ABSTRACT

Title of Dissertation:	DO STATE TAXES PLAY A ROLE IN CORPORATE INVESTMENT DECISIONS? EVIDENCE FROM INTERSTATE INVESTMENT
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Using a novel data set of state-specific investments at the project level and staggered changes in state corporate income taxes, I examine whether corporate income taxes affect firms' investment location decisions in the U.S. In contrast to recent studies that document an insignificant effect on firm-level investments, I find that changes in state taxes have a significant effect on project-level investments—firms locate their investment projects in states that cut their corporate taxes. This effect is stronger for projects that are less geographically constrained and for projects that create more jobs. Additional analysis shows that state taxes are particularly relevant for firms' investment location decisions among competing states. Taken together, this study offers new evidence that state corporate income taxes play an important role in firms' interstate investment location decisions.

DO STATE TAXES PLAY A ROLE IN CORPORATE INVESTMENT DECISIONS? EVIDENCE FROM INTERSTATE INVESTMENT

by

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Chapter 1: Introduction

An important objective of state governments is to stimulate economic growth and create jobs. To entice businesses to invest in their jurisdictions, states compete with each other by reducing corporate income tax rates and offering other tax incentives. Indeed, the race to attract and retain investment has intensified in recent years, as many states still struggle with sluggish economic growth following the financial crisis (Simon, 2017). Yet, we know little about the extent to which firms' investment location decisions are influenced by state corporate income taxes or the types of investments that are more sensitive to changes in state taxes. In this paper I address these questions by exploiting a novel data set that contains state-specific investments at the project level (as opposed to the firm level), which allows me to identify both the location and the nature of each investment project.

Given that corporate tax policy can have a substantial effect on the economy, a large stream of accounting and economics research examines the relationship between tax incentives at different levels (e.g., federal corporate taxes, international corporate taxes) and investment decisions. Optimal capital accumulation theory predicts that tax cuts should reduce the cost of investment and hence induce more capital inflow. The empirical evidence, however, is mixed: while some studies find a positive and significant association between corporate income tax cuts and investment (Caballero et al., 1995; Cummins et al., 1994; 1996; Hines, 1996; Gupta and Hofmann, 2003; Chirinko and Wilson, 2008), other studies find no significant association (Wasylenko, 1981; Coughlin et al., 1991; Asker et al., 2014; Ljungqvist et al., 2017). Hence, whether

tax incentives, and in particular state-level tax incentives, are effective tools to attract investment is an open question.

The mixed evidence to date stems in part from two key challenges this literature faces: endogeneity and data constraints. First, several studies exploit changes in federal income taxes, which are infrequent events and affect all firms simultaneously (e.g., Cummins et al., 1994; Caballero et al., 1995). Hence, given that federal tax rates move together with some macroeconomic factors that can also affect investment, it is hard to distinguish tax effects from contemporaneous non-tax shocks to investment. Studies at the international level (e.g., Cummins et al., 1996; Grubert and Mutti, 2000) are also subject to endogeneity concerns because variation in national tax rates may be correlated with different social, political, legal, and accounting systems across countries. To address these issues, several prior studies use – as I do in this paper – staggered changes in state corporate income tax rates as exogenous shocks. While some of these studies (e.g., Hines, 1993; Gupta and Hofmann, 2003; Chirinko and Wilson, 2008) find that changes in state corporate income taxes have a significant effect on investment at the *state* level, more recent studies by Asker et al. (2014) and Ljungqvist et al. (2017) find no evidence of a significant effect at the *firm* level. This conflicting evidence may be due to the second challenge that this literature faces, namely, the lack of granular investment data at the firm level.

More specifically, investment data are generally available at the firm level, and hence researchers interested in the effect of changes in state corporate income taxes have to rely on the assumption that changes in firm-level investment represent new

investments in the headquarters (HQ) state.[1] In reality, firms often make investments outside of their HQ state. Take General Motors (GM) as an example. GM's HQ is located in Michigan, but in 2016, it announced new investment projects in four different states—Kansas, Kentucky, New York, and Tennessee. As this example illustrates, absent information about the location of firm investment, using firm-level investment in this context may result in substantial measurement error since investment projects do not concentrate in a firm's HQ state. Further, studying firm-level investment implicitly assumes that the sensitivity of corporate investment to tax changes is homogeneous across types of investment. But state-level tax incentives are likely more effective in attracting certain types of investment (e.g., investments that are less geographically constrained or that yield greater tax benefits). Hence, failure to distinguish different types of projects may obscure the actual tax effect on investment location decisions.

To overcome these challenges, in this paper I exploit a novel data set, 'fDi Markets', which contains project-level data on greenfield investments in the U.S. that include the location, type, and sector of each investment project.[2] Specifically, I employ a sample of 6,085 investment-project-years for 1,250 unique firms from 2007 to 2016 to examine the effect of changes in state corporate income taxes on firm

[1] Alternatively, prior research (e.g., Heider and Ljungqvist, 2015; Ljungqvist et al., 2017) approximates the effect of multiple state tax rates by weighting firm establishments based on National Establishment Time Series (NETS) data. However, these studies face the same limitation in that all investments of a firm are affected by a single weighted- average state tax shock instead of matching investment projects to state taxes in their actual locations.

[2] Greenfield investments are investments in which firms establish new facilities from the ground up. They are a primary component of foreign direct investment, together with mergers and acquisitions (M&A). The fDi Markets database provides greenfield interstate investments in the U.S. and foreign direct investment with wide coverage of countries and industry sectors. The data can be found at http://www.fdimarkets.com.

investment. Consistent with optimal capital accumulation theory, I find that firms tend to invest more in states that lower their corporate income taxes, which suggests that firms' investment location decisions are sensitive to changes in state corporate income taxes. This effect is economically meaningful, with firm investment increasing by more than 1.0% of total assets following a tax cut. For the median firm in the sample, this effect corresponds to a $92 million increase in investment in a state following an average tax cut of 1.12%. I further find that firms' investment location decisions show an asymmetric response to changes in corporate taxes: while firm investment is sensitive to reductions in state corporate taxes, it is largely insensitive to tax increases. The latter result may be driven by the irreversibility of investment, as it is costly for firms to withdraw investments once they have been made.

To investigate how the effect of state corporate income taxes varies across types of investment, I conduct two sets of cross-sectional tests. First, I examine whether the tax effect is stronger for investment projects that have greater geographic flexibility, that is, investments that are less constrained by geographic location. I argue that expansion projects rather than new projects, projects that are closer to a firm's HQ, projects that are driven by local factors such as market size or transportation accessibility, and projects that require labor with specific skills are more geographically constrained and hence less sensitive to changes in state corporate income taxes. Consistent with these predictions, I find that the effect of state tax cuts is stronger for investments in new facilities, investments that are distant from a firm's HQ, investments that are less dictated by location-specific factors, and investments that are not in high-tech industries.

Second, I examine whether the tax sensitivity of investment is greater for investments that are expected to receive greater benefits from state corporate income taxes based on a state apportionment formula.[3] I argue that firm investment location decisions should be more sensitive to changes in state corporate income taxes when a higher portion of the firm's taxable income is apportioned to the state. In particular, I predict that, ceteris paribus, a larger portion of a firm's taxable income is apportioned to the state when the firm pays more wages to employees in the state. I find that investments accompanied by a larger number of new hires and, therefore, apportion a larger taxable income to states by the payroll factor, show greater sensitivity to state tax cuts. Firm investment location decisions should also be more sensitive to changes in state taxes when states' apportionment formulas apply more weight to physical presence (i.e., payroll and property factors), whereas they should be less sensitive to changes in state taxes when states place more weight on sales, which can potentially reduce income tax burdens for firms that have property and payroll in the state. Consistent with these predictions, I find that investment location decisions are more sensitive to changes in state taxes when states put more weights on property and payroll factors whereas they are less sensitive to changes in state taxes when state apportionment formulas put more weight on the sales factor.

A concern with the above analysis is that unobserved confounding factors could bias the results. To mitigate this concern, I next adopt a matched sample approach whereby I compare firm investments in a treated state with investments in untreated neighboring states, which are viewed as having a similar economic and business

[3] I provide details on the state apportionment formula in Section 3.

environment as the treated state. I continue to find a significant association between state tax cuts and investment, indicating that states that decrease their corporate income taxes attract more investment than their neighboring states, which are often the most competitive states. When I aggregate investments at the state level, I find that states that cut corporate income taxes enjoy 3.59% more investment inflow relative to their neighboring states, suggesting that the tax sensitivity of firms' investment location decisions has an economically significant effect.

To reconcile my finding with firm-level evidence from prior research, I conduct two analyses. First, following prior research, I examine the effect of state tax changes on *aggregate firm-level* investment based solely on a firm's HQ state. In contrast to my findings above on *project-level* investment, I find that changes in state corporate income taxes do not have a significant effect on firm-level investment. This finding further highlights the importance of identifying the location of firms' individual investment projects to properly match projects to the tax rate changes. Second, I examine whether firm-specific tax treatments affect corporate investment location decisions. I find that firm-specific tax treatments and other subsidies significantly reduce investment sensitivity to changes in state corporate income taxes, suggesting that firm-specific benefits can act as a substitute for tax cuts in location decisions. This result also shows that changes in state corporate income taxes continue to play a major role in investment decisions after controlling for firm-specific treatments.

In additional analyses, I show that my main findings are robust to controlling for other state tax policies that may affect firm investment decisions such as changes in R&D, investment, or job creation tax credits as well as changes in personal income

tax and capital gains tax rates. Further, I do not observe delayed response or anticipation effects around changes in corporate income tax rates, indicating that firm investment decisions respond to changes in tax policy on a timely basis.

This paper contributes to the literature in two main ways. First, this study extends a growing literature on firm investment decisions by investigating how firms choose the location of new capital investment. In particular, this study provides new evidence that state corporate income taxes have a real effect on firms' interstate investment location decisions. This evidence is based on a novel data set with granular investment information at the project level, which allows me to overcome the measurement error in prior studies that approximate a firm's investment locations using the firm's HQ state by matching the state in which a project is located with tax changes in the corresponding state. Such disaggregation is critical as I find that, in contrast to prior literature, state corporate income tax cuts have an economically significant effect on firms' investment location decisions. Second, this study provides in-depth evidence on firms' investment decisions at the project level. In practice, firms evaluate and make investment decisions at the project level. Prior corporate finance and accounting literature, however, focus primarily on investments aggregated at the firm level due to the lack of project level data.[4] The granular investment data that I employ allow me to examine how the effect of changes in corporate income taxes varies across types of projects and sectors.

[4] Prior research has also used U.S. Bureau of Economic Analysis (BEA) data to examine the foreign direct investment of MNEs (multi-national enterprises) in various settings (e.g., Desai et al., 2009; Blouin et al., 2012; Hanlon et al., 2015; Desai et al., 2016; Faulkender et al., 2016). However, the BEA excludes firms that make purely domestic investments and it does not separately report firms' domestic investments from total investments. Thus, these studies cannot identify interstate investments in the U.S. at the project level.

This study also has several policy implications. First, I provide evidence that tax cuts at the state level are an effective tool for attracting investments to states. Thus, in addition to firm-specific tax treatments and apportionment tax formulas that favor investment, states can increase firm investment, and in turn support job growth, by cutting corporate income taxes. Second, I find variation in responses to changes in state corporate income taxes, which implies that while states can attract more investment by cutting corporate income taxes, tax cuts alone may not be sufficient to attract investment in, say, high-tech industries. These results suggest that to attract investment in specific industries, states may also need to offer non-tax incentives related to factors such as education or R&D infrastructure. Third, results of the neighboring-states analysis suggest that changes in one state's taxes can affect investment in competing states as well as investment in the treated state. States should take into account competing states' tax policies when considering their own tax policies, since both will determine the relative attractiveness of the states.

The rest of the paper is organized as follows. Chapter 2 provides a brief review of related literature. Chapter 3 provides background related to my research questions and develops the paper's hypotheses, while Chapter 4 describes the sample, data, and research design. Chapter 5 presents the main empirical analysis, and Chapter 6 provides results of robustness checks. Finally, Chapter 7 concludes.

Chapter 2: Related Literature

2.1. Tax Rate Change and Investment

As tax rates can directly affect the net present value of an investment, corporate taxes play a significant role in determining managers' investment decisions. Optimal capital accumulation theory (Jorgenson, 1963; Hall and Jorgenson, 1967) predicts that a tax rate cut should reduce the cost of investment and lead to an increase in capital investment. Hence, all else equal, firms will choose to invest in states with lower taxes.

Due to the substantial economic impact of corporate income taxes, a large body of accounting and economic research has examined whether such taxes are associated with firm investment. Empirical studies yield mixed findings on the impact of tax rate changes. Specifically, a number of studies find a strong association between changes in tax rate and level of capital expenditure (Auerbach and Hassett, 1991; Cummins et al., 1994, 1996; Caballero et al., 1995; Hines, 1996; Hassett and Hubbard, 2002; Gupta and Hofmann, 2003; Chirinko and Wilson, 2008), while others find no significant effect (Wasylenko, 1981; Newman and Sullivan, 1988; Coughlin et al., 1991; Asker et al., 2014; Ljungqvist et al., 2017).

