Impact of Corporate Taxes on Industry Employment

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Abstract

This is the first paper to thoroughly investigate the employment effects of corporate taxation at the industry level. Do corporate taxes affect employment rates at the industry level? If they do, then are the effects consistent across all industries? Answering these questions have proved empirically challenging. This paper uses an identification strategy that exploits variation in corporate income tax rates across U.S. states and tries to understand how it impacts industry employment at the county level by focusing on contiguous counties straddling state borders over the period starting from 1990 to 2010. The results show that any change in corporate tax affect employment rate in the good producing sector, but employment rate within service sector is only affected by an increase, and not by any decrease, in the corporate tax rates. The paper further presents some interesting findings at a further disaggregation by looking at some of the major economic sectors based on their share of gross domestic product.

Keywords: Corporate Tax, Employment, Industry, Difference-in-Difference, County Pairs.

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1 Introduction:

In the run-up to the 2016 General Election, one presidential nominee proposed lowering the corporate tax rates, while the other proposed to increase them with both arguing that their respective tax rates would be beneficial to Americans (Dwyer 2016). Beyond the political rhetoric, variation in tax policy has existed in American politics for at least a century, resulting in one of the most complex corporate tax structures in the world. High corporate tax rates disincentivize corporations to invest in the United States lowering employment rates; however, low corporate taxes create a loss of revenue for the federal government affecting social spending in human capital. To inform this debate, I examine the responses to changes in corporate taxes at the state level in a given industry in terms of employment. I follow the model developed by Ljungqvist and Smolyansky (2016) who use a spatial discontinuity approach to look at the impact of corporate taxes on employment and income. The main findings of their work are that an increase in corporate tax rates leads to a decrease in employment rate, however they find little evidence of an increase in employment and income resulting from corporate tax cuts. Why is it that corporate tax changes do not have a symmetric relationship with employment? I explore this link in more detail by focusing on industry level analysis.

Increases in employment or not, both these arguments assume homogenous effect of corporate tax rates across all industries. This assumption is misleading because specificity of each industry navigates its response to the tax rates. For one, not all industries are equally mobile. Finance, Insurance and Information sectors are relatively more mobile than sectors like Retail, Healthcare and Construction. Second, some industries are more capital intensive while others are more labor intensive. A wide range of manufacturing industries mostly durable goods industries along with some service producing industries are somewhat capital/technology intensive and sectors such as retail trade and construction tend to be labor intensive. Therefore, one should suspect different response to tax changes across different industries.

Transition of the US economy, from manufacturing to service, has reshuffled the structure
of employment. Employment in the manufacturing sector has declined steadily since the 1990s while the service sector has experienced an increase in employment. The Bureau of Labor Statistics (BLS) predicts employment growth in health care and social assistance and professional and business services, the two largest service-producing sectors, to continue to (Henderson 2015). Furthermore, in the goods-producing sectors, it is projected that employment will be mainly driven by growth in construction.

Against this background, an empirical examination is necessary to determine if the variation in the rate of state corporate taxes across the US economy has any explanatory power in predicting the variation in industry level employment at the county level. This allows us to shed light on two important inquiries: Do corporate taxes matter at all for employment at the industry level? And, are the effects consistent across all industries? My results show that the service sector and goods producing sector of the economy do react differently to corporate tax cuts. The service sector responds only to corporate tax increases, while, the effect of corporate tax increase on service sector is not economically significant. The goods producing sector, however, responds to both increase and decrease in corporate tax. My point estimates suggest that a 1% increase in corporate tax rate leads to a 1.8% decrease in employment while a 1% cut in the rate leads to a 1.7% increase in employment in the goods producing industry as a whole. The paper further presents some interesting findings at a further disaggregation by looking at some of the major economic sectors based on their share of gross domestic product.

The remainder of this paper is organized as follows. The next section gives an overview of the empirical literature between taxes and economic growth. It also provides a brief discussion of the possible mechanisms through which taxes can stimulate the economy. Section 3 discusses the theoretical framework. Section 4 looks into the empirical model that I have used for the analysis. Section 5 discusses the data and presents the identification strategy. Section 6 discusses results from the regressions and conduct robustness checks. I explore some insightful extension to the overall analysis. Lastly, section 7 concludes and provides

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1Henderson (2015)
direction for future work.

2 Literature Review

Existing studies of corporate tax rates on the economy fall into two broad categories: those using a macro approach and those using the micro approach. Most of the past work, with a few exceptions, focuses on the macroeconomic level by analyzing aggregate time series data. Although my research focuses on the micro effects of corporate taxes on industry level employment, due to the abundance of work focusing on taxes and their impact on macroeconomic outcomes, these studies are discussed below as well.

Romer and Romer (2010) are the leading advocates of the macro approach and they look at the overall U.S federal tax burden as a share of GDP since World War II and propose a unique technique that has come to be known as the 'narrative approach' to address identification and endogeneity concerns. The authors analyze the narrative record of Presidential speeches and Congressional reports to identify shocks in taxes which occur due to changes in legislation. These include increases in taxes to deal with an inherited budget deficit from a previous administration and tax cuts aimed at enhancing long term growth. The problem of reverse causality is reduced by separating the legislated tax changes that are the result of economic changes and those taken for more exogenous reasons. The research finds much larger negative effects of taxes than earlier studies that lump all tax changes together and find that a tax increase (cut) of 1% of GDP reduces (raises) output by 3% after about two years. These results are strongly significant and highly robust even after adding a number of control variables to the baseline model, including controlling for the state of the economy, monetary policy and dynamic shocks to government spending.

