reason may come from the government regulation. According to the report from Sveriges Riksdag, in the second adjustment in 2012, there are rules of limitation that stop some company having less tax payable by using interest deductions to have advanced and complex tax planning. The tax planning is used to be eligible and the rules forbid this action. This may moderate the effect of interest rate in our case.

Compared to the public firms in United States researched by Heider and Ljungqvist (2014), the private companies in Sweden have higher leverages and are more sensible to tax change. Despite that we can only compare the leverage change in tax cut for private company to the leverage change in tax rise for the public firm, we still believe that it is of value as it may show the difference in sensitivity towards financing opportunities between private and public companies, which we mention in the last part of literature review and hypothesis. According to Heider and Ljungqvist (2014), Public firms increase leverage by around 0.004 (40 basis points) (1.90% of median leverage) for every percentage-point tax increase. The level of variation is larger for private companies from our research that the overall research companies decrease leverage by around 0.048 (480 basis points) (5.7% of median leverage) for every percentage point tax decrease. Although there are differences in the leverage condition for private and public company, we can say that private company is more sensible to financing strategy based on the percentage change.

The general leverage of private company is higher than that of public company. The median leverage from our sample is 0.842, while the median leverage in the sample of

Heider and Ljungqvist (2014) is 0.211[7]. Except for the potential reason that private company is more open to financing and does not have so many limitations, it may also due to the fact that public firms are able to raise capital from different channels like issuing stocks, while debt is the relatively more important financing method for private companies.

Empirical result of ITSA shows that neither of tax reductions have short-term effect. The reason for that may be the stickiness of long-term debts. In the data selection, we only choose companies which have long-term liabilities as samples. Due to restrictions from covenants and laws, companies cannot adjust their leverage immediately. As for long-term effect, another interesting discovery is the first tax reduction (from 28% to 26.3%, taking effect in 2009) increased corporations' leverage while the second one (from 26.3% to 22%, taking effect in 2013) decreased it. We try to ascribe this phenomenon to government monetary policies and macroeconomic situation. As is well known, global financial crisis and following economic depression swept every country and corporation. Many private firms were in a state of loss under those years, let alone considering payable taxes. In order to resurrect economy, Riksbank reduced repo rate frequently and dramatically. Plus quantitative easing and other stimulus monetary policies, the whole condition was pushing Swedish companies to borrow money and expand. Under such context, tax reduction was not enough to decrease leverage, especially the extent wasn't that much. However, when 2013 Riksdagen decided to slash 4.3% of tax rate, consideration of tax shield played a key role to decrease the leverage for companies.

Seeing through all regression models and corresponding results, we need to answer one emerged question: Why do the first two model and ITSA Model get completely different answers? In difference-in-difference and another AREG regression, tax reduction has significant decreased corporate leverage. Meanwhile, ITSA concludes that tax reduction has little short-term effect and increased leverage as the long-term effect of 2009 reduction. For this seemingly confused phenomenon, we try to provide a potential explanation.

The first two model we applied both treat periods before and after tax reduction as two blocks and compare two blocks to reach the conclusion that after-reduction period has less leverage than pre-reduction one. To some extent, it is a valuable observation. However, they do not take endogenous trend of leverage into account. In contrast to that, ITSA model using independent variable _t to check the endogenous trend of leverage without tax reduction. From the regression result we know that before 2009, Swedish private firms had already begun the process of deleverage. The reason of deleverage trend may be macroeconomic depression both in Sweden and around the world. All in all, tax

[7] Heider and Ljungqvist use debt to assets to calculate the leverage. The median total book leverage is 0.174, which is transformed to 0.211 using debt to equity to calculate the leverage.

reduction in 2009 increased leverage based on the original trend. However, the original deleverage trend renders leverage after 2009 is lower than before.

This difference between different models is partly served as a reason why we want to introduce interrupted time series analysis into accounting and finance field. It provides more insights into object's endogenous property and allocate accountabilities more precisely. In addition, due to the model introduce endogenous trend, it distinguishes short-term and long-term effects well, which is rare for other models. Last but not least, the model doesn't require control group. When study a case like that- tax reduction in the whole country- researchers do not necessarily need to find agents to divide treat group and control group.

From the fourth model we can see that the decrease of interest rate has a slight negative effect on tax cut's influence on leverage. It may be the reason that when interest rate decreases with tax rate, it results in the reduction of financing cost. As a result, even though the leverage does not decrease as expectation, the tax shield deductible part will become smaller conforming to the lower financing cost. So, there is no incentive to alter the leverage as low as it should be.