The mixed findings on the impact of corporate taxes are driven mainly by the endogenous relationship between tax rate changes and unobserved underlying factors, such as economic conditions or measurement errors in proxies. In particular, multiple studies have focused on changes in federal income taxes, which are infrequent events and affect firms simultaneously (e.g., Cummins et al., 1994; Caballero et al., 1995). Hence, given that federal tax rates move together with certain macroeconomic factors that also can affect investment, it is difficult to disentangle tax effects from

contemporaneous non-tax shocks to investement. Studies at the international level (e.g., Cummins et al., 1996; Grubert and Mutti, 2000) also face endogeneity concerns that arise from differences in social, political, legal, and accounting systems across countries.

2.2 Staggered State Tax Changes

A multistate setting provides advantages for studying the tax effect. State tax rate changes occur more frequently than on the federal level, and states share more homogeneous non-tax factors (e.g., culture, federal regulations, labor costs and quality) than do countries. In addition, staggered changes in state tax rates affect only a subset of firms, which makes the multistate setting more attractive than country-level setting as an identification strategy. Hence, many multistate taxation studies (e.g., Newman, 1983; Wasylenko and McGuire, 1985; Klassen and Shackelford, 1998; Goolsbee and Maydew, 2000; Gupta and Hofmann, 2003; Chirinko and Wilson, 2008) adopt staggered state tax rate changes as exogenous shocks and conduct tests with macro data, aggregated at the state level.

Although some of these studies (e.g., Hines, 1993; Gupta and Hofmann, 2003; Chirinko and Wilson, 2008) find that changes in state corporate income taxes have a significant effect on investments at the *state* level, more recent studies by Asker et al. (2014) and Ljungqvist et al. (2017) do not find a significant effect at the *firm* level. This conflicting evidence may be due to the lack of granular investment data at the firm level. Specifically, investment data are generally avaialble at the firm level, and, hence, researchers interested in the effect of changes in state corporate income taxes have to

rely on the assumption that changes in firm-level investments represent new investments in the HQ state.

As a specific example, an investment account in a financial statement (e.g., 10-K report, Compustat) provides only a summary of multiple projects.[5] Therefore, it is not possible to observe which activity or what type of investment responds to corporate income tax, despite the relative importance of taxes on a firm's location decision's being likely to vary significantly according to project characteristics. Because current studies cannot connect changes in state tax rates to the geographical location of investments, which is particularly important for state-level taxes, whether and to what extent state taxes attract investment is still an open question.

[5] In an international setting, Shroff et al. (2014) identify the location of investment using the financial data of subsidiaries, obtained from the ORBIS database. Please see Shroff et al. (2014) for a more detailed description of the ORBIS database. Giroud and Rauh (2017) use Census microdata to estimate the impact of state taxes on business activity. However, the capital stock of establishments is estimated using the perpetual inventory method and it is available only for the manufacturing industry.

Chapter 3: Background and Hypotheses

3.1. State Corporate Income Taxes

To levy state taxes on the earning of a corporation, states must define what is included as the taxable income of a corporation. If a corporation operates in multiple states, as a multistate firm, states decide the portion of income that should be considered taxable, based on an apportionment formula. The most common formula uses physical property, payroll, and sales as apportionment factors, and the corporation's taxable income is distributed among the states on the basis of the state's share of property, payroll, and sales. Specifically, a multi-state corporate income tax X_i, in particular state *i*, is determined by the following formula:

$$X_i = \left\{\left[\left(w_i^s \times \frac{s_i}{s}\right) + \left(w_i^L \times \frac{l_i}{L}\right) + \left(w_i^P \times \frac{p_i}{p}\right)\right] \times \pi\right\} \times r_i \quad ,$$

where π is the firm's U.S. (or worldwide) taxable income, r_i is the statutory corporate income tax rate in state *i*, and s_i, l_i, and p_i are the firm's sales, payroll, and property in state *i*, respectively. Each state's apportionment factor is divided by the firm's total sales, payroll, and property. W_is are the weights on each apportionment factors, which sum to one. For example, Missouri places equal weight on three apportion factors, which makes W_i in Missouri one-third for each.[6] A firm's state tax is directly affected by the interstate capital investment, as such investment creates payroll and physical property in its destination state.

[6] As of 2016, there are eleven states that have adopted the equally weighted three-factor formula: Alaska, Delaware, Hawaii, Kansas, Mississippi, Missouri, Montana, New Mexico, North Dakota, Oklahoma, and Rhode Island.

I use the highest statutory tax rate of state corporate income tax to exploit the variation of state tax changes, following prior literature. It is based on the assumption that a firm's tax burden is affected by the total changes in the statutory tax rate. This assumption can raise the question if firms can deduct the state tax expense in calculating federal income tax. The amount of state tax deduction, however, is limited by the two regulations. First, the IRS requires the company to pay a minimum amount of federal tax, called alternative minimum tax (AMT). Hence, firms cannot deduct the total amount of state tax from federal tax liability if the federal tax burden fails to meet the AMT. In addition, states have allowed different deductibility of their state taxes in calculating federal tax expenses. For these reasons, a higher statutory state tax rate generally incurs a greater tax expense for a corporation.

3.2. Hypotheses

Firms' investment location decisions have drawn academic attention due to their implications for local economies. Early studies examine firms' location decisions, using state-level employment growth data, and conclude that lower state corporate taxes create more employment in that state (Newman, 1983; Wasylenko and McGuire, 1985). Hines (1996) also reports that state corporate taxes significantly affect the location of foreign direct investments in the U.S.

However, whether inferences based on state or country-level data can be extended to project-level investments is unclear. Although Chirinko and Wilson (2008) find that state tax credits and lower corporate tax rates enhance state-level capital expenditure, firm-level studies often do not find that changes in state corporate taxes have a significant effect on investment. Moreover, state and local taxes represent a

small percentage of total costs, so their effect might not be significant (Due, 1961). Further, if higher state tax rates indicate a strong fiscal package that includes more spending on infrastructure, education, and other investment incentives, then higher taxes have the potential to attract companies due to the items that can benefit business. For example, New York and California levy relatively high corporate income taxes, but they have favorable business environments that attract investments, offsetting their high state tax rates.

In this paper, I examine whether there is a significant association between changes in state corporate income tax rates and investment location. Stated in an alternative form, my first hypothesis is:

H1a: *Changes in state taxes significantly affect firms' investment location decisions.*

Prior literature indicates that corporate entities respond asymmetrically to staggered changes in state tax rates. Specifically, Heider and Ljungqvist (2015) and Mukherjee et al. (2017) report that firms adjust their leverage ratio or innovation when state tax rates increase but do not respond to state tax cuts. Theoretically, firms should adjust their investments symmetrically to both state tax cuts and state tax increases as the desired level of capital investment changes. Due to the stickiness or irreversibility of investments, however, it is not clear, in practice, whether the firms' investments related to tax increases are as sensitive to tax cuts (Dixit and Pindyck, 1994). Given such friction, I examine whether firms respond more strongly to tax cuts than to tax increases. I expect that firms will show asymmetric responses to tax changes. Hence, my hypothesis is as follows:

H1b: *Firm investments are more strongly correlated with state tax cuts than with state tax increases.*

Next, I present a prediction in regard to the tax sensitivity of interstate investments as depending on the type of investment project. Although prior literature assumes that the tax sensitivity of corporate investments is homogeneous across all investments, state taxes can be more effective in attracting certain types of investments. Failure to distinguish among different types of projects may obscure the actual tax effect on investment location decisions. Thus, I conduct two sets of cross-sectional tests. First, I group the investment projects that are more likely to have greater geographic flexibility, depending on their investment characteristics. If investments can benefit from non-tax factors that make them less flexible to changes in state taxes, the effect of state taxes on investment location decision would be limited. Stated formally, my second hypothesis is as follows:

H2: *Changes in state tax rates have a greater effect on investment activities that have greater geographical flexibility.*

Specifically, I examine whether the tax effect is stronger on investment projects that have one of the following characteristics: (1) new investment, (2) industries other than high-tech, (3) activities that are not location specific, or (4) investments that are distant from their HQ. As noted, investments are irreversible. Hence, firms cannot easily adjust their investments in response to tax rate changes if they already have established facilities for a given state. For example, consider that a firm builds a large manufacturing plant in Ohio. It then would be difficult to relocate this facility to another state or lay off workers, even if the state corporate tax rate were to rise. In contrast,

firms can quickly change the location of a plant in the initial stages in response to lower state tax rates. Therefore, I expect a significant association between changes in state taxes and investments and that this relationship should be stronger for new investments than for expansions of existing investments. Stated formally, my hypothesis is as follows:

H2a: *Changes in state taxes have a greater effect on new investments than on investments in existing facilities.*

State governments are becoming increasingly active in promoting high-tech development for its impact on the local economy (Office of Technology Assessment, 1984). On the one hand, high-tech projects favor states with lower tax rates as general interstate investments. On the other hand, managers in such industries may consider non-tax factors, such as the availability of highly educated workers or a certain infrastructure, as far more important determinants. In this case, no change in investment in high-tech industries will be observed in response to tax rate changes. Hence, it is unclear whether investments in high-tech industries are sensitive to state corporate tax rates. I thus provide the following prediction:

H2b*: Changes in state taxes have a greater effect on investments in industries outside the high-tech sector*.

Although there are various forms of investment activities, from business services and manufacturing to HQ relocation, firm-level studies aggregate these items and treat them as a single investment. Not all investment activities, however, are equally sensitive to corporate tax rate changes. For instance, the location of retail and business services, such as legal and management consultation or the offices of

physicians, are affected mainly by the local market size and customer accessibility (Wood, 1993; Bennett et al., 1999; Aguilera, 2003). In addition, where logistics and distribution activities are located is determined mainly by transportation accessibility (Verhetsel et al., 2015).[7] Hence, tax considerations receive less priority in regard to these activities. Investment activities that are not location specific should provide a better basis for evaluating the effects of state taxes on location decisions. Thus, my hypothesis is as follows:

H2c: *Changes in state taxes have a greater effect on investment activities that are regarded as less location specific.*

Locating firm investments close to the HQ is advantageous because firms are able to benefit from better monitoring and access to information (Chhaochharia et al., 2012; Giroud, 2013). For instance, Giroud finds that the HQs' proximity increases investment and total factor productivity. Hence, I expect that firms consider tax rates less in investment location decisions when they locate investments near the HQ, as non-tax benefits outweigh the tax costs. If firms need to make investments in distant states, however, their location decisions can be more sensitive to the state tax rates, as investment projects are generally evaluated based on a profit-maximizing model. It follows that:

H2d: *Changes in state taxes have a greater effect on investments that are distant from headquarters.*

A firm's federal taxable income is apportioned to each state based on each state's apportionment formula, which usually has physical property, payroll, and sales

[7] I also confirmed that this is the case through interviews with tax experts with relevant experience.

as its apportionment factors. Based on the apportionment formula, firms' state tax burdens are subject to larger effects from changes in state taxes when greater taxable income is apportioned to the states, and, thus, such a firm's investment location decision is more sensitive to changes in state taxes. Hence, as a second set of cross-sectional tests, I examine whether the tax sensitivity of investments is greater for investments that are expected to receive greater benefits from state corporate taxes based on the apportionment formula. Accordingly, my hypothesis is as follows:

H3: *Changes in state tax rates have a greater effect on investments that are expected to receive grater benefits from state corporate taxes based on the apportionment formula.*

Specifically, the effect of state tax rates on investment projects can vary with the number of jobs created, as one main factor of the state tax apportionment formula is payroll. An investment with a larger payroll will apportion more taxable income to the states; thus, firms can receive greater benefits when states lower corporate taxes. Therefore, investments accompanied by a larger number of new hires may show a stronger association with changes in state corporate taxes. In a similar vein, I expect firm investment location decisions to be more sensitive to changes in state taxes when states' apportionment formulas apply more weight to physical presence (i.e., payroll and property factors) and less sensitive to changes in state taxes when states place more weight on sales, which can potentially reduce the income tax burden for firms that have property and payroll in the state.

Chapter 4: Sample, Data, and Research Design

4.1. Sample and Data

I obtain interstate investment data from fDi Markets, which provides detailed descriptions for greenfield investments, in which firms directly establish facilities instead of acquiring another firm's equity. Focusing on greenfield investments is advantageous, as firms have more discretion in choosing the location of the investment than in the case of mergers or acquisitions. (Friedman et al., 1992; Coughlin and Segev, 2000). The fDi Markets database, created by fDi Intelligence, a division of the *Financial Times*, covers foreign direct investments all over the world and interstate investments in the United States. These data offer details of interstate investments, including the locations of investing firms and the destination states, as well as descriptions of the relevant sector, activity, and type of investment.