Another useful study by Blanchard and Perotti (2002) uses an alternative approach known as the structural VAR (SVAR) method to analyze the impact of taxes on economic outcomes. Blanchard and Perotti (2002) look into the effect of government spending and tax shocks on economic output in the postwar period and like most of the other empirical studies of taxes
and economic growth, they find that positive tax shocks have a negative effect on output and that positive government spending shocks have a positive impact on output. The advantage of using the SVAR approach is that it is very easy to estimate and variables are allowed to have a contemporaneous impact on other variables. However, the main limitation of the SVAR method is that it is sensitive to the identification restrictions used and, as learned from other literatures using time series data, there is no theoretical guidelines on the right or wrong way of setting these restrictions.

Lee and Gordon (2004) use both cross country and time series information to investigate the relationship between tax rates and the growth rate of a country using data from 1970-1997. A major strength of their paper\textsuperscript{2} is that they look at 70 countries and find a negative relationship between corporate taxes and economic growth. The results also show that other taxes, such as the income tax rate and VAT rate do not have robust statistical associations with output. Their model includes the annual growth rate of GDP per capita as the dependent variable while top statutory corporate tax rate, representative personal income tax rate, consumption tax rate and a set of other control variables serve as the independent variable. The results from the cross-sectional growth regressions\textsuperscript{3} show that a cut in the statutory corporate rate of 10% points raises annual GDP growth per capita by about 0.68% to 1.1% points. The higher coefficient is reported when an instrument is used for the corporate tax rate\textsuperscript{4} due to the presence of endogeneity stemming from both omitted variable bias and reverse causality. The papers also reports estimates of panel regression results where instead of using the year by year variation, the authors use data for three, 5-year periods and one 3-year period\textsuperscript{5}. For the panel regression the paper reports results for the ordinary least squares (OLS), fixed effect and instrument variable (IV) estimation strategies and show

\textsuperscript{2}They look at a broad range of countries which includes both developing countries like India and Pakistan and developed economies such as US, UK and Canada.

\textsuperscript{3}Shown in Table 3 in Lee and Gordon (2004)

\textsuperscript{4}The weighted average of corporate tax rate, weighting by the reciprocal of distance between the two countries, is used as an instrument for the corporate tax rate (Lee and Gordon 2004).

\textsuperscript{5}As mentioned by Mcbride (2012) an article published by the Tax Foundation, this might be to smooth out business cycle effects
that a cut in the statutory corporate tax rate of 10% points increases annual growth rate of GDP per capita by about 0.58% to 1.82% points.\footnote{6} Finally, the article provides some evidence that higher corporate taxes increases personal income tax revenue while lower rates result in lower revenues. Lee and Gordon (2004) provides an intuitive argument from these results that higher corporate tax rates reduce growth by reducing entrepreneurial activity.

Ferede and Dahlby (2012) confirm the results of Lee and Gordon (2004) and investigate further the relationship between tax rate and growth at the sub-national level using Canadian provinces. The problem of using cross country analysis is the variation in the tax bases for different countries; a problem solved by looking at the sub-national level such as Canadian provinces which all use similar tax bases.\footnote{7} Using data from 1977-2006 to analyze the effects of taxes on growth, the authors did not find any statistical association between personal income tax rates and growth but did find a strong and robust relationship between the corporate tax rate and growth rate. The growth regression results in the paper show that a corporate rate reduction of 1% led to an increase in per capita GDP growth rate of about 0.1 – 0.2%. The paper also reports an investment regression and argues that private investment is the channel through which taxes affect growth. The results from those regressions show that a 1% increase in corporate tax rate is associated with a 0.3 – 0.4% decrease in the average private investment to GDP ratio (depending on the set of control variables).\footnote{8}

Karras and Furceri (2009) further analyze the influence of taxation on economic performance using annual data from 1965 – 2003 from a panel of 19 European economies.\footnote{9} Just like previous papers, they also find a negative relationship between taxes and real GDP per capita. Specifically, Karras and Furceri (2009) report that an increase in the total tax rate of 1% of GDP effects real GDP per capita on the range of minus 0.5% to minus 1% in the long run. These results are quite similar to those obtained by Blanchard and Perotti (2002)\footnote{6} Similar to the cross sectional growth regressions the higher coefficient is reported when used IV and country dummies.\footnote{7} Feredy and Dahlby (2012); Milligan (2014)\footnote{8} Shown in Table 3 in Feredy and Dahlby (2012)\footnote{9} All these are OECD countries.
for the US economy. This negative relationship with real GDP per capita holds for all four of the largest type of taxes (taxes on income, profits and capital gains, taxes on property, social security contributions and taxes on goods and services) which the authors have also examined in this paper. Their empirical model is slightly different from the other papers since they introduce the change in the tax rate as their independent variable with various lags. Furthermore, when doing a robustness check, they modify their model to address the problem of serial correlation by introducing the lagged values of growth rate of real GDP per capita. In the second robustness check, inspired from Blanchard and Perotti (2002), they estimated the VAR-type system with two equations allowing the change in tax rate to respond to the growth rate of real GDP per capita and also the other way around.

The link between taxes and manufacturing wages using a panel of 72 countries from 1981 to 2002 by Hasset and Mathur (2006). Their findings show that the average income tax has no effect on wages while the effect of corporate taxes on wages are highly robust and statistically significant. Their model follows Rodrik (1999) with the inclusion of tax variables and reports that a 1% increase in corporate tax is linked to a 0.8 to 1.2% percent decrease in wages, depending on the specification. They also find that this effect is larger for smaller countries.