The mitigation effect of interest rate happens only with firms possessing long-term debt in every year of the research period. It can be explained that for the firm without a regulator long-term debt, it does not emphasize the function of liability. Therefore, minimizing financial cost is the firm's priority and there is no mitigation effect from interest on tax cut.

Through the first, second, and fourth model, the effect of some control variables to leverage is stated. When the effect of these control variables is significant, the ROA, Total Assets, and Depreciation Ratio have a negative effect on leverage and Tangibility has a positive effect on leverage. Apparently, we cannot easily judge the causality behind these effects, but the relationship behind it may be explained as following:

ROA, the return of assets, measures the profitability of the company. From the perspective of a private firm, when they have a reasonable profitability, they may choose to maintain a healthy level of leverage, so their leverage cannot be so high. As a result, the increase of ROA may have a negative effect of leverage.

Total Assets measures the size of the company. This variable is not that significant and exerts different effect (some positive and some negative) on leverage through our regression. Generally, the effect is downside. When a private firm expands, the controller is usually more careful about the speed and risk than the public firm. So, it tends to use equity rather than liability for expansion.

Depreciation Ratio is set to capture the depreciation tax shield. It is no wonder to have a negative effect on leverage, because when a company has enough tax shield from depreciation and amortization, it does not have a strong incentive to get tax shield from

the liability interest payment. So, the higher the depreciation ratio, the more depreciation and amortization a company has, and the less debt and the lower leverage it needs to have for the reason of tax shield.

Tangibility is calculated by the tangible fixed assets divided by total assets. Tangible fixed assets include property, plant, and equipment, which requires a large sum of funds to purchase. For a private company, when it has a lot of tangible fixed assets, it may require more liability to support its capital. As a result, the tangibility has a positive effect on leverage.

6. Conclusion

Because interest paid to debt holders is tax deductible before corporate income taxes are calculated, whereas payments to equity holders do not receive a tax deduction, the tax rate becomes an important determining factor for company capital structure. Theoretically, the fluctuation of tax rate has an influence on the company's leverage as it decides the tax deducted benefit from interest payment. However, recent study shows that the reaction of leverage to tax change is asymmetric, as the firm's leverage does not respond to tax cuts (Heider & Ljungqvist, 2014). Our study therefore aims to investigate whether the tax cut has a significant effect on leverage and the moderating effect from the interest rate changing corresponded to the tax cut. To answer these questions, we use AREG regression, difference in difference method, and an interrupted time series analysis model to research on two corporate tax reductions in Sweden and the effect on private firms.

Our results indicate that firms have a lower financial leverage after the tax cuts. Private firms have a lower leverage by around 0.048 for every percentage-point tax decrease. However, the two tax reductions exert two different trend effects on firms' leverage in long term, with the one in 2009 increases the leverage and the one in 2013 decreases the leverage. The moderating effect from the interest rate is not significant among normal firms. When it comes to firm heavily depending on long-term debt, the decrease of interest rate slightly weakens the effect of tax cuts on leverage.

6.1. Contributions

Recent years after more and more scholars engage in corporate tax research, whether tax is the key determinant of leverage and how does corporate react when tax rate changes become a fierce debate. MM-theorem is under attack for not meeting the reality. Through our thesis, we hope people can obtain more insight for this topic.

Using difference-in-difference and traditional AREG model, we reach the conclusion conforms to theory, which shows leverage will be decreased when tax rate and tax shield lowered. However, we introduce ITSA model into the analysis and find it provides a totally different conclusion. And we further discuss the reason for such differences.

Resort to the discussion, we clearly relate the difference between the common models and interrupted time series analysis model and the strength of the latter. We encourage scholars to be acquainted with and apply it in related research.

In ITSA model, we find the leverage of Swedish private firms was continually decreasing before the tax reduction. And margin by which Riksdag reduce tax rate matters. Small reduction maybe not enough to alleviate the plight of macro-economic but large one functions well.

Concerning the Swedish government implements other two decrease in corporate tax rate from 22 percent to 21.4 percent from 1st January 2019 and to 20.6 percent from 1st January 2022, we see the signal of continuously stimulating the economy and encourage prosperity of business. According to the result of our regression, we anticipate that these two tax reductions will further decrease the leverage of private firm in the degree of about 0.029 and 0.038 respectively.