This organization collects project announcements from multiple sources, including the media, industry associations, and company websites, on a real-time basis. The data are updated each year, taking into account project completion, and incomplete entries are eliminated. Due to its wide coverage and reliability, fDi Markets is the main source for greenfield direct investment estimates used for the United Nations Conference on Trade and Development (UNCTAD) annual report, which is cited as an important data source by other organizations, including The World Bank.[8]

There are, however, some limitations on these data. I can observe only the firms that make investment announcements. Because firms estimate their investments and

[8] See Appendix B for the examples of interstate investment in fDi Markets.

jobs creation when they announce their investment plans, the actual amount can differ from the amount at the time when managers make investment decisions. In addition, I cannot observe the divestiture of an existing facility, which might be a firm's response following a tax increase. Finally, I cannot evaluate the return on an investment project, as the data do not include profits or sales for investment projects.

My sample period starts in 2007, when the interstate data first become available for fDi Markets, and runs through 2016. I collect accounting data from the Compustat annual files and the state economic indicator from the Bureau of Labor Statistics. I use state tax changes identified by Heider and Ljungqvist (2015) from 2007 to 2012. State tax changes after 2012 are obtained from the Tax Foundation and Department of Revenue websites. Appendix C contains a list of 43 tax cuts and 10 tax increases during the sample period. I delete the firms in the financial industry and the firms that are headquartered outside the U.S. The final interstate investment sample consists of 6,085 investment-year observations for 1,250 unique firms in 203 industries at the 3-digit SIC level. I also find that firms invest 609 projects in states that cut their taxes and 130 projects in states that increase their taxes over the sample period.

4.2. Research Design

Figure 1 summarizes the timeline of my research design. I examine the effect of corporate tax rate changes that occur between the beginning of year t-1 and beginning of year t on the firm's interstate investment announcement during year t. All control variables are lagged by one year to mitigate contemporaneous changes in the firm and state economic conditions that may drive changes in interstate investments.

To examine whether firms' investment location decisions are sensitive to changes in corporate taxes (H1a) and respond asymmetrically to tax cuts and tax increases (H1b), I estimate the following regression model:

$$\Delta Investment_{p,i,s,t} = \beta_0 + \beta_1 \Delta State\ tax\ increase_{s,t-1} + \beta_2 \Delta State\ tax\ cut_{s,t-1} + \beta_2 \Delta Controls_{i,s,t-1} + \sum YearFixedEffects + \sum IndustryFixedEffects + \varepsilon_{i,t} \ , \quad (1)$$

where the dependent variable, *ΔInvestment,* is the amount of capital investment scaled by total assets for each project p of firm *i*, which is invested in destination state s in year t. I delete the observations when the individual capital investment (project p) exceeds the firm's total assets (at). Since the announcement of an investment project implies an *increase* in investments and the variables of interest are tax rate changes, I employ a first difference model specification. I use two measures of tax rate changes. First, I use the indicator variables *Tax increase* (*Tax cut)*, which equals to one if a state increases (decreases) corporate income tax rate in year t, zero otherwise. I use the tax changes indicator variables following Heider and Ljungqvist (2015) and Mukherjee et al. (2017), since certain tax rate changes, such as the introduction or repeal of surcharge rates, are hard to quantify whereas their directional effect is clear. I also construct rank variables depending on the magnitude of the tax changes to examine whether investments respond more strongly to the greater tax changes. *Tax increase (decrease)_rank* is a rank variable scaled from 0 to 1. I use the median value to divide tax changes into high and low changes.[9] If a lower state tax rate attracts more investment than other states by raising the expected investment rate of return, I expect β_2 to be positive and significant. If firms reduce their investment in the states where

[9] The main results still hold when I construct the rank variables based on top, middle and bottom terciles.

they increase state taxes, I expect the β_1 to be negative. However, if firms show asymmetric responses and only respond to tax cuts, β_1 could be insignificant.

Δ*Controls* is the vector of the control variables included in regression (1), which primarily follows Heider and Ljungqvist (2015) and Ljungqvist et al. (2017). I control for changes in various firms characteristics in year t-1 including size (*SIZE*), measured as the natural logarithm of total assets; leverage (*Leverage*), measured as the ratio of the sum of long term debts to the market value of common equity; and market-to-book (*Market-to-Book*), measured as the market value of equity scaled by the book value of equity. I also add profitability (*ROA*), cash surplus (*Cash Surplus*), and sales growth rate (*Sales Growth*), which are additional factors that can affect the amount of investment. Dyreng et al. (2013) report that parent firms incorporated in Delaware increase the likelihood of incorporation in Delaware for their subsidiaries, which are regarded as better to avoid state tax burdens by exploiting the Delaware-based state tax avoidance strategy. Hence, I include the Delaware incorporation dummy (*Delaware*), to control for this tax avoidance strategy.[10] Finally, to account for unobserved state economic factors that might be associated with changes in state taxes, I include the lagged change in state unemployment rates and state-specific gross domestic product growth rates (*GSP growth rate*). Variable definitions are detailed in Appendix A. I winsorize all continuous variables at the 0.5% and 99.5% levels following Hedier and Ljungqvist (2015).[11] State fixed effects would overlap with much of the variation of

[10] As a robustness check, I include the state effective tax rate (ETR) defined as state tax expenses over pre-tax domestic income (Dyreng et al. 2013). I use the pre-tax world-wide income if the state ETR is not available. I do not include state ETR in the main test because this significantly reduces the sample by 27%, caused by the missing value of state tax expenses or the presence of loss firms. The main results continue to hold, and the coefficients of state ETR are not significant when included in the baseline model.

[11] Results are consistent when I winsorize at 1% for top and bottom.

the state's fiscal policies and economic situation. Hence, it will reduce the contribution of state level control variables, and attribute much of the explanatory power to the state fixed effects. Therefore, I do not include the state fixed effects following prior studies (Heider and Ljungqvist 2015; Ljungqvist et al., 2017; Mukherjee et al., 2017). Instead, industry fixed effects for each project and year fixed effects are included to control for unobservable industry characteristics and market-wide shocks to investments in a certain year. Standard errors are adjusted for heteroskedasticity and clustered by state.

Chapter 5: Empirical Results

5.1. Descriptive Statistics

Table 1 presents the average amount of interstate investment and number of jobs created from each investment project. Panel A shows interstate investment by year. Firms, on average, announce an investment of $61.7 million for each interstate capital expenditure, creating 138 new jobs. Panel B reports average capital investment and job creation by investment activity. Establishment of a manufacturing facility is the most common type of investment project (27.4%), followed by Logistics, Distribution and Transportation facility (15.9%), and Information technology related infrastructure (7.9%). Headquarters relocation, which is the main focus in Chow et al. (2017), accounts for a small portion (4.2%) of overall investment activities. Panel C shows the number of investment projects by the sourcing state and destination state. Texas and California are the first and second most frequent destination states in attracting investment from firms located in other states, enticing 487 and 353 projects, respectively. There is no state that dominates the number of projects among the total, suggesting that my results are less likely to be driven by a certain state's tax rate change.

Table 2 contains descriptive statistics for the variables used in investment location analyses. The average change in state corporate tax rate is -0.09% with a standard deviation 0.7, suggesting that there is a substantial variation in corporate tax rate change across the states. Among our sample, 67% of the firms are incorporated in Delaware. All variables are defined in Appendix A.

5.2. Tax sensitivity of Interstate Investment

5.2.1. Univariate Analysis

I first report a simple univariate chart which shows whether and to what extent investments are sensitive to changes in state corporate taxes. Figure 2 presents average annual change in announced capital investments at the destination state-year level. The sample includes all project-level investments experiencing corporate income tax changes in their destination states, from 2 years prior to the tax change to 2 years after the change. As controls, all project-level investments whose destination states are not subject to changes in corporate income tax rates are also included as dotted lines. Figure 2a shows changes in capital investments around tax changes. Before a tax cut, the size of new capital investments in the treatment group is very similar to the control group, suggesting there is no pre-trend. However, when a state changes its tax rate as of the beginning of the year t, I find a significant increase in capital investments for the treatment group whereas investments in the control group do not change. Figure 2b presents the difference in capital investments between the treatment group and control group with 95% confidence interval. The mean difference between the two groups ($16.8 million) is highly significant ($p<0.001$) in the year that states change corporate income taxes. Unlike the capital investment in a tax cut year, we do not find a significant difference between the investment in the treatment group and the control group for tax increases. If at all, investments in the treated sample decrease one year after a tax increase and remains at a similar level in the following year. Overall, the univariate results show preliminary evidence that firms respond to the tax rate changes asymmetrically.

5.2.2. Multivariate Analysis

Table 3 shows the multivariate results of estimating Equation (1). Column 1 of Table 3 presents the results for the effect of changes in corporate tax rates on investment location for my first hypothesis H1a and H1b. To test the firm's asymmetric response to changes in state tax rates, I divide state tax rate changes into tax cuts and tax increases. I find that firms' investment location decisions are significantly affected by tax cuts, while they do not respond to the tax increase in general. Specifically, the estimated coefficient on the *Tax_cut* indicator variable is significantly positive (0.010, p-value<0.001), whereas the coefficient on *Tax_increase* is insignificant. Such asymmetry can be explained by investment irreversibility. Once the firm conducts an investment, it is difficult to downsize the investment project by selling off fixed property or cutting job positions.[12] In terms of economic magnitude, the estimates suggest that firms on average locate 1.0% more of total assets following a tax cut in corporate income tax rate. That is, a median size firm increases its investments by $92 million in tax-cutting states.

In Column 2, I run Equation (1) using a rank variable of the magnitude of tax rate changes. Instead of treating all tax increases (decreases) identically with binary indicators, I check whether firms locate their investment projects depending on the magnitude of tax cuts. I observe positive and significant effects of *Tax increase_rank*, suggesting that firms increase their investments following larger tax cuts. The positive and significant impact of state tax cuts on *ΔInvestment* holds after controlling state GSP

[12] Another possible reason on the asymmetry of the result can arise from data limitation. Since we cannot observe divestitures of existing facility, it might understate the firms' responses following a tax increase.

growth rates and state unemployment rates, indicating that state-specific variables are unlikely to influence the association between tax rate changes and interstate investment.

5.3. Investment Characteristics and Tax Sensitivity

Although I find that firms generally increase investments in states with lower corporate tax rates, it is unclear which type of investment is more sensitive or less sensitive to changes in state corporate taxes. I conduct subsample analyses to identify the characteristics that can help us understand cross-sectional differences in the state tax effect on interstate investment. I divide the sample based on the following characteristics: geographically flexible investments (types of investment, high-tech industry, location specific activities, proximity to headquarters) and investments that are expected to receive grater benefits from state corporate taxes.

5.3.1. Geographically Flexible Investments

Type of Investment (New vs. Expansion)

Firms are more careful when they make new investment projects due to relatively higher uncertainty in information and projection of future outcomes than expansion projects. Hence, new investments are likely to be more sensitive to tax rates that can lower the cost of investment. States also tend to favor new investments over expansions of the existing facilities in anticipation of a greater spillover effect in the state economy with a longer period of operation. I divide investment projects into two groups, expansion projects and new entry projects, and re-estimate Equation (1).

The results are presented in Panel A of Table 4. The effect of *Tax cut* is significantly negative only for the *New* subsample whereas the coefficient of *Tax cut* is insignificant for the *Expansion* sample. Also, the magnitude of the coefficient of *Tax*

cut for the *New* subsample is about two times greater than that for the *Expansion* subsample. Unlike the asymmetric response for the overall sample, the coefficient of *Tax increase* becomes significantly negative for the *New* subsample (-0.014, p-value 0.040). As discussed in the previous section, existing facilities make it harder for firms to respond to changes in state taxes, which would suggest results consistent with the insignificant effects for the *Expansion* sample. On the other hand, firms with a new entry project can make location decisions unaffected by previous investments and thereby can choose a project's location with greater sensitivity to both tax cuts and tax increases.

High Tech Industry vs. Other Industries

Many states prefer high-tech investments due to higher growth rates and spillover effects in the local economy. In my second test, I compare the tax sensitivity of investments depending on the industry sector. By using the details of the project data, I identify the industry sector of each project and divide the projects into the high-tec industries and other industries following De Simone et al. (2015) and Francis and Schipper (1999). Due to the data availability, prior studies cannot identify the industry of a project and assume that the industry sector of the investment is the same as the firm's industry. However, the details of each project profile reveal that the industry of the investment does not necessarily match that of the firm itself.