A study by Mendoza, et al (1997) gives a different picture, using data for 18 OECD countries from 1966 to 1990 averaged over five year periods. The authors investigate the relationship between taxes and investment and growth. The tax variables used in their panel growth regressions are labor income taxes, capital income taxes, and consumption taxes. With notable explanatory variables are initial income levels, physical capital, human capital and conditions of trade. The results stand out compared to other studies since they find that the effect of tax rates on growth is insignificant and also find that a cut in labor and capital taxes increases the investment rate while a cut in consumption taxes harms investment. Neither Lee and Gordon (2004) nor Mendoza et al (1997) consider government budget constraints in their empirical research.

The working paper by Ljungqvist and Smolyansky, the main motivation for this research,
uses a micro-level difference in difference (DID) approach to study the impact of changes in state corporate taxes on employment and income at the county level for the US economy over the period 1970 – 2010. They compare all contiguous border county pairs in the United States and find that an increase in top corporate tax rate is associated with a reduction in employment and income; while a corporate tax cut is associated with an increase in employment and income only during recession. The initial setup is quite simple with one group receiving treatment while the other does not (control group) and it is the formation of the control group that is among the more innovative parts of this paper. To get as close to a credible counterfactual as possible, the authors use contiguous border county pairs. This helps to eliminate (or at least reduce) the biasing effects of unobserved local variation in economic conditions that might correlate with the tax change. The point estimates suggest that all else equal, a one percentage-point increase in the top marginal corporate income tax rate reduces employment by between 0.3% and 0.5% and income by between 0.3% and 0.6%, measured relative to neighboring counties on the other side of the state border. Interestingly, the effect of corporate tax changes is asymmetric and the results remain unchanged and statistically significant for all robustness checks. The estimates are incredibly stable regardless of local characteristics such as the flexibility of local labor markets, income levels, population density, or the prevalence of small businesses in a county. They are also stable across the business cycle.

3 Theoretical Framework

In this section, I use a simple microeconomic model similar to Siegloch (2014) of a firm to show under which circumstances capital taxation affects a firm’s employment decision. Let there be a representative firm that produces with a production function $F$ and input factors capital (K) and labor (L). Production function $F$ is a standard neo classical function with positive and decreasing returns to scale, $\frac{\partial F(t)}{\partial t} = F_i > 0$, $\frac{\partial^2 F(t)}{\partial t^2} = F_{ii} < 0$, $F_{ij} > 0$ with $i,j \in \{K,L\}$, $i \neq j$. Furthermore it is also assumed that $F(K,L)$ is strictly concave, implying
that $F_{LL}F_{KK} - F_{KL}^2 > 0$.

The firm faces a corporate profit tax $\tau$ where a share $\alpha \in [0, 1]$ of the capital costs can be deducted from the tax base. The company’s after tax profits $\Pi$ are thus:

$$\Pi = (1 - \tau)[pF(K, L) - wL] - (1 - \alpha\tau)rK$$  \hspace{1cm} (1)

Firms choose capital $K$ and employment $L$ so that $\Pi$ is maximized.

$$\Pi_L = pF_L - w = 0$$  \hspace{1cm} (2)

$$\Rightarrow F_L = \frac{w}{p}$$

$$\Pi_K = p(1 - \tau)F_K - (1 - \alpha\tau)r = 0$$  \hspace{1cm} (3)

$$\Rightarrow F_K = \frac{(1 - \alpha\tau)r}{(1 - \tau)p}$$

From equation (2) it can be seen that labor demand is not directly affected by the corporate tax. Similarly if $\alpha = 1$, i.e if all capital costs are deductible from the profit tax base, capital demand is not affected by $\tau$. Assuming $\alpha < 1$ and total differentiating equation (2) and (3) yields

$$F_{LL} dL + F_{LK} dK = \frac{1}{p} dw - \frac{w}{p^2} dp$$  \hspace{1cm} (4)

$$F_{KK} dK + F_{KL} dL = \frac{1 - \alpha\tau}{(1 - \tau)p} dr - \frac{1 - \alpha\tau}{(1 - \tau)p^2} dp + \frac{1 - \alpha}{(1 - \tau)^2} \frac{r}{p} d\tau$$  \hspace{1cm} (5)

In matrix form

$$\begin{bmatrix}
F_{LL} & F_{LK} \\
F_{KL} & F_{KK}
\end{bmatrix} \times \begin{bmatrix}
dL \\
dK
\end{bmatrix} = \begin{bmatrix}
\frac{1}{p} dw - \frac{w}{p^2} dp \\
\frac{1 - \alpha\tau}{(1 - \tau)p} dr - \frac{1 - \alpha\tau}{(1 - \tau)p^2} dp + \frac{1 - \alpha}{(1 - \tau)^2} \frac{r}{p} d\tau
\end{bmatrix}$$

Solving the above expression yields

$$\frac{dL}{d\tau} = \frac{\frac{1}{p} dw F_{KK} - F_{KL} \frac{1 - \alpha}{(1 - \tau)^2} \frac{r}{p}}{F_{LL}F_{KK} - F_{KL}^2}$$  \hspace{1cm} (6)
\[
\frac{dK}{d\tau} = \frac{F_{LL}(1-\alpha)^{r} \frac{r}{p} - F_{KL} dw}{F_{LL} F_{KK} - F_{KL}^2} \tag{7}
\]