6.2. Limitations

In the writing process, out of limited timing, knowledge and access to data, we feel it remains many pities ought to be refined. However, we can still list it below to serve as a caveat for readers.

Given in recent years, Sweden has only reduction rather than hike for corporation tax, we only check the situations under tax reduction. Although it is a consensus that firms will increase leverage when tax rate increase, the research will be sounder and more comprehensive should we test the tax hike situation as well.

Even as we apply difference-in-difference model to test consequences of tax reduction, the quality of control group is not as good as articles studying America tax reduction. Due to different tax directives in different states, companies in states which do not implement same tax policy are a good control group in nature. In Sweden as a non-federal country, we can only find some agents to create control group forcibly. The rationale we choose firms having no long-term debt as control group is their debt more associated with non-tax purpose (e.g. operating activities). Nonetheless, a better-quality control group will be more helpful. So we introduce ITSA model to buck the problem.

ITSA model is not perfect either. In the ITSA model, we just assume both tax reductions' influence coefficient equals 1 indefinitely. This is a really dubious assumption. If we can set it as withering gradually, the result will be more precise.

Another deficiency in our ITSA model is that the time span is a bit narrow. The perfect precondition for using ITSA model is long-term traced data. We can only apply a 19-year span as the observation period. Although we can extend pre-reduction period, the post-reduction only can have 10 years. The gap between two reductions is also too narrow. We are really skeptical whether only 4 sample points (from 2009 to 2012) can form a effective trend. The alternative is treating two tax reductions as one concerted effort taking effect in the beginning of 2009, but it is abandoned after the trade-off. Apparently, the extent to which tax rate reduced in second change is much bigger than the first one.

Even though we make analysis on the change of leverage, we do not state any discussion about the liability and equity variation following the leverage change. This may be a significant shortage for our thesis that the deeper level of effect on leverage is not discussed. When the leverage decreases following the tax cuts, we do not research

whether company increases the equity or has less liability. So we may miss a clear interpretation on the result of leverage change from the company's motivation and follow-up policy.

6.3. Suggestions for future research

We have a few suggestions for future research within the topic of corporation leverage and taxes. First, disturbance analysis is a good way to check the real effect for the intervention event. It further distinguishes short-term and long-term effect, which are largely dismissed in related research. However, dividing effects into two groups match the reality better and help us understand the mechanism more comprehensively. Parenthetically, interrupted time series analysis is only one kind of disturbance analysis. Improving ITSA model or finding a more suitable model, no matter which way be applied, the methods at disposal will increased.

Second, try to find some better agents used to create control group. The selection criteria of have long-term debt or not is a compromise. If future researchers can innovate more suitable criteria, it will be a big help.

Third, using the natural logarithm is beneficial for the linearization of the corresponding change between two variables when variables are in percentile form. The future researchers can try to use the natural logarithm for the interest rate and tax rate to capture the influence from variation.

Last, we disprove the decrease of interest rate would tamper the reaction of leverage towards tax reduction. Those scholars who hold the opinion of asymmetry theory should find a more convincing way to explain their thoughts.

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8. Appendixes

Table 12. Model 4 Regression for research group with fixed effect

Notes: This is the result of research group doing the regression in model 4 with fixed effect. From the Hausman test we did, we know that a random effect is more suitable for the regression of research group, so we state only the result of that above. In this table, we use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	(1)	(2)
	Leverage	Leverage
Tax	0.055***	0.133***
	(5.659)	(5.732)
Interest Rate	-0.000	-0.000
	(-0.304)	(-0.275)
Interest Rate × Tax	0.000	0.000
	(0.298)	(0.272)
ROA	-1.031***	-1.063***
	(-5.237)	(-5.382)
Total Assets	0.000	0.000
	(0.249)	(0.566)
Tangibility	2.023***	1.838***
	(8.712)	(7.891)
Depreciation Ratio	-2.336***	-2.689***
	(-2.664)	(-3.067)
_cons	-0.029	-1.693***
	(-0.112)	(-2.915)
N	37867	37867
R^2	0.524	0.525
Firm FE	Yes	Yes
Year FE	No	Yes