The regression results are presented in Panel B in Table 4. Surprisingly, the results show that investments in high–tech industries do not respond to state tax rate cuts (Columns 1 and 3), but instead decrease when states raise their corporate income tax rates. The different asymmetric response of high tech projects can be explained by

the creditors' constraints. According to the prior studies (Stighlitz and Weiss, 1981; Himmelberg and Petersen, 1994) moral hazard and adverse selection in debt market are more pronounced for high-tech investments due to the higher information asymmetry. Moreover, returns to high-tech projects are highly uncertain, which reduces the value of collateral to creditors. (Carpenter and Petersen 2002; Ljungqvist et al., 2017). Hence, under the scrutiny by creditors, firms that invest in high-tech industries will reduce the risk when there is a tax increase but their response – increasing the risk – to a tax cut would be more limited. The insignificant effect of tax cuts on high-tech industry investments indicates that states may not fully achieve the intended effects of a tax cut. State policy makers may consider attracting these industries through non-tax factors, such as offering better R&D infrastructure (Chung and Alcacer, 2002).

Location Specific Activity

While prior literature aggregates all investment activities and considers them as a single investment, firms are likely to take into account state corporate taxes in their location decisions differently depending on the type of investment activities. Hence, I check whether the tax sensitivity of investments which are less subject to the location specific factors is higher than that of location specific activities. I accordingly divide the sample into location specific activities (i.e., Business services, and Logistics & Distribution) and other activities.

Panel C in Table 4 reports that firms' investment decisions are more affected by corporate tax cuts when I exclude the investments that are related to retail, business services, and logistics activities (Columns 2 and 4). For example, the estimated coefficient of *Tax cut* in Column 2 is significantly greater (0.012, p-value 0.001) than

Location specific activities in Column 1, providing support that different investment activities respond differently to tax cuts.

Geographical Proximity

Since geographical proximity to HQ provides non-tax benefits by facilitating communication and monitoring, I test to what extent state corporate taxes affect the firms' investment location decisions depending on varying degree of proximity. I measure a geographical proximity of the project by calculating the distance between the city of the firm's HQ and the destination city. If the city information is not available, I calculate the distance between the HQ state and the destination state. Following Chhaochharia et al. (2012), I define the investment project as a local project if it is located within 250 miles from HQ.[13] Panel D reports the tax sensitivity of local investments and distant investments. While distant investments are significantly and positively related to tax cuts, investments close to HQ do not respond to changes in state taxes, suggesting that non-tax benefits outweigh lower tax rates when firms locate their investments near their HQ.

Overall, the results of cross sectional tests presented in Table 4 indicate that the tax sensitivity of investment varies with the characteristics of investments. I find that investments are more sensitive to state tax cuts when they are a new project, in non-high-tech industries and not subject to location specific factors. However, investments that are subject to substantial geographical factors or are located near HQ do not respond to state taxes.

5.3.2. Investments Expected to Receive Grater Benefit from State Corporate Taxes

[13] Chhaochharia et al. (2012) explains that this measure is likely to address potential nonlinear effects of distance.

Job Creation

Providing more jobs to residents has been a primary concern for state policy makers and politicians. In this section, I divide the sample into two groups by the number of new hires and check whether states can attract large job creation investments, which the state prefers, with tax cuts. I identify the investment as a high (low) job creation investment when the investment is expected to create over one hundred jobs.[14]

In Panel A of Table 5, I find contrasting results between the *Large job* and *Small job* subsamples for the effects of tax decrease and increases. Specifically, the coefficient of *Tax cut* is positive and significant only for the *Large job* creation group and is significantly different from that of the *Small job* creation group. This difference is plausible because larger job creation implies larger payroll expenses and, therefore, will induce a larger taxable income apportioned to the destination states by the payroll factor.[15] Hence, the states with lower corporate income taxes appear to be effective in attracting investments with a large number of new jobs.

Moderating Effect of Tax Apportionment Formula

Whereas I have examined investment characteristics that can be more sensitive to the changes in state taxes so far, a firm's state tax burden is determined by both state corporate income tax rates and the state's apportionment formula. In this section, I examine whether firms respond differently to changes in state taxes depending on the

[14] I choose one hundred created jobs as a cut-off since it is regarded as a general cut-off in identifying company size (https://www.sba.gov/advocacy/firm-size-data) and is similar to job created at the top tercile in my sample as well.

[15] This argument does not apply for the states that adopt sales as a single apportionment factor or puts much greater weight on the sales factor. In an untabulated test, I conduct the same test after removing the state-year that puts more than 50% on sales factor, and obtained even stronger results.

variation in state apportionment formulas, which determine the state's portion of taxable income. As mentioned earlier, state corporate tax is calculated based on each state's apportionment formula, which typically has physical property, payroll, and sales as its apportionment factors. Since the relative weight of each apportionment factor has changed differently overtime across states, such time-series and cross-sectional variations of apportionment formulas provide a unique opportunity to test whether firms use changes in state corporate taxes in their tax avoidance strategy in choosing their investment location. Specifically, states that have a lower weight on sales, and thereby a higher weight on property and payroll factors, levy state taxes on a higher portion of taxable income conditional on the same amount of capital expenditure and payroll. On the other hand, if the firm's investments are sensitive to the corporate income tax rates, their sensitivity should be mitigated when the destination state adopts an apportionment method that is not based on physical investments (greater weight on sales factor). For example, a $100 million project in Massachusetts, which places a 50% weight on the sales factor and thus has a 25% weight on the property factor, faces a lower tax burden than a $100 million project in the state of Rhode Island, which has equal weights on all three factors (33.3%) as of 2016.

To test this prediction, I extend the main research design and include the interaction term between *High Sales weight* × *State tax rate change*. I define *High sales weight* as a tercile rank variable based on the weight the state tax apportionment formula places on the sales factor (33.3% and 70% are cut-offs).

$$Investment_{i,s,t} = \beta_0 + \beta_1 \Delta State\ tax\ rate\ increases_{s,t-1} + \beta_2 \Delta State\ tax\ rate\ cuts_{s,t-1} + \beta_3 High\ Sales\ weight_{i,t-1} + \beta_4 (\Delta State\ tax\ rate\ increases_{s,t-1} \times High\ Sales\ weight_{,t-1}) + \beta_5 (\Delta State\ tax\ rate\ cuts_{s,t-1} \times High\ Sales\ weight_{,t-1}) + \beta_6 Controls_{i,s,t} + \sum YearFixedEffects + \sum IndustryFixedEffects + \varepsilon_{i,t}\ , \quad (2)$$

I expect the coefficient of the interaction with tax increases (β_4) to be positive and the coefficient of the interaction with tax cuts (β_5) to be negative if firms locate more investments in states that put higher weight on the sales factor in their apportionment formula (and have lower weights on the property and payroll factors). Panel B of Table 5 shows results that are consistent with the predictions. The coefficient of interaction term of tax increases (*High sales weight×ΔState tax rate increases*) is 0.036 (0.051) in Column 1 (Column 2), implying that investment sensitivity to state taxes is mitigated for states with apportionment methods that favor physical investments.

5.4. Identification Challenges

My research design is based on first-difference regressions which eliminate unobserved state fixed factors that are not explicitly controlled in my model. However, there can be some identification concerns on whether non-tax factors can still affect the relation between corporate income tax changes and investment decisions. I conduct a few tests to show that the main findings are not confounded by other non-tax factors, but instead are driven by the changes in state taxes. First, I revisit the main tests with a control group which is restricted to the projects in neighboring states to rule out possible economic cycles that can coincide with state tax rate changes. Second, I control firm specific subsidies that include other incentives that firms receive, which may affect investment location decisions.

5.4.1. Neighboring States

Since neighboring states are considered to share similar economic and business environment, state tax rates can be the tiebreaker for a corporate investment location decision particularly among the neighboring jurisdictions. Hence, I test whether states that lower their corporate taxes attract investments that would have otherwise gone to neighboring states.

First, I identify state-years with changes in corporate income taxes. Second, each state-year observation is matched with one or more neighboring states that did not change tax rates in the same year. The research design is the same as the baseline test (Equation (1)). Panel A in Table 6 presents the matched sample results. I find that the significant impact of changes in state taxes on investment location continues to hold. The coefficient of *Tax cut* is positive and significant.

Next, I examine whether states that offer lower state taxes can win in the competition for attracting investments among competing states. If the firms decide to invest in states that lower their corporate taxes over the competing states, I should observe a percentage increase in investments relative to all available capital investments that states can potentially obtain. To test this prediction, I calculate the percentage change in investment of treated states relative to all available investments among neighboring states. Specifically, I aggregate all capital investments at the state level and calculate the changes in investments by taking the difference between investments in current and previous year. I then scale the changes in investments by aggregated investments of treated state and its neighboring states in the previous year, which captures all available investment sets that states are potentially able to attract. I include state economic indicators and three other state tax policy variables, since this

is a state-level test. Panel B of Table 6 reports the results. I find that lower state taxes significantly increase the proportion of investments among neighboring states. In economic sense, a state can raise 3.59% more capital relative to neighboring states following a tax cut (Column 1), suggesting that state corporate taxes are an effective tool in attracting investment to a state over competing states.

If firms choose investment locations among neighboring states, then firms can respond not only to the changes in state taxes of target state, but also to the relative attractiveness of tax rates compared to their competing states. In other words, even if states do not raise their taxes, states might lose potential investments if other states lower their taxes. To test this possibility, I calculate relative changes in tax rates between the destination state and its neighboring states. Column 3 and 4 report the results based on the relative changes in state taxes. Consistent with the prediction, I find that relative tax cuts positively and significantly affect the percentage change in state-level investments. The finding indicates that firms respond not only to the changes in taxes of destination state but also to the changes in taxes of neighboring states.

In sum, the results in Table 6 suggest that states indeed can attract more investment by lowering their corporate taxes and thus providing a better investment opportunity compared to their competing states.

5.4.2. Firm-specific Subsidies

In addition to corporate tax changes, state and local governments often provide special tax treatments in the negotiation process with the firm on investments. If the firm's location decision is affected by the firm specific subsidies, its sensitivity to the tax rates should be mitigated, and subsidized projects would be less likely to be located

in the tax-cutting states. To test this prediction, I obtain the firm-specific subsidy data from Good jobs First's subsidy Tracker database (GJFST) and identify the amount of subsidy that each company received from each destination state-year. In addition to the official data from individual states, GJFST supplements the subsidy data from a variety sources including corporate and government press releases and newspaper articles. It provides detailed information about the subsidy which firm received, including the name of the company, project information, timing and the amount of awards (Chow et al., 2017).

I construct the firm-specific subsidies by aggregating the subsidies that local governments provide for each state and divide by the firm's pre-tax domestic income multiplied by 100, following Chow et al. (2017).[16] I then match the firm-specific subsidies with the location of each investment to analyze how much subsidy that firm received for each destination state. Specifically, I extend the main research design and include the interaction term between scaled subsidy benefits (*Scaled benefit*) and tax change variables.

$$Investment_{i,s,t} = \beta_0 + \beta_1 \Delta State\ tax\ increase_{s,t-1} + \beta_2 \Delta State\ tax\ cut_{s,t-1} + \beta_3 Scaled\ benefit_{i,t} + \beta_4 (\Delta State\ tax\ increase_{s,t-1} \times Scaled\ benefit_{i,t}) + \beta_5 (\Delta State\ tax\ cut_{s,t-1} \times Scaled\ benefit_{i,t}) + \beta_6 Controls_{i,s,t} + \sum YearFixedEffects + \sum IndustryFixedEffects + \varepsilon_{i,t} \quad (3)$$

I expect the coefficient of the interaction (β_5) to be negative and significant if the firms which receive the subsidy are less sensitive to the tax cut. The coefficients of the interaction term (*ΔState tax cut× Scaled benefit*) are negative and significant for both columns in Table 7 at the 1% significance level. The findings show that firms'

[16] Chow et al. (2017) use the annualized value of the benefits using the total value divided by the duration of the tax benefits. I use the total value instead of annualized value, because the dependent variable of this paper is based on total amount of investment for each project.

sensitivity to state taxes is significantly mitigated when the firms receive firm-specific subsidies, suggesting that special tax treatment is an effective tool for states to attract corporate investments as well as state tax cuts.

Chapter 6: Robustness Check

6.1. Parallel Trend Assumption

The main specification in Equation (1) assumes that both the treatment group and the control group should show parallel trends in the absence of state tax rate changes. I test whether there is a possible delayed reaction or pre-trend in firms' investment location decisions before or after state tax rate changes. Table 8 includes additional lead and lag tax change variables in addition to the baseline model. Similar to Table 3, the coefficient of *Tax cut* is positive and significant while the coefficient *Tax increase* is insignificant, exhibiting an asymmetric response to state tax changes. In fact, the magnitudes of *Tax cut* coefficients in both columns slightly increase compared to the baseline model. However, I generally do not observe significant investment behavior in anticipation of tax changes in the next year nor a delayed response to the previous tax changes, indicating that firms make a timely investment decision in response to corporate tax changes.[17]

6.2. Other State-level Incentives

There are other attributable factors that make the state attractive as the destination of investments. Also, it is meaningful to compare the relative importance of changes in corporate tax rates and other tax incentives on investment location decisions, since many local governments have sought to lure in businesses by providing tax incentives (Due, 1961; Gupta and Hofmann, 2003). To control the potential

[17] I also check whether state corporate tax rates are serially correlated. I reject the presence of a unit root using augmented Dickey-Fuller tests, suggesting that changes in state corporate tax rates are generally unanticipated. The unit root test results are also consistent with Ljungqvist and Smolyansky (2014).

confounds, I first include personal income tax, capital gains tax, and state-level investment incentive programs in addition to the state economic indicators following prior research (Ljungqvist and Heider, 2015; Chow et al., 2017; Mukherjee et al., 2017). Specifically, I control changes in investment tax credits, R&D tax credits, and job credits as state-level investment incentives. Columns 1 and 2 of Table 9 show that the baseline result in Table 3 is not affected by other state tax policies. Insignificant coefficients of state tax incentive programs suggest that it would be more effective to promote firm investments by lowering state corporate income tax rate, which is a relatively simple policy change, rather than providing other tax credits, which are considered to be complex.