Similar to Siegloch (2014) it is assumed that the non-tax costs of capital are not affected by changes in the tax rate, i.e. \(dp = dr = 0\). If I also make the assumption that labor is perfectly mobile across sectors then, as a consequence, a change in the local tax rate leaves wages in the competitive sector unchanged i.e. \(dw = 0\). Therefore equation (7) becomes:

\[
\frac{dK}{d\tau} = \frac{F_{LL}(1-\alpha)^{r}}{(1-\tau)^2 p [F_{LL} F_{KK} - F_{KL}^2]} < 0
\]

Since \(F_{LL} < 0\) and, by the strict concavity assumption, \(F_{LL} F_{KK} - F_{KL}^2 > 0\). The effect on employment is

\[
\frac{dL}{d\tau} = -\frac{F_{LK}}{F_{LL}} \frac{dK}{d\tau} < 0
\]

4 Empirical Strategy:

I propose a research design that compare all contiguous county-pairs in the United States that are located on opposite sides of a state border. I focus on the changes in corporate tax rates at the state level rather than the federal level as tax changes at the state level are more frequent compared to changes in the top federal corporate income tax rate. Since these tax changes occur at multiple periods across different states, I use a difference-in-differences (DID) approach. This DID approach deals with the problem of confounding variation in economic conditions.

Research on the impact of changes in tax rates confronts two important challenges which makes identification of the causal effect difficult. First, changes in tax policy are usually not random and are mostly influenced by economic events. Second, counterfactual outcomes are not observed. The empirical model I intend to use is similar to the one used in Ljungqvist and Smolyansky (2016) and Heider and Ljungqvist (2014). The difference is that I look into a further disaggregation of employment by focusing on the industry level while Ljungqvist

\footnote{State border discontinuities have also been used in other contexts, for example Dube et al (2010)}
and Smolyansky look at the aggregate county employment. I estimate the following general form of equation for each industry type:

\[ Y_{c,p,s,t} = \lambda T_{s,t} + \delta X_{c,p,s,t} + \phi_s + \kappa_c + \tau_{p,t} + U_{c,p,s,t} \]

where \( c, p, s \) and \( t \) index counties, pair, states and time respectively. Due to unavailability of data on state corporate tax rates for the entire time period, I take the first difference of the above equation. First-differencing help to remove unobserved county (\( \kappa_c \)) and state specific effects (\( \phi_s \)) in the corresponding levels equation. My preferred specification allows for pair specific time effects, \( \tau_{p,t} \) which use only variation in corporate tax rates within each contiguous border county-pair.

\[ \Delta Y_{c,p,s,t} = \lambda \Delta T_{s,t} + \delta \Delta X_{c,p,s,t} + \alpha_{p,t} + \epsilon_{c,p,s,t} \quad (8) \]

\( Y_{c,p,s,t} \) is the average employment (with \( \Delta \) as the first difference operator); \( \Delta T_{s,t} \) measures the magnitude of a change in state corporate tax rates; \( X_{c,s,t} \) is a set of control variables; \( \alpha_{p,t} \) are border-county-pair/year fixed effects, with subscript \( p \) referencing a pair of contiguous border counties; and \( \epsilon_{c,p,s,t} \) is the error term. The coefficient of interest, \( \lambda \), measures the impact of a 1% point change in the corporate tax rate on the change in employment measured relative to neighboring counties on the other side of the state border.

The first differencing helps to remove the unobserved county and state specific fixed effects. My preferred specification allows for pair specific time effects, \( \alpha_{p,t} \) which use only variation in corporate tax rates within each contiguous border county-pair. Similar to Ljungqvist and Smolyansky (2016) and Heider and Ljungqvist (2014) I plan to estimate an improved version of equation 8 and control separately for tax increases (\( T_{s,t}^+ \)) and tax cuts (\( T_{s,t}^- \)):

\[ \Delta Y_{c,p,s,t} = \beta \Delta T_{s,t}^+ + \gamma \Delta T_{s,t}^- + \delta \Delta X_{c,p,s,t} + \alpha_{p,t} + \epsilon_{c,p,s,t} \quad (9) \]

In both of our preferred specifications 8 and 9, \( \alpha_{p,t} \) controls for the variation between county pairs. I am assuming part of my error term for the county pairs are correlated with the
control variables or even may directly be with my tax variable. Hence there are endogeneity issues. To solve endogeneity, we introduce the pair specific time effects. The key identifying assumption in specification \( \delta \) is that \( E(\Delta T_{s,t},c_{p,p,s,t}) = 0 \). The standard errors in both the specification are clustered at the state level.

I believe that after taking into account of the state specific effects those changes in shocks are correlated for observation at the state level and so I cluster the standard errors at the state level.

5 Data

For the analysis, I use industry level data for employment in each county and have examined all state corporate tax changes from 1990 – 2010 to construct the variable measuring tax increases and tax cuts in equation \( \delta \). I selected this time period as it coincides with the availability of consistent data on the important variables at the state level needed to estimate the impact of state level corporate tax rate changes on county level industry employment. The Bureau of Labor Statistics reports industry level annual average employment data classified according to the North American Industry Classification System (NAICS). I use the data at the NAICS level 2 representing some of the major economic sectors. I focus on the major sectors based on their share of gross domestic product.