Table 13. Robust test for model 1 with research group

Notes: This table states the robust test result of AREG for the research group. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	(1)	(2)	(3)	(4)	(5)
	Leverage D/A	Leverage D/A	Leverage D/A	Leverage D/A	Leverage D/A
Year since 2009	-0.020***		-0.019***		
	(-15.892)		(-11.689)		
Year since 2013		-0.017***	-0.003*	-0.022***	
		(-10.873)	(-1.658)	(-13.658)	
Year 2009 to 2013				-0.019***	
				(-11.689)	
Tax					0.004***
					(13.753)
ROE	-0.009***	-0.008***	-0.009***	-0.009***	-0.009***
	(-7.802)	(-7.480)	(-7.800)	(-7.800)	(-7.631)
Equity	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(-7.901)	(-8.460)	(-7.855)	(-7.855)	(-8.090)
Tangibility E	0.000	0.000	0.000	0.000	0.000
	(0.437)	(0.819)	(0.427)	(0.427)	(0.611)
Depreciation Ratio E	0.009***	0.009***	0.009***	0.009***	0.009***
	(3.600)	(3.629)	(3.601)	(3.601)	(3.618)
_cons	0.375***	0.370***	0.375***	0.375***	0.271***
	(407.074)	(453.492)	(407.081)	(407.081)	(38.520)
N	37867	37867	37867	37867	37867
R^2	0.761	0.761	0.761	0.761	0.761
Firm FE	Yes	Yes	Yes	Yes	Yes

Table 14. Robust test for model 1 with strict group

Notes: This table states the robust test result of AREG for the strict group. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	(1)	(2)	(3)	(4)	(5)
	Leverage D/A	Leverage D/A	Leverage D/A	Leverage D/A	Leverage D/A
Year since 2009	-0.009***		-0.003		
	(-4.322)		(-1.285)		
Year since 2013		-0.014***	-0.011***	-0.015***	
		(-5.485)	(-3.609)	(-5.627)	
Year 2009 to 2013				-0.003	
				(-1.285)	
Tax					0.002***
					(5.624)
ROE	-0.002	-0.002	-0.002	-0.002	-0.002
	(-1.226)	(-1.183)	(-1.240)	(-1.240)	(-1.251)
Equity	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(-2.932)	(-2.878)	(-2.834)	(-2.834)	(-2.830)
Tangibility E	0.001***	0.001***	0.001***	0.001***	0.001***
	(5.763)	(5.837)	(5.742)	(5.742)	(5.733)
Depreciation Ratio E	-0.051***	-0.052***	-0.052***	-0.052***	-0.052***
	(-7.895)	(-7.944)	(-7.938)	(-7.938)	(-7.936)
_cons	0.513***	0.512***	0.513***	0.513***	0.445***
	(281.896)	(309.074)	(282.106)	(282.106)	(38.850)
N	9519	9519	9519	9519	9519
R^2	0.839	0.839	0.839	0.839	0.839
Firm FE	Yes	Yes	Yes	Yes	Yes

Table 15. Robust test for model 2 with research group

Notes: This table states the robust test result of diff-in-diff for the research group. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	(1) Leverage D/A	(2) Leverage D/A	(3) Leverage D/A	(4) Leverage D/A	(5) Leverage D/A	(6) Leverage D/A	(7) Leverage D/A	(8) Leverage D/A	(9) Leverage D/A	(10) Leverage D/A
Year since 2009	-0.004**	-0.022***			-0.000	-0.025***				
	(-2.075)	(-6.251)			(-0.205)	(-6.758)				
Treated	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
Treated × Year since 2009	-0.016***	-0.016***			-0.018***	-0.018***				
	(-7.210)	(-7.236)			(-6.357)	(-6.378)				
Year since 2013			-0.007***	-0.027***	-0.007**	0.002	-0.007***	-0.023***		
			(-3.143)	(-7.203)	(-2.391)	(0.474)	(-3.099)	(-6.253)		
Treated × Year since 2013			-0.010***	-0.010***	0.003	0.003	-0.014***	-0.015***		
			(-3.543)	(-3.567)	(1.020)	(1.021)	(-5.122)	(-5.141)		
Year 2009 to 2012							-0.000	-0.025***		
							(-0.205)	(-6.758)		
Treated × Year 2009 to 2012							-0.018***	-0.018***		
							(-6.357)	(-6.378)		
tax									0.001***	0.004***
									(3.080)	(6.203)
Treated × Tax									0.002***	0.002***
									(5.202)	(5.227)
ROE	-0.004***	-0.004***	-0.004***	-0.004***	-0.004***	-0.004***	-0.004***	-0.004***	-0.004***	-0.004***
	(-4.379)	(-4.835)	(-4.116)	(-4.825)	(-4.376)	(-4.834)	(-4.376)	(-4.834)	(-4.248)	(-4.829)
Equity	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(-9.944)	(-9.751)	(-10.203)	(-9.814)	(-9.886)	(-9.747)	(-9.886)	(-9.747)	(-10.008)	(-9.793)
Tangibility E	0.000	0.000	0.000*	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(1.450)	(1.044)	(1.814)	(1.137)	(1.445)	(1.050)	(1.445)	(1.050)	(1.611)	(1.090)
Depreciation Ratio E	0.015***	0.015***	0.015***	0.015***	0.015***	0.015***	0.015***	0.015***	0.015***	0.015***
	(6.383)	(6.281)	(6.413)	(6.271)	(6.371)	(6.276)	(6.371)	(6.276)	(6.394)	(6.282)
_cons	0.341***	0.362***	0.337***	0.362***	0.341***	0.362***	0.341***	0.362***	0.258***	0.207***
	(454.898)	(159.119)	(512.543)	(159.048)	(454.927)	(159.119)	(454.927)	(159.119)	(44.485)	(15.513)
N	55062	55062	55062	55062	55062	55062	55062	55062	55062	55062
R^2	0.768	0.769	0.768	0.769	0.768	0.769	0.768	0.769	0.768	0.769
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Table 16. Robust test for model 2 with strict group