In the next step, I add state-level political and economic conditions that can potentially coincide with the state tax policy. I find that my results are robust to the inclusion of union membership, level of education, the timing of the gubernatorial elections and the state governor's party affiliation.

6.3. Firm-level Investment Response to Changes in HQ State Taxes

This paper focuses on how firms choose investment locations for each investment project in response to changes in *destination state* taxes. In this section, I revisit prior studies that used *Capex* from Compustat as a proxy for firm-level investments and check whether *HQ state* tax rate changes affect firm-level investments. Following Lungqvist et al. (2016), *Capex* is defined as net capital expenditure over the book value of assets. I use this research design in my baseline test (Equation (1)) with the same sample period, but I change the dependent variable from *project-level* investments to *Capex* as a proxy for *firm-level* investments and use *HQ state* tax

changes instead of *destination state* tax changes. I also control lead and lag tax change variables to address timing concerns.

Table 10 reports the results. Column 1 and 2 show the results based on all available firms from Compustat, and Column 3 and 4 use the same firm-year observations with the baseline test. The results of both samples show an insignificant relationship between HQ state tax changes and firm-level capital expenditure, consistent with Asker et al. (2015) and Ljungqvist et al. (2017). The contrasting result shown in Table 10 suggests that it is important to match the geographical location of each corporate investment project with state taxes in order to precisely analyze the effect of staggered state tax rate changes on firms' investment decisions.

Chapter 7: Conclusion

Firms' capital investment decisions have a large economic impact on local communities. While a large literature sheds light on the optimality of firms' investment decisions, we know little about the factors that drive firms' investment *location* decisions when they make new capital investments. In particular, do corporate state taxes play an important role in firms' investment location decisions? This paper fills this void by exploiting a novel dataset that contains investment data at the project level and examines how firms' investment location decisions are influenced by changes in state tax rates, and more importantly, which types of investment are more sensitive to changes in state taxes.

I find that firms invest in states with lower taxes, ceteris paribus. Moreover, the tax sensitivity of firms' investment location decisions varies across types of investment project as different project types face different costs and benefits from changes in state taxes. Specifically, I find that projects with more geographic flexibility are more sensitive to changes in state corporate income taxes, as are projects that expect to receive greater benefit from state corporate income taxes based on states' tax apportionment formulas. However, investment projects driven by local non-tax factors or associated with existing facilities are less responsive to state corporate income tax cuts, indicating that states cannot attract all types of investment simply by cutting tax rates. Lastly, I find that changes in state corporate income taxes continue to play a major role in investment location decisions after controlling for firm-specific tax treatments, which prior literature often considers but does not fully account for.

The findings of this paper contribute to our understanding of corporate investment decisions by employing project-level data. Although states compete with each other to attract business by reducing tax rates and offering other tax credits, the extent to which such tax incentives attract corporate investment is an open question that has practical implications for policymakers. This paper sheds light on the effectiveness of state corporate income taxes as a mechanism to attract and retain investment. Overall, this paper offers new evidence that state corporate income taxes play an important role in firms' interstate investment location decisions.

Figure 1. Timeline of the research design

Figure 1 summarizes the timing of corporate tax rate changes that occur between the beginning of year t-1 and beginning of year t on the firm's interstate investment announcement during year t.

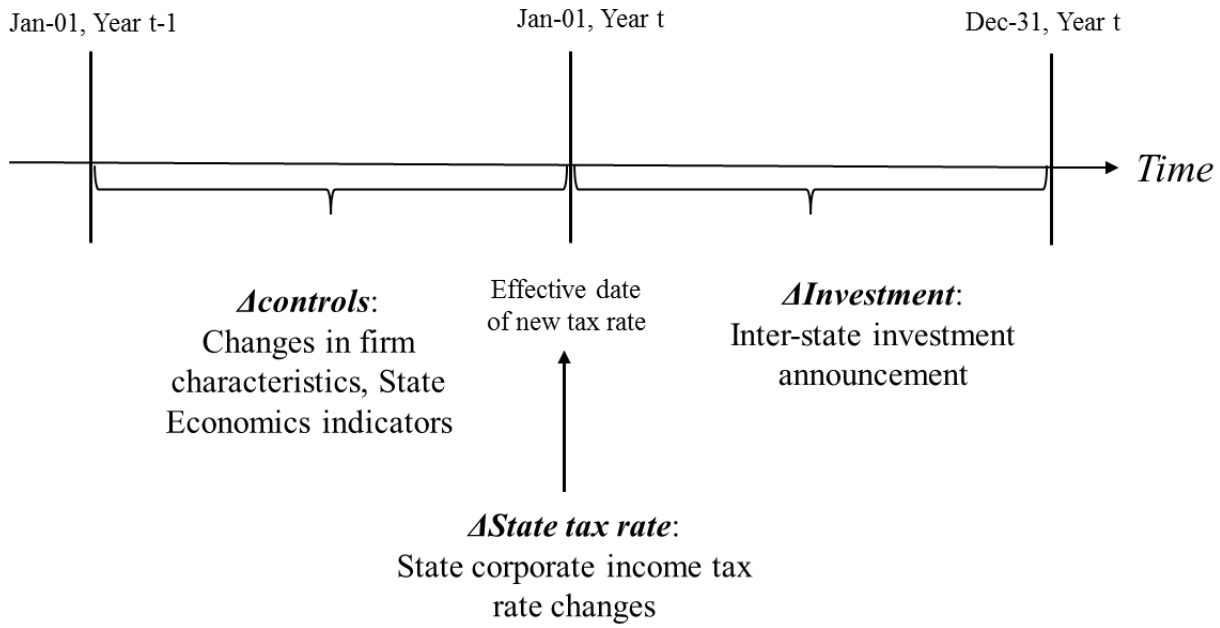
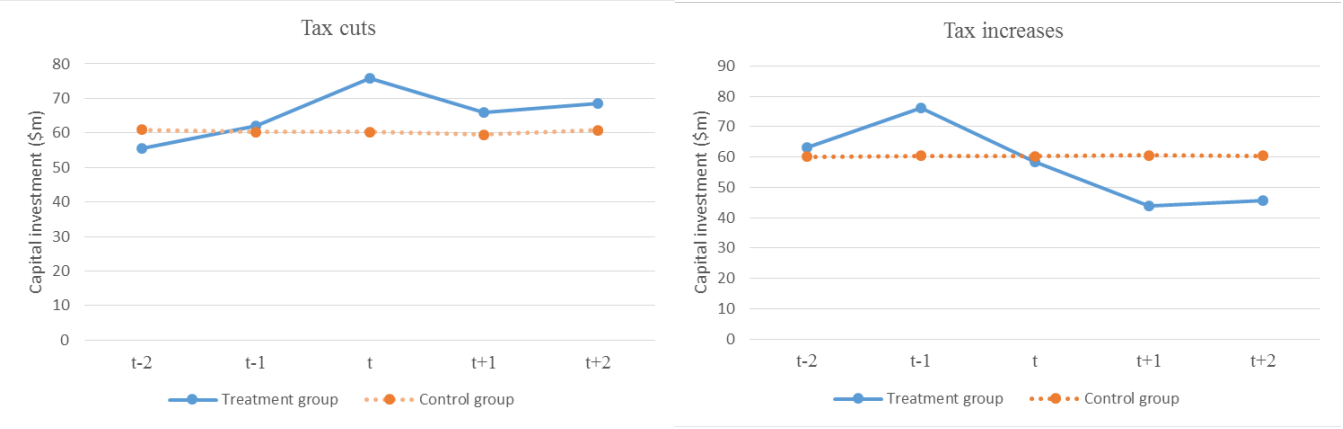


Figure 2. Annual changes in capital investment around state tax increases and tax cuts

This figure shows the average annual change in the amount of announced capital investments at destination state-year level. The sample includes all project-level investment experiencing a corporate income tax changes in their destination states over the period 2007-2016 and, as controls, all project-level investment whose destination states are not subject to changes in corporate income tax rates. Year t is the year that changed their state tax rates as of the beginning of the year t.

Figures 2a. Treated and control group



Figures 2b. Difference-in-differences

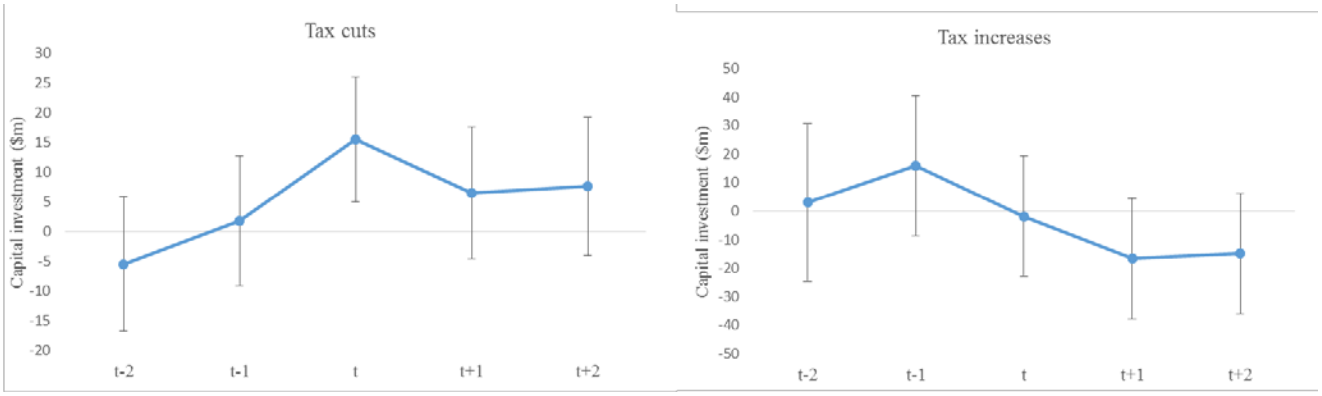


Table 1. Interstate investment by year, activity, and state

Table 1 presents an average amount of interstate investment and number of job created from each investment. Panel A shows interstate investments by year. Panel B reports the capital investment and job creation by investment activity. Panel C shows the number of investments by its sourcing state and destination state.

Panel A. Interstate investment by year

Year	N	Capital Investment (Million)	Number of job creation
2007	443	85.3	172.8
2008	454	91.7	186.5
2009	623	67.1	145.0
2010	741	57.3	116.8
2011	813	51.2	98.4
2012	537	59.5	125.9
2013	680	58.2	107.4
2014	624	49.6	77.7
2015	604	64.3	132.9
2016	566	51.4	86.5
	6,085	61.7	137.5

Table 1 continued

Panel B. Interstate investment by activity

Investment Activity	N	%	Capital Investment (Million)	Number of job creation
Business Services	379	6.2%	8.1	61.8
Construction	116	1.9%	122.8	247.4
Customer Contact Centre	427	7.0%	7.3	251.4
Design, Development & Testing	431	7.1%	37.3	124.0
Education & Training	124	2.0%	25.7	63.1
Electricity	161	2.6%	299.9	47.4
Extraction	26	0.4%	319.6	273.8
Headquarters	257	4.2%	19.4	164.3
Information technology & Internet Infrastructure	480	7.9%	109.9	70.1
Logistics, Distribution & Transportation	969	15.9%	53.0	199.6
Maintenance & Servicing	185	3.0%	11.6	64.4
Manufacturing	1667	27.4%	91.4	146.0
Recycling	34	0.6%	33.7	65.2
Research & Development	80	1.3%	30.7	90.7
Sales, Marketing & Support	656	10.8%	14.7	62.4
Shared Services Centre	34	0.6%	24.3	277.7
Technical Support Centre	59	1.0%	27.4	285.6
Total	6,085	100%	61.7	137.5

Table 1 continued

Panel C. Interstate investment by state

	Sourcing State N	Destination State N		Sourcing State N	Destination State N
AK	1	16			
AL	12	134	MT	0	15
AR	93	62	NC	253	310
AZ	48	146	ND	1	44
CA	552	353	NE	175	37
CO	104	148	NH	4	30
CT	338	60	NJ	208	92
DC	19	40	NM	1	58
DE	46	20	NV	29	56
FL	165	282	NY	492	206
GA	201	230	OH	364	307
HI	4	18	OK	34	83
IA	12	98	OR	21	68
ID	16	28	PA	263	183
IL	391	163	RI	29	17
IN	114	288	SC	20	161
KS	36	98	SD	4	18
KY	45	195	TN	88	194
LA	51	126	TX	406	487
MA	137	152	UT	15	65
MD	85	108	VA	263	169
ME	5	32	VT	6	20
MI	274	114	WA	299	121
MN	137	92	WI	111	87
MO	108	112	WV	253	52
MS	5	75	WY	1	15

Table 2. Descriptive statistics

Panel A contains descriptive statistics for the variables used in investment location analyses. My sample period starts from 2007, when the interstate data first become available for fDi Markets, to 2016. I delete the firms in the financial industry and the firms that are headquartered outside the U.S. The final "interstate investment sample" consists of 6,085 investment-year observations for 1,250 unique firms in 203 industries at the 3-digit SIC level. Panel B reports Pearson (Spearman) correlations in the lower (upper) diagonal of the panel. Correlations in bold are significant at the 10%, 5% or 1% level. All variables are defined in Appendix A.

Panel A. Descriptive Statistics

Variable	Mean	Std. Dev.	P25	P50	P75
Δcorporate tax rate	-0.091	0.702	0.000	0.000	0.000
Corporate Tax Rate	6.177	2.943	5.5	6.5	8.25
Capital investment ($m)	61.728	125.553	6.700	22.600	57.600
Scaled investment	0.025	0.082	0.001	0.002	0.0116
Number of job creation	137.510	199.576	40.000	70.000	145.000
R&D tax credit rate	0.064	0.056	0.000	0.050	0.100
Job creation tax credit	0.804	0.397	1.000	1.000	1.000
Capex deduction rate	0.020	0.032	0.000	0.000	0.030
Δcapital gain tax	0.002	0.457	0.000	0.000	0.000
Δpersonal income tax	0.000	0.459	0.000	0.000	0.000
Firm-level economic variables					
ΔFirm Size	0.083	0.197	-0.009	0.056	0.133
ΔMarket-to-Book	-0.210	9.239	-0.420	0.071	0.507
ΔLeverage	0.004	0.151	-0.027	0.000	0.030
ΔROA	0.001	0.169	-0.016	0.000	0.016
ΔCash surplus	-0.002	0.083	-0.022	-0.001	0.019
ΔSales growth	1.122	0.708	0.987	1.050	1.153
Delaware	0.670	0.470	0.000	1.000	1.000
State Economic variables					
ΔGSP	1.191	2.580	0.106	1.420	2.591
ΔUnemployment Rate	0.115	1.499	-0.900	-0.400	0.600

Table 2 continued

Panel B. Correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Capital investment	1.000	**0.424**	**0.411**	0.011	-0.006	**0.038**	0.020	**0.022**	**-0.024**	-0.004	-0.019	**0.073**	0.016	-0.010
Jobs created	**0.358**	1.000	**0.124**	0.020	-0.002	0.020	-0.011	0.007	0.002	0.014	**-0.043**	**0.022**	-0.009	-0.001
Scale invest	**0.152**	0.011	1.000	-0.006	-0.016	0.016	0.006	**-0.036**	0.021	-0.006	**0.140**	**0.024**	-0.016	**0.045**
Tax cut	**0.037**	**0.022**	**0.025**	1.000	**-0.049**	**0.025**	0.007	**0.030**	-0.003	0.005	0.013	-0.003	**0.071**	**-0.097**
Tax rise	-0.004	**-0.025**	-0.011	**-0.049**	1.000	**-0.026**	**-0.034**	-0.017	**-0.060**	-0.016	**0.030**	-0.017	0.013	**0.080**
ΔFirm Size	0.005	0.019	**0.043**	0.018	-0.017	1.000	**-0.075**	**0.260**	**0.147**	**0.023**	**0.499**	**0.050**	**0.099**	**-0.097**
ΔMarket-to-Book	0.004	**-0.023**	0.012	**-0.022**	-0.017	**-0.087**	1.000	**0.047**	**0.072**	**0.088**	**-0.049**	0.003	0.006	**-0.066**
ΔLeverage	**-0.036**	0.000	**-0.054**	0.001	**-0.056**	**0.358**	**-0.033**	1.000	**-0.023**	**-0.082**	**-0.023**	0.012	0.008	**-0.054**
ΔROA	-0.006	-0.003	-0.003	0.001	**-0.029**	-0.002	**0.083**	**-0.153**	1.000	**0.327**	**0.179**	-0.008	**0.051**	-0.019
ΔCash Surplus	-0.007	0.003	**0.044**	0.012	**-0.025**	**-0.075**	**0.073**	**-0.108**	**0.478**	1.000	**0.032**	**0.024**	-0.020	**0.027**
ΔSales Growth	0.008	-0.016	0.017	-0.007	-0.007	**0.190**	-0.006	**-0.033**	**0.036**	**0.026**	1.000	**0.039**	**0.150**	**-0.085**
Delaware	**0.038**	**0.041**	-0.004	-0.003	-0.017	**0.039**	**-0.022**	0.003	**0.029**	0.008	**0.043**	1.000	0.004	**-0.032**
ΔGSP Growth Rate	0.020	0.017	0.007	**0.091**	0.015	**0.083**	-0.021	**0.031**	0.013	**-0.022**	-0.021	0.002	1.000	**-0.494**
ΔUnemployment Rate	-0.016	**-0.032**	0.019	**-0.119**	**0.034**	**-0.108**	**0.032**	**-0.060**	-0.010	**0.028**	**0.055**	-0.011	**-0.647**	1.000

Table 3. Effect of corporate income tax changes on capital investments

Table 3 reports results of the multivariate regression of capital investments on state tax rate changes. I divide the state tax changes into tax cuts and tax increases. In Column 1 of Panel A, I use Tax cuts and Tax increases that are indicators in Column 2 of Panel A, I run Equation (1), using the rank variable sorted by the magnitude of tax rate changes. In Panel B, I test whether there is a possible delayed reaction or pre-trend in firms' investment location decisions before or after state tax rate changes. The model includes additional lead and lag tax change variables in addition to the baseline model. All variables are defined in Appendix A. p-values are calculated using standard errors clustered by destination state and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Dependent variable: Capital Investment	
	(1)	(2)
Tax cut	0.010***	
	(0.000)	
Tax increase	-0.006	
	(0.206)	
Tax cut_rank		0.013***
		(0.001)
Tax increase_rank		-0.004
		(0.478)
ΔSIZE	0.026*	0.026*
	(0.077)	(0.075)
ΔMarket-to-Book	-0.000	-0.000
	(0.375)	(0.394)
ΔLeverage	-0.039**	-0.039**
	(0.022)	(0.023)
ΔROA	-0.001	-0.001
	(0.977)	(0.976)
ΔCash_Surplus	0.043	0.043
	(0.186)	(0.183)
ΔSales growth	-0.008	-0.008
	(0.374)	(0.377)
Delaware	-0.003	-0.003
	(0.311)	(0.304)
GSP growth rate	0.001	0.001
	(0.181)	(0.212)
State Unemployment rate	-0.001	-0.001
	(0.808)	(0.802)
Industry Fixed effects	Yes	Yes
Year Fixed effects	Yes	Yes
Observations	6,085	6,085
Adjusted R-squared	0.125	0.125

Table 4. Tax sensitivity of investment characteristics

Table 4 reports the cross-sectional results of the multivariate regression of capital investments on state tax rate changes depending on the investment characteristics. Panel A divides investments into New-entry projects vs. Expansion projects. Panel B group the investment projects into High-tech industries vs. Non high-tech industries. Panel C divide the sample into location specific activities (i.e., Business services, and Logistics & Distribution) and other activities. Panel D compares projects located near HQ vs. projects that are distant from HQ. All variables are defined in Appendix A. p-values are calculated using standard errors clustered by destination state and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A. Tax sensitivity of investment between new and expansion

	Dependent variable: Capital Investment			
	New	Expansion	New	Expansion
	(1)	(2)	(3)	(4)
Tax cut	0.011***	0.006		
	(0.003)	(0.164)		
Tax increase	-0.014**	0.001		
	(0.040)	(0.848)		
Tax_cut_rank			0.014***	0.011
			(0.010)	(0.154)
Tax_increase_rank			-0.015*	0.008
			(0.063)	(0.450)
ΔSIZE	0.038*	0.008	0.038*	0.008
	(0.079)	(0.522)	(0.076)	(0.515)
ΔMarket-to-Book	-0.000	-0.000	-0.000	-0.000
	(0.301)	(0.924)	(0.310)	(0.987)
ΔLeverage	-0.053**	-0.016	-0.053**	-0.015
	(0.013)	(0.256)	(0.013)	(0.263)
ΔROA	0.011	-0.074***	0.011	-0.074***
	(0.696)	(0.006)	(0.700)	(0.006)
ΔCASH_Surplus	0.034	0.009	0.034	0.010
	(0.511)	(0.831)	(0.508)	(0.815)
ΔSales growth	-0.014	0.009	-0.014	0.009
	(0.217)	(0.375)	(0.217)	(0.372)
Delaware	-0.004	-0.001	-0.004	-0.001
	(0.395)	(0.859)	(0.390)	(0.839)
GSP growth rate	0.001	-0.000	0.001	-0.000
	(0.245)	(0.905)	(0.269)	(0.808)
State Unemployment rate	0.001	-0.001	0.001	-0.001
	(0.745)	(0.678)	(0.754)	(0.685)
New – Expansion:				
Tax cut	0.005		0.003	
	(0.425)		(0.780)	
Tax increase	-0.015		-0.023	
	(0.084)		(0.083)	

Industry Fixed effects	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes
Observations	3,500	2,585	3,500	2,585
Adjusted R-squared	0.160	0.134	0.160	0.135

Table 4 continued

Panel B. Tax sensitivity of high-tech vs. other industries

	Dependent variable: Capital Investment			
	High tech	others	High tech	others
	(1)	(2)	(3)	(4)
Tax cut	0.006	0.011***		
	(0.460)	(0.000)		
Tax increase	-0.020***	0.003		
	(0.000)	(0.678)		
Tax_cut_rank			0.006	0.016***
			(0.560)	(0.002)
Tax_increase_rank			-0.024***	0.006
			(0.003)	(0.465)
ΔSIZE	0.053**	0.016	0.053**	0.016
	(0.046)	(0.281)	(0.047)	(0.273)
ΔMarket-to-Book	0.000	-0.000*	0.000	-0.000*
	(0.753)	(0.085)	(0.752)	(0.096)
ΔLeverage	-0.032	-0.038***	-0.032	-0.038***
	(0.279)	(0.004)	(0.277)	(0.004)
ΔROA	0.013	0.040	0.013	0.040
	(0.729)	(0.235)	(0.730)	(0.237)
ΔCASH_Surplus	-0.092	0.086**	-0.092	0.087**
	(0.238)	(0.025)	(0.239)	(0.025)
ΔSales growth	0.002	-0.027	0.002	-0.027
	(0.829)	(0.150)	(0.836)	(0.152)
Delaware	0.005	-0.005	0.005	-0.005*
	(0.246)	(0.103)	(0.246)	(0.100)
GSP growth rate	0.000	0.001	0.000	0.001
	(0.860)	(0.156)	(0.902)	(0.168)
State Unemployment rate	0.001	-0.001	0.000	-0.001
	(0.919)	(0.685)	(0.965)	(0.707)
High-tech – Others:				
Tax cut	-0.005		-0.010	
	(0.340)		(0.331)	
Tax increase	-0.023		-0.030	
	(0.005)		(0.005)	
Industry Fixed effects	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes
Observations	1,470	4,615	1,470	4,615
Adjusted R-squared	0.152	0.134	0.152	0.134

Table 4 continued

Panel C. Tax sensitivity of investments - Location specific activity

	Dependent variable: Capital Investment			
	Location specific	Others	Location specific	Others
	(1)	(2)	(3)	(4)
Tax cut	-0.003	0.012***		
	(0.496)	(0.001)		
Tax increase	0.008	-0.007		
	(0.562)	(0.150)		
Tax_cut_rank			-0.002	0.017***
			(0.695)	(0.005)
Tax_increase_rank			0.004	-0.004
			(0.755)	(0.490)
ΔSIZE	0.017	0.035**	0.017	0.035**
	(0.599)	(0.024)	(0.603)	(0.024)
ΔMarket-to-Book	0.000	-0.000	0.000	-0.000
	(0.794)	(0.408)	(0.802)	(0.437)
ΔLeverage	-0.060*	-0.027*	-0.060*	-0.027*
	(0.075)	(0.073)	(0.076)	(0.074)
ΔROA	0.046**	-0.057	0.046**	-0.057
	(0.048)	(0.184)	(0.048)	(0.185)
ΔCASH_Surplus	0.015	0.076*	0.015	0.077*
	(0.737)	(0.096)	(0.734)	(0.094)
ΔSales growth	-0.000	-0.010	-0.000	-0.010
	(0.994)	(0.356)	(0.991)	(0.358)
Delaware	-0.006	-0.002	-0.007	-0.002
	(0.349)	(0.564)	(0.349)	(0.550)
GSP growth rate	0.002*	0.000	0.002*	0.000
	(0.079)	(0.830)	(0.076)	(0.902)
State Unemployment rate	0.003	-0.003	0.003	-0.003
	(0.597)	(0.313)	(0.581)	(0.301)
Location specific – Others:				
Tax cut	-0.015		-0.019	
	(0.013)		(0.034)	
Tax increase	0.015		0.008	
	(0.309)		(0.554)	
Industry Fixed effects	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes
Observations	1,348	4,737	1,348	4,737
Adjusted R-squared	0.196	0.188	0.196	0.188

Table 4 continued

Panel D. Tax sensitivity of investments - Distance from HQ

	Dependent variable: Capital Investment			
	Local	Distant	Local	Distant
	(1)	(2)	(3)	(4)
Tax cut	-0.011	0.012***		
	(0.320)	(0.001)		
Tax increase	-0.015	-0.003		
	(0.255)	(0.597)		
Tax_cut_rank			-0.012	0.017***
			(0.225)	(0.001)
Tax_increase_rank			-0.019	-0.001
			(0.253)	(0.909)
ΔSIZE	-0.000	0.028**	-0.000	0.028**
	(0.994)	(0.039)	(0.999)	(0.038)
ΔMarket-to-Book	-0.000	-0.000	-0.000	-0.000
	(0.761)	(0.281)	(0.758)	(0.296)
ΔLeverage	-0.033	-0.039**	-0.033	-0.039**
	(0.251)	(0.013)	(0.252)	(0.013)
ΔROA	0.040	-0.000	0.040	-0.000
	(0.440)	(0.992)	(0.445)	(0.991)
ΔCASH_Surplus	-0.035	0.040	-0.037	0.040
	(0.572)	(0.328)	(0.548)	(0.326)
ΔSales growth	0.016	-0.007	0.015	-0.007
	(0.852)	(0.307)	(0.857)	(0.309)
Delaware	-0.001	-0.004	-0.001	-0.004
	(0.920)	(0.180)	(0.924)	(0.177)
GSP growth rate	-0.002	0.001**	-0.002	0.001**
	(0.547)	(0.016)	(0.532)	(0.022)
State Unemployment rate	-0.020*	0.001	-0.020*	0.001
	(0.099)	(0.685)	(0.097)	(0.672)
Local – Distant:				
Tax cut	-0.023		-0.029	
	(0.023)		(0.003)	
Tax increase	-0.012		-0.018	
	(0.329)		(0.214)	
Industry Fixed effects	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes
Observations	675	5,410	675	5,410
Adjusted R-squared	0.213	0.132	0.213	0.132

Table 5. Investments expected to receive grater benefits from corporate taxes

Table 5 reports the cross-sectional results of the multivariate regression of capital investment on state tax rate changes depending on the investment that are expected to receive greater benefit from corporate taxes based on state apportionment formulas. Panel A compares the projects that create a Large number of jobs vs. Small number of jobs. Panel B reports the results of Equation (2), which tests the effects of apportionment factor on investment location decisions. All variables are defined in Appendix A. p-values are calculated using standard errors clustered by destination state and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A. Tax sensitivity of investments - Number of job creation

	Dependent variable: Capital Investment			
	Large job	Small job	Large job	Small job
	(1)	(2)	(3)	(4)
Tax cut	0.019***	0.001		
	(0.004)	(0.712)		
Tax increase	0.005	-0.012*		
	(0.641)	(0.068)		
Tax_cut_rank			0.028***	0.003
			(0.004)	(0.548)
Tax_increase_rank			0.005	-0.009
			(0.671)	(0.290)
ΔSIZE	0.020	0.020	0.020	0.020
	(0.472)	(0.196)	(0.476)	(0.199)
ΔMarket-to-Book	-0.000	-0.000	0.000	-0.000
	(0.978)	(0.389)	(0.935)	(0.388)
ΔLeverage	-0.061*	-0.021	-0.061*	-0.021
	(0.065)	(0.128)	(0.064)	(0.135)
ΔROA	0.097**	0.011	0.097**	0.011
	(0.043)	(0.681)	(0.044)	(0.678)
ΔCASH_Surplus	0.059	0.055	0.060	0.056
	(0.247)	(0.161)	(0.240)	(0.160)
ΔSales growth	-0.022	-0.008	-0.022	-0.008
	(0.483)	(0.238)	(0.493)	(0.246)
Delaware	-0.001	-0.004	-0.001	-0.004
	(0.833)	(0.256)	(0.829)	(0.254)
GSP growth rate	-0.001	0.002**	-0.001	0.002**
	(0.442)	(0.016)	(0.424)	(0.019)
State Unemployment rate	-0.003	0.001	-0.003	0.001
	(0.450)	(0.737)	(0.474)	(0.752)
High job – Small job:				
Tax cut	0.018		0.025	
	(0.024)		(0.036)	
Tax increase	-0.007		0.014	
	(0.193)		(0.337)	
Industry Fixed effects	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes
Observations	2,289	3,796	2,289	3,796
Adjusted R-squared	0.289	0.108	0.290	0.108

Table 5 continued

Panel B. Effects of apportionment factor on investment location decisions

	Dependent variable: Capital Investment	
	(1)	(2)
Tax cut	0.015***	
	(0.004)	
Tax increase	-0.031***	
	(0.002)	
High Sales Weight ×Tax cut	-0.008	
	(0.189)	
High Sales Weight ×Tax increase	0.036***	
	(0.004)	
Tax_cut_rank		0.024***
		(0.006)
Tax_increase_rank		-0.046***
		(0.001)
High Sales Weight ×Tax_cut_rank		-0.016
		(0.132)
High Sales Weight ×Tax_increase_rank		0.051***
		(0.001)
High Sales Weight	0.003	0.004
	(0.278)	(0.245)
Control variable		
Firm characteristics	Yes	Yes
State economic controls	Yes	Yes
Industry Fixed effects	Yes	Yes
Year Fixed effects	Yes	Yes
Observations	5,875	5,875
Adjusted R-squared	0.133	0.133

Table 6. Neighboring States

Table 6 shows the test results of whether states that lower their corporate taxes attract investments that would have otherwise gone to the neighboring states. Panel A in Table 6 presents the matched sample results. First, I identify the state-years which changed their corporate income taxes. Second, each state-year observation is matched with one or more neighboring states that did not change tax rates in the same year. Panel B examines examine whether states that offer lower state taxes show a percentage increase in investment relative to all available capital investments that states can potentially obtain. All variables are defined in Appendix A. p-values are calculated using standard errors clustered by destination state and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A. Matched sample analysis

	Dependent variable: Capital Investment	
	(1)	(2)
Tax cut	0.007**	
	(0.036)	
Tax increase	-0.007	
	(0.111)	
Tax cut_rank		0.009**
		(0.048)
Tax increase_rank		-0.007
		(0.176)
ΔSIZE	0.041*	0.041*
	(0.098)	(0.097)
ΔMarket-to-Book	0.000	0.000
	(0.884)	(0.850)
ΔLeverage	-0.034*	-0.034*
	(0.053)	(0.054)
ΔROA	-0.069	-0.069
	(0.139)	(0.139)
ΔCASH_Surplus	0.092	0.092
	(0.131)	(0.130)
ΔSales growth	-0.019	-0.019
	(0.387)	(0.389)
Delaware	-0.001	-0.001
	(0.825)	(0.812)
GSP growth rate	0.000	0.000
	(0.635)	(0.690)
State Unemployment rate	0.002	0.002
	(0.652)	(0.660)
Industry Fixed effects	Yes	Yes
Year Fixed effects	Yes	Yes
Observations	3,042	3,042
Adjusted R-squared	0.186	0.186

Table 6 continued

Panel B. Neighboring states analysis at the state level

	Dependent variable: % change in state-level investment			
	(1)	(2)	(3)	(4)
Tax cut	3.593**			
	(0.047)			
Tax increase	-1.683			
	(0.771)			
Tax cut_rank		5.925*		
		(0.053)		
Tax increase_rank		0.819		
		(0.912)		
Relative Tax cut			3.266*	
			(0.057)	
Relative Tax increase			-0.332	
			(0.733)	
Relative Tax cut_rank				5.665**
				(0.028)
Relative Tax increase_rank				0.428
				(0.732)
GSP growth rate	0.070	0.050	0.093	0.099
	(0.754)	(0.830)	(0.688)	(0.664)
State Unemployment rate	0.007	0.007	0.006	0.007
	(0.616)	(0.616)	(0.674)	(0.590)
State R&D tax credits	-0.303	-0.299	-0.284	-0.281
	(0.101)	(0.102)	(0.112)	(0.102)
State Job tax credits	-2.706	-2.498	-3.450	-3.597
	(0.409)	(0.446)	(0.264)	(0.214)
State investment tax credits	1.237	1.324	1.350	1.455
	(0.233)	(0.202)	(0.188)	(0.147)
Year Fixed effects	Yes	Yes	Yes	Yes
Observations	457	457	457	457
Adjusted R-squared	0.056	0.058	0.058	0.063

Table 7. Firm-specific subsidies

Table 7 reports the results of Equation (3), which tests the effects of firm-specific subsidy on investment location decisions. All variables are defined in Appendix A. p-values are calculated using standard errors clustered by destination state and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Dependent variable: Capital Investment	
	(1)	(2)
Tax cut	0.010***	
	(0.000)	
Tax increase	-0.006	
	(0.208)	
Scaled_benefit×Tax cut	-0.007***	
	(0.001)	
Scaled_benefit×Tax increase	-0.002	
	(0.868)	
Tax_cut_rank		0.014***
		(0.001)
Tax_increase _rank		-0.004
		(0.487)
Scaled_benefit×Tax_cut_rank		-0.009***
		(0.007)
Scaled_benefit×Tax_increase_rank		-0.004
		(0.801)
Scaled_benefit	0.001	0.001
	(0.450)	(0.450)
Control variable		
Firm characteristics	Yes	Yes
State economic controls	Yes	Yes
Industry Fixed effects	Yes	Yes
Year Fixed effects	Yes	Yes
Observations	6,085	6,085
Adjusted R-squared	0.125	0.125

Table 8. Parallel Trend Analysis

Table 8 tests a possible delayed reaction or pre-trend in firms' investment location decisions before or after state tax rate changes. The model includes additional lead and lag tax change variables in addition to the baseline model. All variables are defined in Appendix A. p-values are calculated using standard errors clustered by destination state and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

		Dependent variable: Capital Investment	
		(1)	(2)
Tax cut	at t= -1	-0.003	
		(0.526)	
	at t= 0	0.012***	
		(0.000)	
	at t= +1	-0.005	
		(0.223)	
Tax increase	at t= -1	-0.010*	
		(0.083)	
	at t= 0	-0.006	
		(0.199)	
	at t= +1	0.010	
		(0.226)	
Tax cut_rank	at t= -1		-0.004
			(0.431)
	at t= 0		0.016***
			(0.001)
	at t= +1		-0.004
			(0.426)
Tax increase_rank	at t= -1		-0.012
			(0.139)
	at t= 0		-0.004
			(0.473)
	at t= +1		0.010
			(0.178)
Control variable			
Firm characteristics		Yes	Yes
State economic controls		Yes	Yes
Industry Fixed effects		Yes	Yes
Year Fixed effects		Yes	Yes
Observations		6,085	6,085
Adjusted R-squared		0.125	0.125

Table 9. Other state-level incentives

Table 9 shows the baseline test results after controlling potential confounds. Columns 1 and 2 include personal income tax and capital gains tax, and state-level investment incentive programs in addition to the state economic indicators. Columns 3 and 4 also add state-level political and economic conditions. All variables are defined in Appendix A. p-values are calculated using standard errors clustered by destination state and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Dependent variable: Capital Investment			
	(1)	(2)	(3)	(4)
Tax cut	0.010***		0.009***	
	(0.000)		(0.001)	
Tax increase	-0.006		-0.006	
	(0.214)		(0.200)	
Tax cut_rank		0.014***		0.013***
		(0.002)		(0.003)
Tax increase_rank		-0.004		-0.004
		(0.491)		(0.487)
Other state tax policy				
State Personal income tax	-0.002	-0.002	-0.002	-0.002
	(0.458)	(0.476)	(0.448)	(0.471)
State Tax on capital gains	0.004	0.004	0.004	0.004
	(0.173)	(0.167)	(0.209)	(0.205)
State R&D tax credits	0.000	0.000	0.000	0.000
	(0.491)	(0.472)	(0.546)	(0.524)
State Job tax credits	0.005	0.005	0.004	0.005
	(0.270)	(0.239)	(0.363)	(0.315)
State investment tax credits	-0.002*	-0.001	-0.002*	-0.001
	(0.065)	(0.100)	(0.086)	(0.123)
Political & Economic Condition				
Lagged change in			-0.002	-0.002
Democratic governor			(0.695)	(0.741)
=1 if one year to next			-0.000	0.000
Gubernatorial election			(0.927)	(0.987)
Union membership			0.001	0.001
			(0.668)	(0.682)
State tax rates in t-1			0.001	0.001
			(0.147)	(0.148)
Education			-0.000	-0.001
			(0.953)	(0.829)
Control variable	Yes	Yes	Yes	Yes
Industry Fixed effects	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes
Observations	6,085	6,085	6,085	6,085
Adjusted R-squared	0.125	0.125	0.124	0.124

Table 10. Firm level investment response to HQ State tax Rate changes

Table 10 revisits prior studies that used *Capex* from Compustat as a proxy for firm-level investments and examines whether HQ state tax rate changes affect firm-level investments. Column 1 and 2 show the results based on all available firms from Compustat. Column 3 and 4 use the same firm-year observations with the baseline test. All variables are defined in Appendix A. p-values are calculated using standard errors clustered by destination state and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

		Dependent variable: Capex (firm level)			
		(1)	(2)	(3)	(4)
Tax cut	at t= -1	0.001		-0.005	
		(0.580)		(0.154)	
	at t= 0	0.000		0.004	
		(0.848)		(0.357)	
	at t= +1	-0.005		-0.008**	
		(0.218)		(0.041)	
Tax increase	at t= -1	0.000		0.005	
		(0.836)		(0.390)	
	at t= 0	-0.000		-0.001	
		(0.981)		(0.797)	
	at t= +1	-0.002		-0.004	
		(0.397)		(0.357)	
Tax cut_rank	at t= -1		0.001		-0.005
			(0.694)		(0.162)
	at t= 0		-0.002		0.005
			(0.371)		(0.331)
	at t= +1		-0.005		-0.010**
			(0.331)		(0.048)
Tax increase_rank	at t= -1		-0.000		0.007
			(0.949)		(0.335)
	at t= 0		-0.002		-0.003
			(0.420)		(0.668)
	at t= +1		-0.001		-0.004
			(0.621)		(0.432)
Control variable		Yes	Yes	Yes	Yes
Industry Fixed effects		Yes	Yes	Yes	Yes
Year Fixed effects		Yes	Yes	Yes	Yes
Observations		32,120	32,120	2,955	2,955
Adjusted R-squared		0.089	0.089	0.012	0.012

Appendices

Appendix A: Variable Definition

Variable	Definition
Main Variables	
Δ Investment	Capital investments, calculated as interstate investment at each *project level* over the book value of assets in the beginning year
Corporate tax rate	Highest statutory rate in state corporate income tax rate bracket
Relative state tax rate	State's tax rate relative to highest tax rate among its neighboring states
% change in state investment	(investment in state t - investment in state t-1)/ (investment in state t-1 + neighboring states in year t-1)
Tax Increase	Indicator variable that takes 1 if states *increase* corporate income taxes, 0 otherwise
Tax Cut	Indicator variable that takes 1 if states *decrease* corporate income taxes, 0 otherwise
Relative Increase	Indicator variable that takes 1 if *Relative state tax rate* is positive, 0 otherwise
Relative Cut	Indicator variable that takes 1 if *Relative state tax rate* is negative, 0 otherwise
Tax Increase_rank	Rank variable scaled from 0 to 1. I use the median value and divide the tax increases into high and low depending on the magnitude of changes in tax rates
Tax Cut_rank	Rank variable scaled from 0 to 1. I use the median value and divide the tax cuts into high and low depending on the magnitude of changes in tax rates
Relative Increase_rank	Rank variable scaled from 0 to 1. I use the median value and divide the *Relative Increase* into high and low depending on the magnitude of changes in tax rates
Relative Cut_rank	Rank variable scaled from 0 to 1. I use the median value and divide the *Relative Cut* into high and low depending on the magnitude of changes in tax rates
High_Tech	Takes 1 if project is in a high technology industry sector defined following Francis and Schipper (1999), zero otherwise
Firm level variables (all variables are used as lagged change between year t-1 and year t)	
Firm Size	Log value of total assets.
Leverage	Long term debt scaled by the total assets in year t-1.
Market-to-Book	Market-to-book ratio calculated as the market value of equity over the book value of equity
ROA	Earnings divided by total assets
Sales Growth	Log of sales in current year t over last year (t-1) sales
Cash Surplus	Cash from assets-in-place (oancf-dpc+xrd) over the total assets in year t-1
Delaware	Takes 1 if the firm in incorporated in Delaware, zero otherwise
Capex	Capex is defined as net capital expenditure over the book value of assets.
Firm specific subsidy	Sum of subsidies that firm received during the year t in each destination state divided by domestic pretax income (pidom). I use worldwide pretax income if domestic pretax income is not available.
State ETR	State effective tax rates, defined as state current tax expenses over domestic pre-tax income. State ETR is truncated at zero and 0.5, following Dyreng et al. (2013).
State level variables (all variables are used as lagged change between year t-1 and year t)	
GSP Growth rate	Annual gross state product growth rate.

State unemployment rate	Annual unemployment rate in each state.
Union membership	Portion of private-sector employees who belong to a labor union in year t. Data is obtained from Hirsch and Macpherson (2003) as updated on the website, http://unionstats.com.
EDUCATION	Educational attainment measure as percentage of population who has Bachelor's or higher degree. The data come from Bureau, U.S. Census. "American Community Annual Survey".
Democratic governor	Indicator variable that takes one if the state is governed by a Democratic governor, and zero otherwise. Data is obtained from state election Web sites.
R&D Tax Credits	The median deduction rate at which a firm can deduct its R&D expenditure tax credit directly from state corporate income tax liability.
Job Creation Tax Credits	Indicator variable equals to 1 when state has job creation tax credit, 0 otherwise. I obtained the data from AppendixA1in Neumark and Grijalva (2013).
Investment Tax Credits	The rate at which a firm can deduct its capital of capital expenditure directly from its state corporate income tax liability.
State Personal Tax Rate	The maximum state tax rate on wage income, estimated for an additional $1,000 of income on an initial $1,500,000 of wage income. The data come from Daniel Feenberg, available at http://users.nber.org/~taxsim/state-rates.
State Capital Gains Tax Rate	The maximum state tax rate on long-term capital gains. The data come from Daniel Feenberg, available at http://users.nber.org/_taxsim/ state-rates.

Appendix B: Example of greenfield investment in *FdI Data*

State Tax rate cut: Kentucky (2008-01-01), 7% to 6%

*December 2008 - ConocoPhillips (United States) is investing **$58.50 m** in the city of Louisville (KY) (Kentucky), United States in the Alternative/Renewable energy sector in a Research & Development project*

Houston-based energy giant ConocoPhillips Co.'s will open a Global Technology and Corporate Learning Center in Louisville, to focus on renewable energy and high-tech carbon fuels recovery. ConocoPhillips hopes to have the center operational by 2012. The Corporate Learning Center will be used to train the company's worldwide workforce.

- Sub sector: Wind electric power

- Project type: New

State Tax rate cut: Indiana (2014-01-01), 8% to 7.5%

*March 2014 - GE Aviation [Subsidiary of General Electric (GE)] (United States) is investing **$115.00 m** in the city of Lafayette (IN) (Indiana), United States in the Aerospace sector in a Manufacturing project, creating 230 jobs*

Aircraft engine and component manufacturer GE Aviation, a subsidiary of Connecticut-based General Electric, has announced it will invest $115m opening a LEAP jet engine assembly plant in Lafayette, Indiana. The company will create 230 jobs by 2020 at the 20,905 sq m facility. The plant is expected to open in early 2016. The facility will also provide engine maintenance services.

- Sub sector: Aircraft engines, other parts & auxiliary equipment

- Project type: New

State Tax rate cut: North Carolina (2014-01-01), 6.9% to 6.00%

*October 2014 - DuPont (United States) is investing **$30.00 m** in the city of Kinston (NC) (North Carolina), United States in the Chemicals sector in a Manufacturing project, creating 18 jobs*

Delaware-based DuPont, a chemical company, has announced it will expand its plant in Kinston, North Carolina. The company will invest $30m and create 18 new jobs by 2017. The plant manufactures Sorona, a biopolymer used in textiles such as carpets and mats. The One North Carolina Fund offered up to $80,000 in grants.

- Sub sector: Resin & artificial synthetic fibres & filaments

- Project type: Expansion

Appendix C: List of State Corporate Tax Rate Changes

State	Year	Description
KY	2007	Decrease in top corporate income tax rate from 7% to 6%
ND	2007	Decrease in top corporate income tax rate from 7% to 6.5%
NJ	2007	Introduction of 4% tax surcharge on tax liability
NY	2007	Decrease in top corporate income tax rate from 7.5% to 7.1%
VT	2007	Decrease in top corporate income tax rate from 8.9% to 8.5%
WV	2007	Decrease in top corporate income tax rate from 9% to 8.75%
CT	2008	Repeal of 20% tax surcharge
KS	2008	Decrease in tax surcharge from 3.35% to 3.1%
MD	2008	Increase in top corporate income tax rate from 7% to 8.25%
MI	2008	Introduction of corporate income tax with a top rate of 4.95%; replaces a gross-receipts tax without interest deductibility
TX	2008	Abolition of income tax replaced with gross receipts tax without interest deductibility
CT	2009	Introduction of 10% tax surcharge on tax liability
KS	2009	Decrease in tax surcharge from 3.1% to 3.05%
NC	2009	Introduction of 3% tax surcharge on tax liability
ND	2009	Decrease in top corporate income tax rate from 6.5% to 6.4%
OH	2009	Tax decrease: from 8.5% to 0.26% (phase out of income tax from year 2005)
OR	2009	Increase in top corporate income tax rate from 6.6% to 7.9%
WV	2009	Decrease in top corporate income tax rate from 8.75% to 8.5%
MA	2010	Decrease in top corporate income tax rate from 9.5% to 8.75%
NJ	2010	Repeal of 4% tax surcharge
IL	2011	Increase in top corporate income tax rate from 4.8% to 7%
KS	2011	Decrease in tax surcharge from 3.05% to 3%
MA	2011	Decrease in top corporate income tax rate from 8.75% to 8.25%
NC	2011	Repeal of 3% tax surcharge
ND	2011	Decrease in top corporate income tax rate from 6.4% to 5.15%
OR	2011	Decrease in top corporate income tax rate from 7.9% to 7.6%
CT	2012	Unscheduled two-year extension of tax surcharge on tax liability and increase to 20%
MA	2012	Decrease in top corporate income tax rate from 8.25% to 8%
MI	2012	Increase in top corporate income tax rate from 4.95% to 6%
WV	2012	Decrease in top corporate income tax rate from 8.5% to 7.75%
ID	2013	Decrease in top corporate income tax rate from 7.6% to 7.4%
IN	2013	Decrease in top corporate income tax rate from 8.5% to 8.0%
ND	2013	Decrease in top corporate income tax rate from 5.15% to 4.53%
WV	2013	Decrease in top corporate income tax rate from 7.75% to 7.0%

(Continued)

State	Year	Description
AZ	2014	Decrease in top corporate income tax rate from 6.968% to 6.5%
IN	2014	Decrease in top corporate income tax rate from 8.0% to 7.5%
NC	2014	Decrease in top corporate income tax rate from 6.9% to 6.0%
NM	2014	Decrease in top corporate income tax rate from 7.6% to 7.3%
WV	2014	Decrease in top corporate income tax rate from 7.0% to 6.5%
AR	2015	Introduction of 3% tax surcharge on tax liability
AZ	2015	Decrease in top corporate income tax rate from 6.5% to 6.0%
DC	2015	Decrease in top corporate income tax rate from 9.98% to 9.4%
IL	2015	Decrease in top corporate income tax rate from 9.5% to 7.75%
IN	2015	Decrease in top corporate income tax rate from 7.5% to 7.0%
NC	2015	Decrease in top corporate income tax rate from 6.0% to 5.0%
NM	2015	Decrease in top corporate income tax rate from 7.3% to 6.9%
RI	2015	Decrease in top corporate income tax rate from 9% to 7%
AZ	2016	Decrease in top corporate income tax rate from 6.0% to 5.5%
IN	2016	Decrease in top corporate income tax rate from 7.0% to 6.5%
NC	2016	Decrease in top corporate income tax rate from 5.0% to 4.0%
ND	2016	Decrease in top corporate income tax rate from 4.53% to 4.31%
NM	2016	Decrease in top corporate income tax rate from 6.9% to 6.6%
NY	2016	Decrease in top corporate income tax rate from 7.1% to 6.5%

For the rank variable, I estimate the effect of surcharge by multiplying change in surcharge rate with the top statutory corporate income tax rate.

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