I take the tax increase and decrease data from Heider and Ljungqvist (2014) who report

\[ \Delta(Y_{c1,p,s1,t} - Y_{c2,p,s2,t}) = \lambda \Delta(T_{s1,t} - T_{s2,t}) + \delta \Delta(X_{c1,p,s1,t} - X_{c2,p,s2,t}) + \alpha_{p,t} - \alpha_{p,t} + \epsilon_{c1,p,s1,t} - \epsilon_{c2,p,s2,t} \]

where \( c1 \) and \( c2 \) are border counties belonging to the same pair \( p \) and \( s1 \) and \( s2 \) are the two neighboring states. It can be seen from the above expression that taking the difference between individual pairs cancels out the county-pair-year effects \( \alpha_{p,t} \) since it is the same for both the counties belonging to the same pair. This process is repeated for all 1,178 contiguous county pairs, and then pooled OLS is applied to the transformed data.

\[ \text{Source: www.census.gov/cgi-bin/sssd/naics/naicsrch?chart=2012} \]
the list of state corporate income tax changes from 1989 to 2011 in their paper. So, I take those data from the appendix of their paper. The authors obtained their data from the Tax Foundation and the raw data is available in the Book of the States. I focus on changes in the top statutory marginal tax rate as states either have a flat corporate tax rate structure or they charge the top rate on even relatively low levels of income. I have identified 27 tax increases and 56 tax cuts over the 20 year period from 1990 to 2010 and find in any given year, on average, 2.6% of states increase taxes and 5.5% of states cut taxes. Table 2 reports summary statistics of the 83 changes in state corporate income tax rates.

As in Ljungqvist and Smolyansky (2016), I control for the fractions of the county’s residents who are aged over 25 and have a college degree; live in a rural area; are white; are aged under 21; are aged over 65; reside in owner-occupied residences; or live in single-mother households. The necessary data were obtained from the National Historical Geographic Information System (NHGIS.org) and for off-census years I linearly interpolate the relevant numerator and denominator and then divide the two to obtain each of these percentage measures, giving me an average growth rate of each variable over the course of a decade.
This approach is standard in the literature and is used in Ljungqvist and Smolyansky (2016).

5.1 Sample Construction: Treatment and Controls

The sample consists of all 1,178 contiguous county pairs with the treatment group including the counties that are located along the border of a state that experience a tax change. The neighboring counties that lie on the other side of the border in a neighboring state that has not changed its corporate income tax rate serve as the control group. My model accommodates “repeated treatments” meaning a county can experience a sequence of tax changes over its time in the panel. Further, a county experiencing a tax shock can serve as a control later while the neighboring county, which initially served as the control, can be part of the treatment group in later years when it experiences a tax change.

Second a border county may adjoin multiple contiguous counties in the neighboring state meaning a county can be part of multiple pairs depending on the number of counties it shares the borders with. In these cases, the regression specification observations for a border county may be duplicated if it belongs to more than one pair.

Finally, I estimate equations 8 and 9 with a sample that includes only years in which one of the counties in a contiguous border-county pair experiences a tax change. Years without a tax change in a contiguous county pair are excluded from the estimation sample since I want to focus on the comparison part and years without a tax change in a contiguous county pair do not provide a treatment group.

Table 3 provides descriptive statistics of my dependent variable for the contiguous border county pair sample separated by treated and control counties. Employment levels differ significantly across industries but virtually identical for the treated and control border counties within the same industry.
6 Main Findings

6.1 Service Producing Industries

Within the service sector, increase in corporate tax results in decrease in employment, yet this effect is not economically significant. The tax cuts, however, produces no change in employment rate. One explanation of this—taxes having no or little effect on employment—could be that the service sector is already employing the optimum level of human capital. And any savings or costs, resulting from increase or decrease in taxes, only affects the future capital-intensive investments and not the labor market.

But each industry within the service industry generates different results, solidifying the hypothesis that effect of taxation does not depend on the deterministic law of economics but due to specificity, structure of each industry.

With contribution of about 13% of GDP, Real Estate, rental and leasing sector is the largest service producing industry in the United States. It is a significant contributor to the U.S economy, employing over million people and generating billions of dollars of economic output each year. The results in this sector reveal that the employment effect is driven entirely by tax increases. The effect of a tax increase is significant both statistically (at the 5% level) and economically; with an increase in the corporate tax rate by 1% point reducing employment by 2.1% when it is scaled by county population. However, tax cuts, even in this largest service industry do not statistically affect employment.

In the healthcare and social assistance sector, the tax cuts lead to significant increase in employment; reducing the corporate tax rate by 1% increases employment by 1.5% in a treated county. The effect is significant, both statistically (at the 10% level) and economically. However, tax increases do not affect employment rate.

The Professional, Scientific and Technical Services sector is another important sector within the service producing industries providing skilled jobs and stimulus for new investment. The sector includes legal, accounting, architecture, engineering and associated services and accounts for 7.2% of GDP in 2015. The coefficient estimates show that changes in cor-
porate income taxes affect employment negatively, controlling both for observed changes in county demographics and for unobserved variation in local economic conditions. Economically, a 1% decrease in corporate tax rate increases employment by 2.5% (at the 5% level). In contrast a 1% increase in corporate tax rate reduces employment, but, while this effect is statistically significant, it is not economically significant with a point estimate of only 0.0095.

Employment within the Retail and Information Sector, reduces with tax increases. The changes in employment within both sectors are economically small, yet statistically significant. However, corporate tax cuts do not lead to increase in employment.

Employment in Finance, Insurance and within Wholesale Trade sector do not change due to changes in corporate tax, either statistically or economically.

6.2 Goods Producing Industries

Contrary to the finding within the service industry, corporate tax increase and decrease affects employment in the good producing industry. The effect is significant both statistically and economically: Increasing (decreasing) the state’s corporate tax rate by 1% point reduces (increases) employment by 1.8% (1.7%) in a treated county.

The goods producing industries consists of industries from the following sectors: agriculture, forestry, fishing, hunting, mining, construction; and manufacturing. In this research, I focus on the impact of corporate taxation on employment changes within manufacturing and construction sectors only, as they are the two largest sectors in the goods producing industry.

In the manufacturing sector, a corporate tax increase of 1% leads to a decrease in employment by about 1.28% while a corporate tax cut of 1% leads to an increase in employment by about 1.65%. The coefficients for both tax increases and tax cuts are statistically and economically significant. The competitive nature of the manufacturing industry is evident in the response of employment to tax changes. Firms that sell output in a competitive market have little control over prices, and firms that hire from a competitive labor market must pay
the market wage to attract new workers. Competitive firms thus reacts to cuts in corporate
taxes by increasing production, investing more and hiring more workers as suggested by my
results.

With construction sector, tax cuts do not produce any change in the employment rate.
However, any tax increase significantly reduces employment within this industry: 1% in-
crease in corporate tax rate leads to a 3.45% decrease in private employment. This result is
statistically and economically significant. Such a significant change highlights the volatility
of employment within the construction sector.

6.3 Robustness
My baseline employment measure scales the number of jobs by total county population.
Ljungqvist and Smolyansky (2016) suggested that the effect of tax increases on employment
could potentially be driven by an increase in the birth rate or in the number of retirees
moving to a treated county. To investigate this possibility I scale employment by a measure
of the size of the workforce by using the number of county residents aged between 20 to 75
as a proxy for the size of the workforce. The results remain consistent for all the sectors
with the point estimates be nearly identical.

Another potential concern is the presence of some counties which are quite large relative
to the whole state. These counties may influence state policy so I try to address this concern
by estimating the effects on employment in a subset of border counties that account for less
than 10% of a state’s population. Table 7 presents this further robustness check addressing
this concern for the Goods industry and the Service industry as a whole. The point estimates
are virtually identical to the baseline results. The results for all the other individual sectors
are not reported in the tables.
7 Conclusion and Caveats

Every debate about corporate taxation assumes that changes in corporate taxes will have uniform effect across the aggregate economy. By bifurcating the economy into service sector and goods producing sector, I observe the effect of changes in corporate taxes at the industry level.

To analyze the impact of corporate taxes on employment is empirically challenging. I use an identification strategy that investigates how changes in the top corporate tax rate at the state level impacts industry employment at the county level by focusing on county pairs across state borders. This spatial discontinuity design helps to establish a causal interpretation of the results by establishing a more credible counterfactual.

Within the service sector, I find that an increase in corporate tax rate results in decrease in employment. This result remains consistent in Real Estate, Rental and Leasing, and Professional, Scientific and Technical Services industry. Corporate tax cuts, however does not affect employment within the service sector apart from the Health Care and Professional, Scientific and Technical Services industry.

Within the Goods Producing Sector, relative to the Service sector, the overall effect of changes in corporate taxes are much more significant and responsive. An increase in corporate tax rate leads to decrease in employment, and a decrease in the rate leads to an increase in employment across the whole sector. But within the sector, we find two different employment effects between manufacturing and construction industry. The manufacturing industry is affected by both tax increase and cuts. However, employment within construction industry is only affected by tax increases.

We find that each industry reacts differently to changes in corporate taxation. Yet, much of the political debate hinges on ‘good for the economy’ and ‘bad for the economy’ slogans. These results highlight the importance of looking at micro-level data before making policies. This result provides policymakers and scholars an opportunity to devise industry specific tax policy thus giving them more freedom and choice when it comes to the task of taxation.

While interpreting these results it is also important to keep in mind of some limitations.
of this research with the most important drawback being that county level data on other economic quantities such as investment are not available. Another question not fully answered by my result is how employment might react if the federal government changes corporate income tax rates. Understanding this would require a structural model for the macro economy. Due to federal corporate tax changes there might be a change in the monetary policy which will lead to changes in interest rates, expected inflation, and exchange rate. All these have to be taken into consideration when building the macro model. Developing such a model is an important task for future work.
References


The table above reports summary statistics of the 83 changes in state corporate income tax rates that occurred over the period from 1989 to 2012. The data come from the information listed in Appendices A and B of Heider and Ljungqvist (2015). Throughout the analysis, the paper focuses on changes in the top statutory marginal tax rate.

<table>
<thead>
<tr>
<th></th>
<th>Tax increases</th>
<th>Tax cuts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean tax change</td>
<td>1.53%</td>
<td>-0.61%</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>1.07%</td>
<td>0.87%</td>
</tr>
<tr>
<td>Minimum tax change</td>
<td>0.25%</td>
<td>-0.032%</td>
</tr>
<tr>
<td>Median tax change</td>
<td>1.28%</td>
<td>-0.40%</td>
</tr>
<tr>
<td>Maximum tax change</td>
<td>4.95%</td>
<td>-5.5%</td>
</tr>
<tr>
<td>Number of tax changes</td>
<td>27</td>
<td>56</td>
</tr>
</tbody>
</table>
Table 3: Summary Statistics

The table reports descriptive statistics of my dependent variable for the contiguous border county pair sample separated by treated and control counties, measured the year before a tax change. Employment levels differ significantly across industries but virtually identical for the treated and control border counties within the same industry providing some support for the identification strategy.

<table>
<thead>
<tr>
<th>Contiguous Border County-Pair Sample</th>
<th>Treated States</th>
<th>Control States</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>s.d</td>
</tr>
</tbody>
</table>

**Goods Producing Industries**
- Overall private employment: 7,468.7 (s.d 272), 8151.2 (s.d 303.3)
- Wage employment/county population: 8.52% (s.d 0.099%), 8.26% (s.d 0.065%)

**Service Producing Industries**
- Overall private employment: 27,666.7 (s.d 2,021.4), 25,912.8 (s.d 1,219.2)
- Wage employment/county population: 18.56% (s.d 0.19%), 18.46% (s.d 0.16%)

**Real Estate and Rental and Leasing (13.1% of GDP)**
- Overall private employment: 538 (s.d 66.5), 564.3 (s.d 30.3)
- Wage employment/county population: 0.30% (s.d 0.008%), 0.30% (s.d 0.007%)

**Finance and Insurance (7.2% of GDP)**
- Overall private employment: 2,840.2 (s.d 373), 1,680.8 (s.d 88)
- Wage employment/county population: 1.04% (s.d 0.027%), 0.93% (s.d 0.014%)

**Health Care and Social Assistance (7.2% of GDP)**
- Overall private employment: 5,890 (s.d 542), 5,484.3 (s.d 253.6)
- Wage employment/county population: 3.34% (s.d 0.032%), 3.08% (s.d 0.031%)

**Professional, Scientific and Technical Services (7.2% of GDP)**
- Overall private employment: 2,874.2 (s.d 359.4), 2,368.9 (s.d 186.0)
- Wage employment/county population: 0.87% (s.d 0.023%), 0.85% (s.d 0.023%)

**Wholesale Trade (6.1% of GDP)**
- Overall private employment: 1,944.8 (s.d 157.5), 1,917.2 (s.d 112.8)
- Wage employment/county population: 1.21% (s.d 0.022%), 1.16% (s.d 0.022%)

**Retail Trade (5.9% of GDP)**
- Overall private employment: 4,722 (s.d 214.4), 5,049.2 (s.d 201.8)
- Wage employment/county population: 4.23% (s.d 0.032%), 4.20% (s.d 0.032%)

**Information (4.7% of GDP)**
- Overall private employment: 1,424.1 (s.d 179.5), 1,039.5 (s.d 62.2)
- Wage employment/county population: 0.55% (s.d 0.041%), 0.54% (s.d 0.041%)

**Manufacturing (12% of GDP)**
- Overall private employment: 5,848.7 (s.d 220.6), 6,194 (s.d 242)
- Wage employment/county population: 5.92% (s.d 0.094%), 5.90% (s.d 0.088%)

**Construction (4.1% of GDP)**
- Overall private employment: 1,671.4 (s.d 84.7), 2,133 (s.d 104)
- Wage employment/county population: 1.66% (s.d 0.022%), 1.56% (s.d 0.018%)
Table 4: Corporate Tax Effects On Employment in the Service Producing Industries

I estimate the effect of corporate income taxes on employment in a difference-in-difference specification that regresses log changes in county employment on changes in the state’s top marginal corporate income tax rate. My baseline employment measure is the total number of wage and salary jobs (full-time and part-time) in a county scaled by total county population. Treated counties are those that are located along the border of a state that changes its corporate income tax rate. Control counties are the neighboring counties that lie on the other side of the border in a neighboring state that has not changed its corporate income tax rate. Each regression includes a border-county-pair/year fixed effects common to neighboring counties on both sides of the border, thus removing the influence of time-varying shocks to local economic conditions. All specifications include changes in county-level demographic controls as detailed in the text (to conserve space, their coefficients are not reported). Standard errors clustered at the state level are shown underneath the coefficient estimates in parentheses.

<table>
<thead>
<tr>
<th>Dependent variable: Change in log Employment</th>
<th>Real Estate, Rental &amp; Leasing</th>
<th>Finance &amp; Insurance</th>
<th>Health Care &amp; Social Assistance</th>
<th>Professional, Scientific &amp; Technical Services</th>
<th>Wholesale Trade</th>
<th>Retail Trade</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in Tax Rate</td>
<td>-0.0104</td>
<td>-0.0034</td>
<td>0.0076**</td>
<td>-0.0400***</td>
<td>-0.0059</td>
<td>-0.0073***</td>
<td>-0.0063*</td>
</tr>
<tr>
<td></td>
<td>(0.0058)</td>
<td>(0.0025)</td>
<td>(0.0028)</td>
<td>(0.0035)</td>
<td>(0.0031)</td>
<td>(0.0041)</td>
<td>(0.0029)</td>
</tr>
<tr>
<td>Magnitude of Tax Increase</td>
<td>-0.0322**</td>
<td>-0.0034</td>
<td>0.0042</td>
<td>-0.0050*</td>
<td>-0.0063</td>
<td>-0.0091***</td>
<td>-0.0088*</td>
</tr>
<tr>
<td></td>
<td>(0.0075)</td>
<td>(0.0031)</td>
<td>(0.0037)</td>
<td>(0.0046)</td>
<td>(0.0041)</td>
<td>(0.0088)</td>
<td>(0.0048)</td>
</tr>
<tr>
<td>Magnitude of Tax Cut</td>
<td>0.0324</td>
<td>0.000043</td>
<td>0.0152*</td>
<td>0.0256**</td>
<td>0.0051</td>
<td>0.0028</td>
<td>0.0002</td>
</tr>
<tr>
<td></td>
<td>(0.0057)</td>
<td>(0.0062)</td>
<td>(0.0062)</td>
<td>(0.0062)</td>
<td>(0.0068)</td>
<td>(0.0031)</td>
<td>(0.0069)</td>
</tr>
<tr>
<td>Demographic Controls</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Border-County-Pair/Year Fixed Effects</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Observations</td>
<td>3,845</td>
<td>4,739</td>
<td>3,413</td>
<td>3,796</td>
<td>4,212</td>
<td>5,790</td>
<td>4,410</td>
</tr>
</tbody>
</table>

Note: *p<0.1; **p<0.05; ***p<0.01
I estimate the effect of corporate income taxes on employment using a difference-in-difference set up that regresses log changes in county employment on changes in the state’s top marginal corporate income tax rate. My baseline employment measure is the total number of wage and salary jobs (full-time and part-time) in a county scaled by total county population. Treated counties are those that are located along the border of a state that changes its corporate income tax rate. Control counties are the neighboring counties that lie on the other side of the border in a neighboring state that has not changed its corporate income tax rate. Each regression includes a border-county-pair/year fixed effects common to neighboring counties on both sides of the border, thus removing the influence of time-varying shocks to local economic conditions. All specifications include changes in county-level demographic controls as detailed in the text (to conserve space, their coefficients are not reported). Standard errors clustered at the state level are shown underneath the coefficient estimates in parentheses.

<table>
<thead>
<tr>
<th></th>
<th>Manufacturing (12% of GDP)</th>
<th>Construction (4.1% of GDP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in Tax Rate</td>
<td>−0.0138*** (0.0021)</td>
<td>−0.0275*** (0.0036)</td>
</tr>
<tr>
<td>Magnitude of Tax Increase</td>
<td>−0.0128*** (0.0027)</td>
<td>−0.0345*** (0.0046)</td>
</tr>
<tr>
<td>Magnitude of Tax Cut</td>
<td>0.0165** (0.0050)</td>
<td>0.0089 (0.0085)</td>
</tr>
<tr>
<td>Demographic Controls</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Border-County-Pair/Year Fixed Effects</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Observations</td>
<td>5,126</td>
<td>4,951</td>
</tr>
</tbody>
</table>

*Note:* *p<0.1; **p<0.05; ***p<0.01
Table 6: Corporate Tax Effects On Industry Employment

I estimate the effect of corporate income taxes on employment in a difference-in-difference specification that regresses log changes in county employment on changes in the state’s top marginal corporate income tax rate. My baseline employment measure is the total number of wage and salary jobs (full-time and part-time) in a county scaled by total county population. Treated counties are those that are located along the border of a state that changes its corporate income tax rate. Control counties are the neighboring counties that lie on the other side of the border in a neighboring state that has not changed its corporate income tax rate. Each regression includes a border-county-pair/year fixed effects common to neighboring counties on both sides of the border, thus removing the influence of time-varying shocks to local economic conditions. All specifications include changes in county-level demographic controls as detailed in the text (to conserve space, their coefficients are not reported). Standard errors clustered at the state level are shown underneath the coefficient estimates in parentheses.

<table>
<thead>
<tr>
<th>Dependent variable: Change in log Employment</th>
<th>Service Producing Industries (1)</th>
<th>Goods Producing Industries (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in Tax Rate</td>
<td>−0.0030**</td>
<td>−0.0181***</td>
</tr>
<tr>
<td></td>
<td>(0.0011)</td>
<td>(0.0021)</td>
</tr>
<tr>
<td>Magnitude of Tax Increase</td>
<td>−0.0049***</td>
<td>−0.0185***</td>
</tr>
<tr>
<td></td>
<td>(0.0014)</td>
<td>(0.0027)</td>
</tr>
<tr>
<td>Magnitude of Tax Cut</td>
<td>0.0016</td>
<td>0.0171***</td>
</tr>
<tr>
<td></td>
<td>(0.0025)</td>
<td>(0.0048)</td>
</tr>
<tr>
<td>Demographic Controls</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Border-County-Pair/Year Fixed Effects</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Observations</td>
<td>5,792</td>
<td>5,804</td>
</tr>
</tbody>
</table>

Note: *p<0.1; **p<0.05; ***p<0.01
Table 7: Robustness

For robustness check, I scale employment by a measure of the size of the workforce by using the number of county residents aged between 20 to 75 as a proxy for the size of the workforce. Another potential concern is the presence of some counties which are quite large relative to the whole state. These counties may influence state policy so I try to address this concern by estimating the effects on employment in a subset of border counties that account for less than 10% of a state’s population. Each regression includes a border-county-pair/year fixed effects common to neighboring counties on both sides of the border, thus removing the influence of time-varying shocks to local economic conditions. All specifications include changes in county-level demographic controls as detailed in the text (to conserve space, their coefficients are not reported). Standard errors clustered at the state level are shown underneath the coefficient estimates in parentheses.

<table>
<thead>
<tr>
<th></th>
<th>Service Producing Industry (1)</th>
<th>Goods Producing Industry (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in Tax Rate</td>
<td>$-0.0033^{**}$</td>
<td>$-0.0188^{***}$</td>
</tr>
<tr>
<td></td>
<td>(0.0012)</td>
<td>(0.0022)</td>
</tr>
<tr>
<td>Magnitude of Tax Increase</td>
<td>$-0.0054^{***}$</td>
<td>$-0.0193^{***}$</td>
</tr>
<tr>
<td></td>
<td>(0.0015)</td>
<td>(0.0028)</td>
</tr>
<tr>
<td>Magnitude of Tax Cut</td>
<td>0.0022</td>
<td>0.0176^{***}</td>
</tr>
<tr>
<td></td>
<td>(0.0027)</td>
<td>(0.0051)</td>
</tr>
<tr>
<td>Demographic Controls</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td></td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Border-County-Pair/Year Fixed Effects</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Observations</td>
<td>5,483</td>
<td>5,511</td>
</tr>
</tbody>
</table>

Note: *p<0.1; **p<0.05; ***p<0.01