Notes: This table states the robust test result of diff-in-diff for the strict group. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	(1) Leverage D/A	(2) Leverage D/A	(3) Leverage D/A	(4) Leverage D/A	(5) Leverage D/A	(6) Leverage D/A	(7) Leverage D/A	(8) Leverage D/A	(9) Leverage D/A	(10) Leverage D/A
Year since 2009	-0.004**	-0.023***			-0.000	-0.021***				
	(-2.055)	(-5.319)			(-0.097)	(-4.801)				
Treated	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
Treated × Year since 2009	-0.005	-0.005*			-0.003	-0.003				
	(-1.632)	(-1.648)			(-0.754)	(-0.764)				
Year since 2013			-0.007***	-0.023***	-0.007**	-0.001	-0.007***	-0.023***		
			(-3.272)	(-5.148)	(-2.547)	(-0.270)	(-3.179)	(-5.073)		
Treated × Year since 2013			-0.006*	-0.006*	-0.004	-0.004	-0.007*	-0.007*		
			(-1.708)	(-1.720)	(-0.906)	(-0.909)	(-1.849)	(-1.862)		
Year 2009 to 2012							-0.000	-0.021***		
							(-0.097)	(-4.801)		
Treated × Year 2009 to 2012							-0.003	-0.003		
							(-0.754)	(-0.764)		
tax									0.001***	0.004***
									(3.166)	(5.072)
Treated × Tax									0.001*	0.001*
									(1.854)	(1.866)
ROE	0.003***	0.003**	0.003***	0.003**	0.003**	0.002**	0.003**	0.002**	0.003**	0.003**
	(2.578)	(2.245)	(2.601)	(2.251)	(2.571)	(2.244)	(2.571)	(2.244)	(2.554)	(2.245)
Equity	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(-7.682)	(-7.604)	(-7.630)	(-7.610)	(-7.618)	(-7.606)	(-7.618)	(-7.606)	(-7.618)	(-7.607)
Tangibility E	0.001***	0.001**	0.001***	0.001***	0.001***	0.001**	0.001***	0.001**	0.001***	0.001**
	(2.797)	(2.555)	(2.843)	(2.580)	(2.779)	(2.545)	(2.779)	(2.545)	(2.763)	(2.553)
Depreciation Ratio E	0.023***	0.023***	0.023***	0.023***	0.023***	0.023***	0.023***	0.023***	0.023***	0.023***
	(4.791)	(4.734)	(4.735)	(4.728)	(4.739)	(4.737)	(4.739)	(4.737)	(4.737)	(4.735)
_cons	0.351***	0.368***	0.351***	0.368***	0.351***	0.368***	0.351***	0.368***	0.307***	0.251***
	(323.335)	(118.844)	(363.044)	(118.843)	(323.442)	(118.845)	(323.442)	(118.845)	(39.349)	(13.958)
N	26714	26714	26714	26714	26714	26714	26714	26714	26714	26714
R^2	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826	0.826
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes