State Taxation and the Reallocation of Business Activity: Evidence from Establishment-Level Data

Xavier Giroud

Columbia University, National Bureau of Economic Research, and Centre for Economic Policy Research

Joshua Rauh

Stanford University, Hoover Institution, Stanford Institute for Economic Policy Research, and National Bureau of Economic Research

Using census microdata on multistate firms and their organizational forms, we estimate the impact of state taxes on business activity. For C corporations, employment and the number of establishments have short-run corporate tax elasticities of −0.4 to −0.5 and do not vary with changes in personal tax rates. Pass-through entity activities show tax elasticities of −0.2 to −0.4 with respect to personal tax rates and are invariant with respect to corporate tax rates. Capital shows similar patterns. Reallocation of productive resources to other states drives around half the effect. The responses are strongest for firms in tradable and footloose industries.

The impact of state business taxation on employment and capital has been heavily debated in both academic and policy circles on both theoretical and empirical grounds. The public finance literature has long recognized that business taxation affects marginal incentives through effec-

We are grateful to Erik Hurst (the editor), four anonymous referees, Jeffrey Brown, Steve Davis, William Gale, Austan Goolsbee, Jim Hines, Charles McLure, David Merriman, Holger Mueller, Mitchell Petersen, James Poterba, Juan-Carlos Suarez Serrato, Amit Seru, Danny

Electronically published April 9, 2019
[*Journal of Political Economy*, 2019, vol. 127, no. 3]
© 2019 by The University of Chicago. All rights reserved. 0022-3808/2019/12703-0007$10.00

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

tive marginal tax rates and the cost of capital (Hall and Jorgenson 1967; Fullerton 1984). More recent literature shows that taxation can have a strengthened impact on the discrete choice of business location through the impact of average tax rates and overall profitability, particularly in the presence of economic rents (Devereux and Griffith 2003; Auerbach 2006). On the other hand, increased business taxation might not have a large effect on the level of hiring and investment if businesses can change their activities to use more tax-favored production strategies or organizational forms or if tax revenues are spent on public goods that improve the state's business climate.[1]

An empirical literature starting with Carlton (1979, 1983) and Bartik (1985), and surveyed in Bartik (1991), has studied the geographic location decisions of new firms or establishments as a function of state tax and other characteristics.[2] Studies beginning with Helms (1985) and Wasylenko and McGuire (1985), and more recently Gale, Krupkin, and Rueben (2015) and Suarez Serrato and Zidar (2016), have used aggregated panel data at the state, county, or industry level to examine the effect of state and local taxes on economic growth, employment, or capital formation.[3] And a rich literature has modeled the tax implications of firms' choices of whether to enter foreign markets, notably Devereux and Griffith (1998,

Yagan, Owen Zidar, and Eric Zwick for helpful discussions and comments, and to seminar participants at Chicago, Stanford, Massachusetts Institute of Technology, Columbia, Wharton, New York University, Yale, University of California Los Angeles, London Business School, London School of Economics, Utah, Toronto, Tilburg, Erasmus, Bocconi, Lausanne, Luxemburg, the London Business School Causality Conference, the NBER Public Economics meetings (fall 2015), the NBER Corporate Economics meetings (fall 2015), the 2015 National Tax Association meetings, the 2016 American Economic Association meetings, the 2016 Texas Finance Festival, the 2016 Minnesota Corporate Finance Conference, and the 2016 Barcelona Graduate School of Economics Summer Forum. We thank David Colino, Bryan Chang, and Young Soo Jang for research assistance. Any opinions and conclusions expressed herein are those of the authors and do not necessarily represent the views of the US Census Bureau. All results have been reviewed to ensure that no confidential information is disclosed. Data sources and coding information are provided as supplementary material online.

[1] For example, Fajgelbaum et al. (2019) estimate firm and worker mobility and preferences for public services jointly in a spatial model.

[2] Other papers taking various approaches to measuring the effect of tax policy on the location of new plants or firms include Coughlin, Terza, and Arromdee (1991), Papke (1991), Wasylenko (1991), Hines (1996), Guimaraes, Figueiredo, and Woodward (2003, 2004), Gabe and Bell (2004), Rathelot and Sillard (2008), and Brüllhart, Jametti, and Schmidheiny (2012).

[3] Earlier papers focusing on one municipal or geographic area include Grieson et al. (1977) and Grieson (1980) on the New York City and Philadelphia income taxes, respectively. Fox (1981) examines Cuyahoga County, Ohio, and Newman (1983) focuses on the South. Papers following on the panel approach of Helms (1985) using aggregated panel data include Papke (1987), Mofidi and Stone (1990), Goolsbee and Maydew (2000), Bania, Gray, and Stone (2007), Reed (2008), Gale et al. (2015), and Suarez Serrato and Zidar (2016). Moretti and Wilson (2017) use patent office data on the location of investors to show that changes in state personal and corporate taxation have an effect on the geographical location of innovative activity.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

2003); see also Grubert and Mutti (2000), Devereux, Griffith, and Simpson (2007), Devereux, Lockwood, and Redoano (2008), and Duranton, Gobillon, and Overman (2011).

This line of work has faced two main challenges. First, tax policy is not exogenously determined, so that ascribing a causal interpretation to correlations between state tax changes and counts of businesses or employees has been problematic. The primary concern is that state governments might change tax policy in anticipation of changing economic conditions. In one approach to address this issue, Fox (1986), Holmes (1998), Holcombe and Lacombe (2004), and Ljungqvist and Smolyansky (2016) use county-level data to study how state taxation affects business activity in border counties between states that change policies and those that do not. The second challenge is that the studies have lacked comprehensive microdata at the establishment level, so that the decisions of individual businesses cannot be tracked over time, leaving uncertainty as to whether firms are relocating their businesses to other regions or reducing the scale of their operations.

This study uses comprehensive and disaggregated establishment-level data from the US Census Bureau to examine the impact of state business taxation on employment and capital. We focus on firms with establishments in multiple states, which must set their organizational form at the federal level to be applicable to all establishments. To measure an effect of state tax policy on business activity, we begin by exploiting the fact that the corporate tax code directly affects only firms organized as subchapter C corporations, whereas firms organized as S corporations, partnerships, or sole proprietorships (so-called pass-through entities) are directly affected only by the individual tax code and other business taxes.[4] Our approach is therefore closely related to that of Yagan (2015), who investigates the impact of dividend taxes using the distinction between S corporations and C corporations.[5]

Our study is unique in that we use fully disaggregated data at the firm and establishment levels and distinguish between firms of different organizational form for tax purposes. This setting allows for separate measurement of the effects of the corporate tax code on the activities of C cor-

[4] Cooper et al. (2015) document that pass-through entities currently generate more than half of US business income, having risen from much lower levels in the 1980s. Goolsbee (2004) examines how firms adjust their organizational form with respect to state taxes at the corporate level, an adjustment margin that we also consider in our data. Since our sample firms all operate in multiple states, however, it is not surprising that we observe quite little leakage out of the corporate sector for these firms as a result of state-level tax policy.

[5] Yagan (2015) uses the distinction between C corporations and S corporations to test whether the 2003 dividend tax cut affected corporate investment, as only C corporations are subject to the double taxation created by the taxes on capital income.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

porations and of the effects of the personal tax code on the activities of pass-through entities, as well as tests for cross-effects. Furthermore, the establishment-level microdata allow us to disentangle reallocation versus pure economic disincentives of taxation.

Our primary sample consists of all US establishments from 1977–2011 belonging to firms with at least 100 employees and having operations in at least two states. On the extensive margin, we find that a 1 percentage point increase (decrease) in the state corporate tax rate leads to the closing (opening) of 0.04 establishments belonging to firms organized as C corporations in the state. This corresponds to an average change in the number of establishments per C corporation of 0.5 percent. A similar analysis shows that a 1 percentage point change in the state personal tax rate affects the number of establishments in the state per pass-through entity by 0.4 percent. The cross-correlations between pass-through activity and corporate tax rates, and between corporate activity and personal tax rates, are zero.

On the intensive margin of number of employees per establishment, we find very similar results. Furthermore, we find that the marginal effective tax rate (in the sense of Fullerton [1984]) has a larger point estimate effect than the statutory rate on the intensive margin, consistent with the predictions of Devereux and Griffith (1998, 2003).[6] Focusing on manufacturing firms, we find that capital shows directional patterns similar to labor in its response to taxation. The point estimates of the elasticities are 31–35 percent smaller for capital, although the standard errors are not large enough to reject the null hypothesis that the magnitude is the same as the effect on labor.

Opposite effects of around half of these magnitudes are observed in response to tax changes in the other states in which firms operate, so that around half of the baseline effect is offset by reallocation of activity across states. This lends strong support to the view that tax competition across states is economically relevant and is consistent with findings by Davis and Haltiwanger (1992) that emphasize the importance in the labor market of shifts in the distribution of employment opportunities across work sites. The remaining changes in establishments and employment reflect either forgone economic activity or moving abroad.

Further analysis captures complexities, heterogeneity, and changes in state tax codes regarding apportionment of income in multistate firms. If a company has a physical presence in more than one state, the company must apportion its profits according to each state's apportionment fac-

[6] The marginal effective tax rate captures differences in the impact of the statutory rate on the firm's marginal tax burden due to differences in the present value of depreciation allowances and investment tax credits.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

tor weights for property, payroll, and sales.[7] We show that the response of moving establishments, employees, and capital is greatest when the physical location of a firm's employees and property carries a larger weight in assigning the tax burden to a given state. Even when the location of sales carries a larger weight, however, we find strong effects when rules are in effect that mitigate the tax attractiveness of firms moving to high sales apportionment states (so-called throwback and throwout rules).

We further address endogeneity concerns by adopting a narrative approach in the spirit of Romer and Romer (2010), focusing on the 161 tax changes in the sample of more than 100 basis points. For changes that were passed to deal with an inherited budget deficit or to achieve a long-run goal—changes less likely to be correlated with confounding factors that can affect output and economic activity—we find magnitudes very similar to those in the full sample of establishments affected by these large cuts. Around half of the effects are felt in the tax year in which the tax rate changed, with the full force being felt in the following year. We further augment the narrative approach by looking separately at tax changes at the state level that occurred in response to windfalls and shocks from the federal tax reform acts of 1981 and 1986, finding effects of magnitude similar to those of the other large increases and cuts in the corporate and personal tax rates.

Overall, our findings on the effects of corporate taxation are larger than those found in work that has examined the impact of tax policy at the national level, such as Mertens and Ravn (2014), which finds using narrative approaches that a 1 percentage point cut in the average corporate income tax rate at the federal level raises employment by a maximum of 0.3 percent. Tax competition across states roughly doubles the baseline effects that would be found in the absence of firms' ability to move across states.

Our elasticities are significantly smaller than those of Suarez Serrato and Zidar (2016), who use a 10-year establishment elasticity of 4 estimated in reduced-form aggregated panel data to calibrate their incidence model. We demonstrate that these differences are due in part to the time horizon (we find elasticities of 1.2 using our identification strategy over 10 years), but in greater part due to the fact that our identification strategy allows us to control for state-level economic variation that may be correlated with but not caused by tax changes. When we remove fixed effects that control for composition effects and nontax reasons a given firm may choose to be active in a given state, our estimates appear much closer to those in Suarez

[7] Strictly speaking, a state might have the right to tax a firm even if the firm does not have a physical presence. That is, physical presence is sufficient, but perhaps not necessary, for what is called "taxable nexus." For example, providing installation or technical support of a product in a state can generate nexus.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

Serrato and Zidar's study. Our results therefore imply that the actual elasticities for existing firms are between those implied by national-level regressions such as those in Mertens and Ravn (2014) and regressions on aggregated state-level data such as those in Suarez Serrato and Zidar (2016).

This paper is organized as follows. Section I reviews the background and related literature on business taxation at the state level. Section II discusses the data and methodology, specifically the establishment-level data from the US Census Bureau, our compilation of changes in state tax codes, the specifications, and the implementation of the robustness checks using the narrative approach and the changes in state tax policy induced by federal legislation. Section III details the main results on the extensive and intensive margins. Section IV provides evidence on heterogeneous treatment effects and general equilibrium. Section V presents conclusions.

I. Background, Literature, and Conceptual Framework

A. *Business Taxation at the State Level*

In many respects, the structure of state business taxation, and especially the definition of income, follows the general outlines of federal tax law. The decision of a firm to incorporate allows for limited liability and centralized management but opens the possibility of entity-level taxation under the corporate tax code at the federal level (Congressional Budget Office 2012). Firms that are incorporated under subchapter C of the federal tax code (C corporations) must pay tax at corporation tax rates. Owners of these firms then pay individual taxes when they receive dividends from the C corporations or when they realize capital gains. Firms that are incorporated under subchapter S of the federal tax code, as well as unincorporated firms organized as partnerships and sole proprietorships, are deemed pass-through entities. Pass-through entities pay no tax at the firm level, but rather pass all profits on to their owners, who must pay taxes immediately on their profits. Firms can also organize as limited liability corporations (LLCs), a structure that offers some of the benefits of corporate organization, such as full liability protection, without necessarily being subject to entity-level taxation under the federal corporate tax code.[8]

Most states have a standard corporate income tax on profits that resembles the federal corporate income tax: taxable income is calculated

[8] There are differences in the incentives that different types of firms face in choosing these different forms of organization. For example, small business owners with losses have a stronger incentive to choose pass-through taxation than corporate taxation when such an election is available (Gordon and Cullen 2006). We consider the potential effects of such heterogeneity in the analysis in several ways below.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

starting with revenues net of allowable cost deductions, and then a corporate tax rate is applied to the state's apportioned share of taxable income.[9] However, as of the end of the sample, three states had no corporate income tax: Nevada, South Dakota, and Wyoming.[10] Texas had no corporate income tax until 1991. Four states taxed corporations in some other way, usually a tax on gross receipts. Starting in 2005, Ohio began to phase out its corporate franchise tax and phased in a Commercial Activities Tax, which applies a rate of 0.26 percent to taxable receipts of over $1 million. Michigan had a Single Business Tax based on a value-added calculation from 1975 onward. In 2008 it then began the phase-in of the Michigan Business Tax, which had a base of gross receipts less purchases, and then finally implemented a regular corporate income tax in 2012. Washington has the Business and Occupation Tax, a gross-receipts tax, during the entire sample period. Texas implemented a Corporate Franchise Tax in 1992, which was then replaced by the Texas Margin Tax in 2008.

Further complicating the analysis of the effects of tax policy on corporate activity are the laws that differ by state as to how taxable income must be apportioned for multistate firms for tax purposes. In contrast to the federal tax treatment of multinational firms, which requires transfer prices for intermediate production inputs moved by the firm across borders, states use apportionment formulas that obviate the need for keeping track of internal prices. In determining state-level tax liabilities, a firm must first determine which states have the power to tax the business or, in tax terminology, whether a company has "nexus" in a state. If a firm has a physical presence in the state, specifically property or employees, then the state clearly has the power to tax. If the firm does not have a physical presence in the state and its activities are limited to "mere solicitation of orders," the state does not have the power to tax the firm.[11] A firm must consider the apportionment formula for each state in which it has nexus.[12]

Apportionment formulas are typically a function of the location of at least one of three different measures of economic activity: sales, payroll, and property. The apportionment formula effectively changes the corporate income tax into a tax on each of the apportionment formula factors (McLure 1980, 1981). Gordon and Wilson (1986) show how appor-

[9] States are not required to follow the federal definition of income in all respects, although most state statutes incorporate the Uniform Division of Income for Tax Purposes Act, a model act intended to create tax uniformity.

[10] Nevada, however, has a payroll tax called the Modified Business Tax. This tax is not included in the analysis.

[11] The Interstate Income Act of 1959, referred to as Public Law 86-272, details conditions under which a firm might lack physical presence in a state but still have nexus in the state.

[12] Some variation exists in the way states tax pass-through entities with nonresident owners. According to Baker Tilly (2014), more than 30 states "require pass-through entities to withhold income tax on behalf of some or all owners—generally nonresidents."

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

tionment approaches can create complex incentives both for multistate firms and for state governments setting tax policy. At the beginning of the sample period, virtually all states used an equally weighted formula, but during the sample period there was a shift toward the use of single-sales apportionment (i.e., a 100 percent weight on sales).

To illustrate by way of example, California had a one-third weight on each of sales, payroll, and property until 1992. A firm with nexus in California would calculate the share of sales, share of payroll, and share of property in California, and the average of these three components would yield the percentage of the firm's taxable income apportioned to California. From 1992 to 2010, the weights in California were 50 percent on sales, 25 percent on payroll, and 25 percent on property.[13] Relative to the pre-1992 regime, firms with more sales in California but less physical presence had to allow more of their income to be taxed in California. Conversely, firms with few in-state sales but more physical presence saw a reduction in their tax burden. These changes went even further in 2011, when California introduced an optional 100 percent weight on sales, and in 2013, when the 100 percent sales weight became mandatory.

Under a pure single-sales apportionment factor, the only variable that matters in apportioning income to the state (assuming the firm has nexus) is what percentage of the firm's sales were in the state itself. However, some states (including California) have so-called throwback rules associated with their apportionment calculations, where states capture income from sales to other states by requiring companies to add (or "throw back") sales that are made to buyers in a state where the company has no nexus, sometimes called "nowhere income." Three states (Maine, New Jersey, and West Virginia) have a "throwout" rule instead of a "throwback" rule, which accomplishes a similar goal, namely, to increase the relative weight of in-state sales in the sales factor, thus increasing the income apportioned to the taxing state. Under throwout rules, states capture the nowhere income by requiring companies to subtract (or "throw out") nowhere sales from total sales, thereby reducing the denominator in the apportionment calculation.

There has been relatively little empirical work studying the impact of apportionment formulas. Using variation in the payroll weight across states and over time, Goolsbee and Maydew (2000) demonstrate that the within-state employment effect of reducing the payroll weight is, on average, substantial and that such a change has a negative effect on employment in other states. Gupta and Mills (2002) find suggestive evidence that firms optimize reported sales locations in response to sales apportionment factors. Klassen and Shackelford (1998) find that manufactur-

[13] This is sometimes referred to as a "double-weighted" sales apportionment factor.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

ing shipments from states that tax throwback sales are decreasing in the corporate income tax rate on sales.

Businesses also pay an array of other taxes, notably sales taxes, unemployment insurance contributions, and property taxes. Furthermore, states often grant targeted tax incentives and financial assistance for specific industries. These taxes are not the primary focus of our paper, but we do include controls for all of these factors in our analysis.

B. Conceptual Framework

The literature has used several different frameworks to model firm location decisions as a function of tax policy. Early literature on the economics of the corporate income tax assessed its incidence and efficiency when the corporate sector produced one set of goods and the noncorporate sector another set of goods (Harberger 1962; Shoven 1976). In these classic settings, the corporate income tax resulted in a redistribution of resources in the economy toward the goods produced by the noncorporate sector and therefore a deadweight loss.[14]

These incidence models are relevant in that they recognize that more mobile factors will escape taxes by flowing into sectors where they are not taxed as heavily. To escape the heaviest tax burden, factors of production may have to be redeployed less efficiently. The original intuition from Harberger (1962) was that, under a set of assumptions, a higher tax burden would drive capital (whose supply is fixed in aggregate) from the taxed into the untaxed sector, and in equilibrium the incidence of the tax would be on the returns to capital in both sectors. Open economy analyses of corporate tax incidence show immobile workers bearing the burden of the tax through lower labor compensation, as capital moves to jurisdictions where it will face lower taxes (McLure 1980, 1981; Kotlikoff and Summers 1987).[15]

The traditional incidence analyses feature a fixed stock of capital and supply of labor making them not particularly suitable to a setting in which firms can invest in new capital and potentially draw on or release surplus labor. Furthermore, their primary goal is to explain the distribution of the burden of the tax. The mobility of labor and capital is better seen as an explanatory factor in their analyses.[16] In contrast, our paper is a study of the effects of taxation on the utilization of labor and capital by firms in different locations.

[14] Gravelle and Kotlikoff (1989) examine efficiency costs of corporate taxation when corporate and noncorporate firms produce the same good, finding logically that such deadweight costs can be substantially higher.

[15] Gravelle (2013) demonstrates the sensitivity of these models' conclusions to modeling inputs such as factor, product, and capital substitution elasticities.

[16] For example, Suarez Serrato and Zidar (2016) use establishment elasticities as an input to their spatial model for calculating incidence.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

Given that our goal is to explain location decisions, a more appropriate conceptual framework for our empirical setting is provided by Devereux and Griffith (1998), based on Horstmann and Markusen (1992). Firms in this model make up to three choices: (1) all choose whether to sell in the domestic market only or to sell in foreign markets as well; (2) those firms that choose to sell in foreign markets then choose whether to export to the foreign market or to set up production in the foreign market (in the case of services, only the latter would be possible); or (3) conditional on producing in the foreign market, the firm can choose to produce in any one of a number of locations.

Devereux and Griffith (2003) build on this model further, highlighting that on the margin of new capital investment, taxes operate through a conventional cost of capital channel. The level of capital investment is therefore influenced by the marginal effective tax rate, defined as the share of the firm's required return on capital that goes to the federal government rather than to investors (Fullerton 1984). Formally, the marginal effective tax rate (ETR) is defined as a function of the statutory tax rate τ, the marginal product of capital $f'(k)$, the rate of economic depreciation of capital (δ), and the after-tax cost of capital ultimately demanded by investors (ρ):

$$\text{ETR} = \frac{f'(k) - \delta - \rho}{f'(k) - \delta}. \tag{1}$$

It is usually assumed (as in Hall and Jorgenson [1967]) that firms set the marginal product of capital equal to the implicit rental value of capital services:

$$f'(k) = \frac{(\rho + \delta)(1 - \text{ITC} - \tau z)}{1 - \tau}, \tag{2}$$

where ITC represents the rate of any investment tax credits, and z represents the present value of depreciation deductions. Gravelle (1994) and Gruber and Rauh (2007) calculate marginal effective tax rates by industry as a function of the specific mix of capital types employed in the production process, the estimated rates of economic depreciation of each type of capital, and the present value of allowable depreciation deductions for each type of capital.

In the Devereux-Griffith model, the net-of-tax incentive for firms to invest in expanding their capital stock for production is a function of the marginal ETR. The average cost, however, affects the choice among production in different locations. As statutory tax rates are likely closer to average rates, Devereux and Griffith (2003) suggest that statutory rates may be appropriate for considering extensive margin effects, and effective tax rates based on the cost of capital may be more appropriate for intensive margin effects.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

The Devereux-Griffith approach therefore implies predictions substantially different from those of the traditional incidence models in terms of the relative responses of capital and labor to taxation. In a framework that is about firms choosing the optimal location of production, the firm moves both capital and labor in response, so that one might expect the responses to tax policy to be of more comparable magnitude to one another if the primary effect reflects business relocation as opposed to differential rates of investment or business expansion.

We note several caveats about the mapping between this theory and our empirical setting. First, in our analysis we describe the "intensive margin" as referring to all changes in labor and capital inputs at a given establishment location. Such changes might reflect changes in new investment, but they also reflect the decision of firms to reallocate business from one location to another. As such, the intensive margin that we examine is a mix of both the business location and marginal investment decisions analyzed in Devereux-Griffith. Second, considering that the value of capital will almost certainly be measured with more error than labor inputs (Becker and Haltiwanger 2006), it is likely that the point estimates of the movement of capital will be biased downward. Third, while the theory predicts that marginal investment decisions depend on marginal ETRs, marginal ETRs depend on equilibrium relationships that govern firms' capital choices. These may be more likely to hold in the long run than in the short run. Furthermore, the construction of ETRs is demanding in terms of assumptions about economic rates of depreciation, the composition of capital used by firms in different industries, and the calculation of depreciation allowances. As such, our main analysis focuses on the effects of statutory rates on economic activity, but we also investigate and find support for the hypothesis that replacing statutory rates with ETRs might improve explanatory power on the intensive margin.

II. Data and Methodology

A. Establishment-Level Data on Firm Business Activity

The establishment-level data are obtained from the US Census Bureau's Longitudinal Business Database (LBD). An establishment is a "single physical location where business is conducted" (Jarmin and Miranda 2003, 15). The LBD covers all business establishments in the United States with at least one paid employee. For each establishment, the LBD includes data on employment, payroll, industry sector, location, and firm identifier.

We supplement the LBD with two other data sets from the US Census Bureau: the Census of Manufactures (CMF) and the Annual Survey of Manufactures (ASM). The CMF covers all US manufacturing establishments, referred to as "plants." The CMF is conducted every 5 years, in years

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

ending with 2 and 7 (the so-called census years). The ASM is conducted in all noncensus years and covers a subset of the plants covered by the CMF: plants with more than 250 employees are included in every ASM year, while plants with fewer employees are randomly selected every 5 years; the probability of being selected is higher for relatively larger plants. Although the ASM is technically referred to as a survey, reporting is mandatory, and fines are levied for misreporting. The CMF and ASM contain detailed plant-level information such as capital expenditures, total assets, and the value of shipments. Accordingly, while the ASM/CMF is less comprehensive than the LBD, it provides a richer set of establishment-level variables.

To create a primary sample for the analysis, we select all multiunit companies in the LBD from 1977–2011 with at least 100 employees and establishments in at least two states. The rationales behind these selection criteria are that we are interested in medium-sized to large firms, and we are interested only in companies that consider multiple states in their location decisions. In this sample, we study the effects of taxation on establishment counts, establishment location, and employment. This primary sample consists of 27.6 million establishment-year observations, corresponding to 647,000 firm-year observations.

A secondary sample consists of those observations in the primary sample that are also in the ASM/CMF. This subsample allows us to study not only the labor allocation decisions of firms but also their capital allocation decisions, as the ASM/CMF data contain information on firm capital stock. We can therefore use this sample to study the effects of taxation on capital investment and location. This secondary sample consists of 854,700 establishment-year observations corresponding to 104,400 firm-year observations.

The LBD can be matched to the Census Bureau's SSEL (Standard Statistical Establishment List), which contains information from the Business Register. In particular, the SSEL provides a tax-based legal form of organization for all firms in the LBD. The identification of the legal form is based on the firm's tax filing status. Firms may be listed as having any one of seven possible legal forms: individual proprietorship, partnership, corporation, taxable cooperative association, tax-exempt cooperative association, government, or other legal form.[17] In this study, we consider only the first three categories (i.e., sole proprietorships, partnerships, and corporations).

Importantly, the SSEL also contains the precise tax filing status of each company. Sole proprietorships and partnerships are always pass-through entities for tax purposes, but firms organized as corporations can be des-

[17] Establishments without payroll are classified into specified legal forms of organization according to the type of income tax form filed (1040C—individual proprietorship; 1065—partnership; 1120 and 1120S—corporation).

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

ignated for tax purposes as C corporations, which are subject to the corporate income tax, or S corporations, which pass through all profits to owners, who then pay individual income tax and other business taxes. Corporations that designate themselves as LLCs can choose to file taxes as a partnership, C corporation, or S corporation. The LBD indicates the precise tax filing status of LLCs.

Figure 1 shows the percentage of companies over time in the sample organized for tax purposes as C corporations and S corporations, as well as partnerships and sole proprietorships. The figure shows the downward trend in C corporations and the upward trend in the pass-through entities over time. This trend began in the early 1980s and accelerated with the passage of the Tax Reform Act of 1986, which made the tax code more favorable to pass-through entities by lowering federal individual tax rates below federal corporate rates. By 2011, 64 percent of firms in our sample of multistate firms were organized for tax purposes as C corporations, 24 percent as S corporations, and the remaining 12 percent as pass-through entities. This composition reflects the fact that multistate businesses are much more likely to be organized as C corporations than businesses operating in one state. According to 2007 statistics from the Congressional Budget Office (2012), 94 percent of businesses in the United

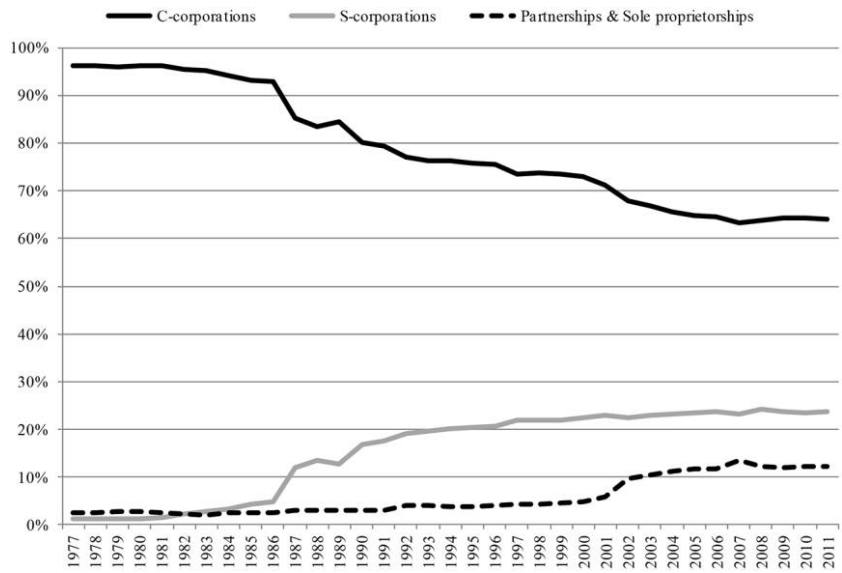

FIG. 1.—Legal forms of organization over time. This figure plots the percentage of companies whose legal form of organization is C corporation, S corporation, and partnership or sole proprietorship. The sample includes all multiunit companies in the Longitudinal Business Database (LBD) with at least 100 employees and establishments in at least two states. The sample period is from 1977 until 2011.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

States are organized as pass-through entities, although they account for only 38 percent of business receipts.

Table 1 shows summary statistics for the sample in the paper at the different levels of observation used in our analysis.[18] Panel A shows the summary statistics at the establishment-year level, covering around 27.6 million observations that will be used in the intensive margin analysis. Panel B shows the summary statistics at the firm-state-year level for the purposes of the extensive margin analysis. There are 4.2 million firm-state-year observations in which firms have a nonzero number of establishments. If we expand the sample to 51 observations per firm-year (50 states plus Washington, DC), filling in the states where a firm has no business activities with zeros, the sample expands to about 33 million firm-state-year observations. Panel C aggregates the sample to the firm-year level, which shows that the sample covers 647,000 firm-year observations, 104,400 of which are in manufacturing.[19]

The average number of employees at an establishment in the LBD data is 50 for C corporations and 36 for pass-through entities, while the median number of employees is approximately 11 in both samples.[20] The average number of establishments a firm has in a state, conditional on the firm being active in that state at all, is 7.06 for C corporations and 3.72 for pass-through entities, while the medians are 1.26 establishments for C corporations and 1.21 establishments for pass-through entities. The higher mean establishment and employee counts for C corporations therefore arise primarily because of the right tail of the distribution of C corporations, the largest of which may have thousands of employees in some establishments and hundreds of establishments in some states.

We also provide summary statistics for the capital stock of the manufacturing firms in the sample. Capital stock is calculated using the perpetual inventory formula, following Lichtenberg (1992). The within-industry variation in the capital stock variable is coming from each establishment's annually reported gross capital expenditures, as the depreciation rates used in the perpetual inventory formula are industry specific.

B. State Tax Codes (1977–2011) and the Development of Explanatory Variables

We compile data on many aspects of business taxation at the state level. We focus on the type of state corporate taxation, corporate tax rates,

[18] The Census Bureau requires us to round observation counts to the nearest hundred.

[19] Note that our sample represents 15 percent of all establishments in the LBD but less than 1 percent of all firms, as our sample selection criteria (multistate firms with at least 100 employees) naturally overweigh firms with more establishments.

[20] Owing to the Census Bureau's disclosure policy, we cannot report median values. Instead, "median" in table 1 refers to a pseudo median that is computed as an average across all observations between the 40th and 60th percentiles.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

TABLE 1
Summary Statistics

	LBD (All Sectors)			ASM/CMF (Manufacturing)		
	All	C-Corp	Pass-Through	All	C-Corp	Pass-Through
	A. Establishment Level					
# employees:						
Mean	49	50	36	311	318	153
Median	11	11	11	142	145	92
Standard deviation	228	235	112	757	772	209
Capital stock ($1997):						
Mean				42,586	43,946	12,850
Median				11,141	11,495	5,886
Standard deviation				170,941	174,555	31,723
Observations	27,600,100	25,271,400	2,328,700	854,700	817,300	37,400
	B. Firm-State Level					
# establishments:						
Mean	6.56	7.06	3.72	1.76	1.79	1.27
Median	1.25	1.26	1.21	1.00	1.00	1.00
Standard deviation	25.67	27.37	11.54	1.94	1.99	.88
# employees:						
Mean	320	352	133	546	569	195
Median	58	61	46	201	210	107
Standard deviation	1550	1,669	411	1,970	2,029	318
Capital stock ($1997):						
Mean				74,765	78,516	16,354
Median				15,805	16,785	6,691
Standard deviation				362,123	373,066	47,513
Observations	4,207,200	3,580,600	626,600	486,800	457,400	29,400
Observations (including zeros)	32,997,200	25,225,300	7,771,900	5,325,600	4,758,400	567,200
	C. Firm Level					
# states:						
Mean	6.50	7.24	4.11	4.66	4.90	2.64
Median	3.37	3.70	2.30	2.28	2.29	2.00
Standard deviation	8.3	9.06	4.31	4.96	5.17	1.44
# establishments:						
Mean	42.66	51.09	15.28	8.18	8.76	3.36
Median	8.04	8.41	6.25	3.36	3.70	2.32
Standard deviation	239.83	269.31	88.43	15.02	15.76	2.67
# employees:						
Mean	2,075	2,547	546	2,547	2,790	516
Median	359	417	252	683	767	295
Standard deviation	11,841	13,480	1,583	9,251	9,756	715
Capital stock ($1997):						
Mean				348,551	384,950	43,204
Median				49,606	57,151	18,885
Standard deviation				1,513,534	1,596,842	112,904
Observations	647,000	494,600	152,400	104,400	93,300	11,100

Note.—In panel A, observations are at the establishment-year level. All refers to all establishments; C-Corp refers to establishments belonging to C corporations; Pass-Through refers to establishments belonging to pass-through entities (S corporations, partnerships, and sole proprietorships). LBD refers to establishments in the Longitudinal Business Database; ASM/CMF refers to establishments in the Annual Survey of Manufactures and the Census of Manufactures. Capital stock is constructed using the perpetual inventory method. In panels B and C, observations are aggregated into the firm-state-year and firm-year level, respectively. Median is the pseudo median, which is computed as the average across all observations between the 40th and 60th percentiles. The sample period is 1977–2011.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

apportionment factors, and throwback rules. We also collect data on sales taxes, unemployment insurance, personal income tax, property taxes, and tax incentives, which we include as control variables.

To characterize each state's corporate tax policy in each year, we obtain the type of state corporate taxation (whether regular corporate income tax, gross receipts tax, no tax, or other) and the corporate tax rates from three main sources: the University of Michigan Tax Database (1977–2002), the Tax Foundation (2000–2011), and the Book of States (primarily the chapter "state finance").[21]

Apportionment factors and throwback rules are obtained from the Commerce Clearing House's State Tax Handbooks. In our baseline analysis, we examine the sensitivity of business activity to the state tax rate τ_C^i. Accordingly, our baseline estimates capture the average effect of state taxation across different apportionment regimes. In further analysis, we explicitly account for apportionment factors and throwback rules. To do this, we interact the state tax rate τ_C^i with a term that reflects the fact that larger sales apportionment factors dull the incentive for the firm to relocate plants and employees. This interaction term is either $1 - \alpha_{\text{sales}}^i$, where α_{sales}^i is the sales apportionment factor, or $1 - \alpha_{\text{sales}}^i(1 - I_{\text{throwback}})$, where $I_{\text{throwback}}$ is an indicator variable for whether the state has a throwback (or throwout) rule. Note that since in practice the property and payroll apportionment factors are always equal during our sample period, such specifications capture the full state-level heterogeneity in apportionment factors. If a state has a 100 percent sales apportionment factor and no throwback, firms would have little incentive to move property or plant across state borders in response to changes in τ_C^i, as the location of firm property and plant would not affect taxes paid, assuming nexus is not changed.[22] Of course, the corporate rate would be expected to matter in this setting even with 100 percent sales apportionment, because firms with high transportation costs and producers of nontradable goods must locate sales and production in the same state. If a throwback rule is in place, then the tax rate would additionally matter to the extent that the firm is selling in states in which it has no nexus (property or employees) or to the federal government.[23] An alternative approach would be to cal-

[21] For the exact locations where we downloaded data, please see the data sources and glossary that are provided as supplementary material online.

[22] A caveat to this is that even if there is a 100 percent sales apportionment formula and no throwback, changes in the rate might give firms the incentive to move in or out of a state entirely. For example, a firm producing solely in Nevada and making sales only in California owes no corporate tax if protected under Public Law 86-272. But once it moves even a small number of employees to California, it has nexus in California and then must pay California income taxes.

[23] Sales to states where a firm has nexus but where no income tax is in place for the relevant form of business may also have to be included under a throwback rule, as the state in question has the right to tax the firm but does not exercise that right (Swain and Hellerstein 2013; Hellerstein, Hellerstein, and Swain 2014).

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

culate apportionment factor adjusted corporate tax rates for each state and firm, although this is possible only for the manufacturing subsample in which we know the values of the firm's capital.

The other tax variables are obtained from a variety of sources. Personal income tax rates, which apply to the pass-through entities, are obtained from the National Bureau of Economic Research database of state-level tax rates. Sales tax rates are obtained from the University of Michigan Tax Database for 1977–2002 and from the Tax Foundation for 2000–2011. Unemployment insurance (UI) provisions are obtained from the Department of Labor's "Significant Provisions of State UI Laws." In our regression analysis, we calculate the UI contribution as the UI base (or the amount of wages that is UI taxable) times the UI rate and estimate specifications with the log of this UI contribution as an explanatory control variable, abstracting away from any additional UI parameters.

As we were unable to obtain data on property tax rates that could be matched with business ownership of property, we instead use the total amount of property taxes collected by state and local governments in the establishment's state divided by total revenues of state and local governments in the establishment's state as a control variable called *property tax share* in the analysis. These data are available from the Census of Government State and Local Finances.

Finally, we also collect and control for 33 targeted business incentives that are compiled annually by the magazine *Site Selection* (formerly *Site Selection and Industrial Development Handbook*). The business incentives are grouped into two categories: 18 different types of financial assistance for industry and 15 different types of tax incentives. Common examples of financial assistance include the existence of a state-sponsored industrial development authority and state or local incentives for establishing industrial plants in areas of high unemployment. Common tax incentives include corporate or personal income tax breaks for new businesses or businesses in certain industries and tax exemptions on various factors of production such as land, capital, equipment, or machinery. For each state-year, we construct a *tax incentives index* that adds one index point for each of the 33 business incentives.[24]

Table 2 shows summary statistics for these tax variables at the state-year level (including the District of Columbia) from 1977–2011. The table shows that the mean corporate tax rate for the state-year observations in the sample is 6.85 percent and the mean personal tax rate is 5.29 percent, with medians slightly higher in each case.

States generally set the payroll and property apportionment factors equal to each other, as reflected by the identical summary statistics on

[24] The *Site Selection* data are not available in all years. To fill in the missing years, we use the latest available year.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

TABLE 2
TAX VARIABLES

	Mean	Standard Deviation	25th Percentile	50th Percentile	75th Percentile
τ_C	6.85	2.95	6.00	7.00	8.90
τ_P	5.29	3.34	3.02	5.82	7.50
Property tax share	.12	.05	.09	.12	.15
UI contribution	699	433	378	585	855
Log(UI contribution)	6.38	.58	5.93	6.37	6.75
Sales tax rate	4.44	1.82	4.00	5.00	6.00
Tax incentives index	21.13	6.42	16.00	23.00	26.00
Payroll apportionment factor	26.82	9.95	25.00	33.33	33.33
Property apportionment factor	26.82	9.95	25.00	33.33	33.33
Sales apportionment factor	46.35	19.88	33.34	33.34	50.00
Throwback rule	.60	.49	.00	1.00	1.00

NOTE.—This table shows summary statistics for the tax variables used in the analysis. τ_C is the top corporate income tax rate (in percent). τ_P is the top personal income tax rate (in percent). Property tax share is the ratio of the total amount of property taxes (collected by the state and local governments) divided by total revenues (of the state and local governments). UI contribution is the top unemployment insurance (UI) rate multiplied by the maximum base wage (in percent). Tax incentives index is an index of tax incentives that adds one index point for each of the 33 tax incentives compiled in the *Site Selection* magazine. Sales tax rate is the sales tax rate in percentage points. Payroll apportionment factor is the apportionment percentage attributed to payroll in percentage points. Property apportionment factor and sales apportionment factor are defined similarly with respect to property and sales, respectively. Throwback is an indicator variable equal to one if the state has a throwback (or a throwout) rule. Summary statistics are computed using all available state-year observations from 1977 to 2011.

these two apportionment factors. At the median the payroll, property, and sales apportionment factors are one-third, reflecting the fact that this was the predominant arrangement at the beginning of the sample period, whereas the mean reflects the fact that there was a shift toward sales apportionment during the sample period. Sixty percent of state-year observations have a throwback rule.

Figure 2 shows the evolution of the distribution of corporate and personal income tax rates over time. Panel A shows that state corporate tax rates generally rose during the 1970s and 1980s and generally fell during the 1990s and early 2000s, with the median corporate rate ticking up in 2011. The distribution of personal income tax rates as shown in panel B behaved differently, becoming more compressed over time. These patterns are further illustrated in figure 3, where increases and decreases in each tax rate are counted by year in histograms. Changes in the personal tax rates were overall more common than changes in the corporate rates, and decreases in personal tax rates during the final decade of the sample were particularly common.

Since our specification compares firms with different legal forms of organization and tax filing statuses, it is important that there is sufficient

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

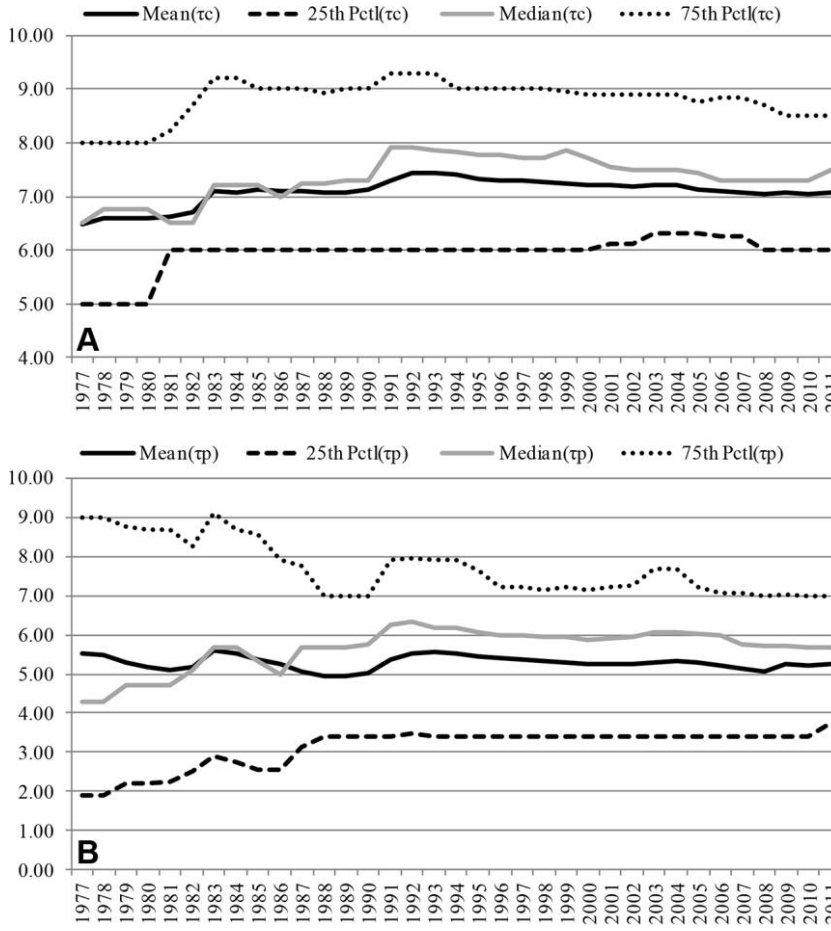

FIG. 2.—Corporate and personal income tax rates over time. This figure plots the evolution of the mean and quartiles of the corporate income tax rate (τ_C, panel A) and personal income tax rate (τ_P, panel B), respectively, across all states from 1977 to 2011.

independent variation in the corporate and personal tax codes. During the sample period, the correlation between the corporate income tax rate and the personal income tax rate is .21, and the correlation in first differences is only .04.

C. *Specifications*

The first set of extensive margin specifications examines the relation between state tax rates and the number of establishments a firm has in each

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

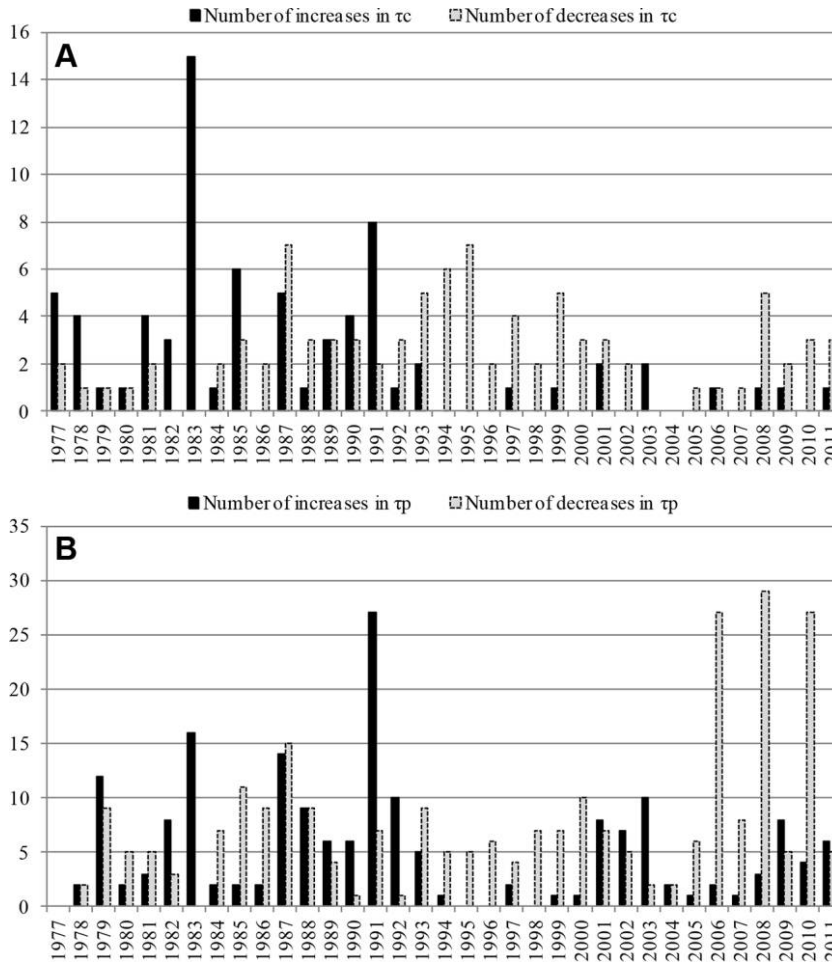

FIG. 3.—Changes in corporate and personal income tax rates over time. This figure plots the number of changes in the corporate income tax rate (τ_C, panel A) and personal income tax rate (τ_P, panel B), respectively, across all states from 1977 to 2011.

state in each year. We estimate these specifications at the firm-state-year level in the sample of 32,997,200 firm-state-year observations, which includes zeros for states that have no observations in a given state in a given year. The dependent variable is the number of establishments firm i has in state s in year t. At a minimum, these specifications all contain both year fixed effects and firm-state fixed effects, which control for nontax factors driving the presence of a given firm in a given state on average over the time period of the study. The primary linear specification is therefore

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

$$\begin{aligned}\#\text{Establishments}_{ist} = \\ &\alpha_{is} + \alpha_t + \beta_{C,C}(\tau_C \times \text{CCorp}) + \beta_{P,P}(\tau_P \times \text{PassThrough}) \\ &+ \beta_{C,P}(\tau_C \times \text{PassThrough}) + \beta_{P,C}(\tau_P \times \text{CCorp}) \\ &+ \gamma\text{CCorp} + \Gamma'\mathbf{X} + \varepsilon_{ist},\end{aligned} \tag{3}$$

where i indexes firms, s indexes states, and t indexes years. We also estimate a number of robustness specifications that include regional trends and industry trends, which are implemented by including interactions of those variables with year fixed effects.

The variables τ_C and τ_P represent the state-level corporate and personal tax rates, respectively, and $\mathbf{X}$ is a vector of other tax climate variables and controls including the sales tax rate, the log of the UI contribution, the property tax share, and the tax incentives index. We also control for the periods in which Ohio, Michigan, Texas, and Washington establishments were subject to the nonstandard forms of corporate taxation discussed in Section I.A by using the appropriate state (or state by year) indicator variables interacted with organizational form. The variable CCorp is an indicator variable equal to one if the establishment belongs to a firm that is a C corporation, and the variable PassThrough is an indicator variable equal to one if the establishment belongs to a firm that is a pass-through entity.[25]

We are testing the null hypotheses that each of the four beta coefficients is zero. The key coefficients of interest for direct responses to taxation are $\beta_{C,C}$ and $\beta_{P,P}$. These represent the effect of a 1 percentage point change in the corporate tax rate on the number of C corporation establishments in the state and the effect of a 1 percentage point change in the personal tax rate on the number of pass-through establishments in the state, respectively. The term $\beta_{C,P}$ reflects the correlation between the corporate tax rate and the number of pass-through establishments in the state, and $\beta_{P,C}$ reflects the correlation between the personal rate and the number of corporate establishments in the state. These "cross-terms" $\beta_{C,P}$ and $\beta_{P,C}$ can be thought of as testing for the presence of spillover effects of the corporate code on the number of pass-through entities and the personal code on the number of corporate entities. These spillovers in theory could occur through reallocation of business activities across the two sectors in response to tax changes, generating positive coefficients. Or in the case of $\beta_{C,P}$, a negative coefficient could be generated if the corporate sector responds to personal tax rates due to the impact of personal tax rates on after-tax wages or possibly on dividends and capital gains. If there are

[25] If firms never changed their form of incorporation, there would be no variation in CCorp within firm-state cells over time, and this term would drop out of the equation.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

no net spillovers across the two sectors, the null hypotheses that $\beta_{C,P} = 0$ and $\beta_{P,C} = 0$ would not be rejected. Linear specifications have drawbacks when applied to count data (Hausman, Hall, and Griliches 1984), so we also employ Poisson regressions and estimate analogous coefficients.

The intensive margin specifications are similar to the extensive margin equations. Specifically, we estimate

$$\begin{aligned}\log(\text{employees}_{it}) = \\ &\alpha_{is} + \alpha_t + \beta_{C,C}(\tau_C \times \text{CCorp}) + \beta_{P,P}(\tau_P \times \text{PassThrough}) \\ &+ \beta_{C,P}(\tau_C \times \text{PassThrough}) + \beta_{P,C}(\tau_P \times \text{CCorp}) \\ &+ \gamma\text{CCorp} + \Gamma'\mathbf{X} + \varepsilon_{ist},\end{aligned} \tag{4}$$

in the full LBD at the establishment-year level, with establishment and year fixed effects, α_i and α_t, respectively. Similarly, in the manufacturing subsample, we estimate equation (4) using as the dependent variable log (capital$_{it}$) to examine capital formation effects.

To establish how much of the measured effects are due to reallocation to other states, we augment specifications (3) and (4) by including a set of tax variables equal to the average tax rates in all other states in which the company has operations. The extensive margin specification is as follows (the intensive margin specification is analogous):

$$\begin{aligned}\#\text{Establishments}_{ist} = \\ &\alpha_{is} + \alpha_t + \beta_{C,C}(\tau_C \times \text{CCorp}) + \beta_{P,P}(\tau_P \times \text{PassThrough}) \\ &+ \beta_{C,P}(\tau_C \times \text{PassThrough}) + \beta_{P,C}(\tau_P \times \text{CCorp}) \\ &+ \varphi_{C,C}(\tilde{\tau}_{C,-s} \times \text{CCorp}) + \varphi_{P,P}(\tilde{\tau}_{P,-s} \times \text{PassThrough}) \\ &+ \varphi_{C,P}(\tilde{\tau}_{C,-s} \times \text{PassThrough}) + \varphi_{P,C}(\tilde{\tau}_{P,-s} \times \text{CCorp}) \\ &+ \gamma\text{CCorp} + \Gamma'\mathbf{X} + \varepsilon_{ist},\end{aligned} \tag{5}$$

where the tax variables with tildes are the average rates for all other states except state s. The variables $\varphi_{C,C}$ and $\varphi_{P,P}$ measure the impact of the change in the average tax rates in other states the firm is active in on the number of establishments in state s itself.

D. Endogeneity of Organizational Form

One concern might be that the results could be affected by firms that change their organizational form in response to the tax code (Gravelle and Kotlikoff 1988, 1989, 1993). Results from Gordon and MacKie-Mason

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

(1990, 1994, 1997) and Goolsbee (1998) suggest that across time periods there is little shifting of organizational form in response to tax rates. Goolsbee (2004) shows evidence that firms do in fact respond to state tax codes by changing their organizational form but concludes that the effects are still "relatively modest."

We address this issue in several ways. First, we note that our analysis considers only firms with establishments in multiple states. As such, the effect of changing organizational form in response to state taxation is likely to be muted in the firms in our sample, and explicit tests for this shifting in our sample confirm this. The organizational form of these firms is most likely determined more by federal tax policy than by the mix of state tax policies they face. Second, we provide evidence that there is essentially zero sensitivity of pass-through entity business activity (establishment counts, labor force, or capital stock) to corporate rates and essentially zero sensitivity of corporate entity activity to personal rates. Firms respond only to tax changes that are relevant for their organizational form as of the time of the tax change. Third, in robustness analysis we show that excluding all observations that are within 5 years of a given firm's legal change of organization leaves our results unaffected.

E. Large Tax Changes, Narrative Approach, and Federal Tax Reforms

In an extension of our analysis, we study a subsample of firms affected by states that changed one of their tax rates by at least 100 basis points. These large tax changes—which we refer to as "treatments"—occurred 161 times during the sample period. The purpose of examining these large changes is to obtain a sample on which we can manageably conduct analysis of the reasons for the tax changes and also so that we can obtain a clean setting without overlapping tax changes for difference-in-differences analysis. We distinguish between four types of treatments: large increases in τ_C, large decreases in τ_C, large increases in τ_P, and large decreases in τ_P.

For each treatment category, we restrict the sample to firms in the treated states 3 years before and 3 years after the treatment.[26] We then estimate the following difference-in-differences specification:

$$\#\text{Establishments}_{ist} = \alpha_{is} + \alpha_t + \beta \times \text{Treatment} + \Gamma'\mathbf{X} + \varepsilon_{ist}, \quad (6)$$

where Treatment is the treatment dummy that equals one for treated firms in the years following the treatment. When changes in τ_C are considered, the treatment group consists of C corporations and the control group of pass-through entities (the other way around for changes in τ_P).

[26] We restrict the treatment window to ensure that our analysis is not affected by multiple treatments or treatment reversals.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

In spirit, this specification is closest to our ideal experiment: we vary a tax parameter and then study the differential response of C corporations and pass-through entities within the same state.

An appealing feature of specification (6) is that it allows us to examine the dynamics of the treatment. Specifically, we estimate a variant of this specification replacing the treatment dummy with a set of indicator variables that capture the dynamics of the large tax changes (1 year before the treatment, year of the treatment, 1 year after the treatment, etc.). If our results are driven by preexisting trends, we should observe an "effect" of the tax changes before they are even implemented, and in fact we observe no such trends. We are also able to identify 19 of these 161 tax changes that were reversed within 3 years, allowing us to examine whether there are differential effects for these tax changes that proved transitory.

We further use specification (6) to implement the narrative approach of Romer and Romer (2010), who note that most tax changes have a single, clearly identifiable motivation that falls into one of four broad categories: (1) offsetting a change in government spending; (2) offsetting some factor other than spending likely to affect output in the near future; (3) dealing with an inherited budget deficit; and (4) achieving some long-run goal, such as higher normal growth, increased fairness, or a smaller role for government. Romer and Romer classify categories 1 and 2 as "endogenous" and categories 3 and 4 as "exogenous." They estimate the effects of changes in federal personal income taxes on GDP growth at the national level, and Mertens and Ravn (2014) extend this approach to study corporate taxes at the federal level.

We adopt this approach with reference to our 161 large tax changes at the state level. Specifically, we search for news articles in the year of each tax change and 2 years prior. We then classify the changes according to the same categories as Romer and Romer (2010). After a careful search of major newspaper databases (Factiva, Lexis-Nexis, Newsbank America's Newspapers, and Access Newspaper Archive Pro), we found newspaper coverage for 107 out of the 161 large tax changes. The majority (83) fall into the exogenous subcategories. We then estimate a variant of specification (6) in which we decompose the treatment dummy into Treatment (exogenous), Treatment (endogenous), and Treatment (unclassified).

Despite its appeal, a drawback of the narrative approach is that it is inherently subjective. To alleviate this concern, we identify a subset of tax changes that are likely exogenous on objective grounds. Specifically, we exploit two federal reforms—the Economic Recovery Tax Act of 1981 (ERTA81) and the Tax Reform Act of 1986 (TRA86)—that triggered changes in state tax policies. The ERTA81 implemented the accelerated cost recovery system (ACRS). Effectively, ACRS accelerated depreciation schedules, thereby reducing tax revenues for states that followed federal rules. To offset this reduction, four states (Indiana, Iowa, Nebraska, and Wisconsin) increased their corporate income tax (Aronson and Hilley 1986).

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

Similarly, TRA86 broadened the tax base for the federal income tax, thus creating a revenue windfall for states that follow the federal definition of the tax base. As a result, 10 \states (California, Delaware, Kansas, Maine, New York, Ohio, Oregon, Rhode Island, Vermont, and West Virginia) and the District of Columbia reduced their personal income tax (Ladd 1993). For two states, Utah and Montana, the reform created a negative shock to the fiscal position, and these states raised their personal income tax in response. In the analysis, we account for these federal tax reforms by decomposing the Treatment (exogenous) dummy into the three dummies: Treatment (ERTA81), Treatment (TRA86), and Treatment (other exogenous).

III. Main Results

A. *Effect of State Tax Rates on the Counts and Locations of Establishments and Employees*

Table 3 presents the main results. The left panel examines the extensive margin—that is, how changes in the state tax code affect the number of establishments a firm has in a given state—following the specification in equation (3). The dependent variable is the number of establishments each firm has in each state in each year, where that value equals zero if an active company has no establishment in the state, and firm-by-state fixed effects are absorbed. The right panel examines the intensive margin in terms of number of employees, in specifications with establishment fixed effects, as shown in equation (4).

The extensive margin point estimates in column 1 are $\beta_{C,C} = -0.037$ and $\beta_{P,P} = -0.016$. Both are statistically significant at the 1 percent level, with standard errors clustered by state. This means that a 100 basis point increase in the corporate tax rate would lead to the closure of 0.037 establishments per C-Corp firm in a given state, out of an average of 7.06 establishments per state per C-Corp firm as shown in table 1. A 100 basis point increase in the personal tax rate would lead to the closure of 0.016 establishments, compared to an average of 3.72 establishments per state per pass-through entity as shown in table 1. These coefficients therefore imply that a 100 basis point increase (decrease) in the statutory corporate income tax rate corresponds to a 0.52 percent decrease (increase) in the number of establishments belonging to C corporations. A 100 basis point increase (decrease) in the statutory personal income tax rate corresponds to a 0.43 percent decrease (increase) in the number of establishments belonging to pass-through firms.

For the range of state income tax rates, a change of 0.01 in τ_C corresponds to a very similar, opposite-signed change in $\log(1 - \tau_C)$, the log of the net-of-tax rate, which is often used in elasticity measurements in the public finance literature. For example, at the mean rate of 6.85 percent,

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

an increase of 0.01 in τ_C corresponds to a decrease of 0.0108 in $\log(1 - \tau_C)$, and a decrease of 0.01 in τ_C corresponds to an increase of 0.0107 in $\log(1 - \tau_C)$. The coefficients we estimate are therefore similar to net-of-tax elasticities.

In column 2, we further control for log(GDP), which is the natural logarithm of GDP at the state level (obtained from the Bureau of Economic Analysis [BEA]). As can be seen, the coefficients are about 20–40 percent smaller compared to those in column 1. Importantly, they remain large in economic terms and statistically significant. Including log(GDP) has the obvious advantage that it prevents the regression from attributing any changes in establishment counts to changes in economic activity that might be unrelated to tax policy. On the other hand, including this control is tantamount to the (strong) assumption that the changes in economic activity had nothing to do with the tax policy itself. Given this caveat, we do not include log(GDP) in our baseline specification. The coefficients on the key tax variables in the Poisson specification in column 3 are around 40 percent smaller than in the linear specification.

In the above discussion we focused for simplicity on changes of 100 basis points. A 100 basis point change in tax rates is considerably higher than the standard deviation of the change in rates. A one standard deviation change in the corporate income tax rate is 32 basis points and a one standard deviation change in the personal income tax rate is 53 basis points. So a one standard deviation change in τ_C corresponds to a 0.17 percent ($= 0.52\% \times 0.32$) change in the number of corporate establishments and a one standard deviation change in τ_P corresponds to a 0.23 percent ($= 0.43\% \times 0.53$) change in the number of pass-through establishments.

In column 4, the level of observation is now the establishment-year, of which there are 27.6 million belonging to firms with more than 100 employees and active in more than one state. The results indicate an elasticity of C corporation employment of 0.4 with respect to the state corporate income tax rate and an elasticity of pass-through business employment of 0.2 with respect to the personal income tax rate. In other words, a 1 percentage point change in the state corporate rate has an opposite effect on employment at existing establishments of C corporations by 0.4 percentage points. A 1 percentage point change in the state personal rate has an opposite effect on employment at existing establishments of pass-through entities by 0.2 percentage points. We caution that since our sample consists of firms that already have establishments in multiples states, the effects we measure are reflective of the responses of firms that are more cheaply able to shift factors of production across state borders than firms operating in only one state. Finally, in column 5, we again observe that including log(GDP) reduces the elasticities by about 10–20 percent.

In all specifications, the coefficients $\beta_{C,P}$ and $\beta_{P,C}$ are economically negligible and statistically insignificant, so that we reject neither of the null hypotheses regarding the cross-terms. That is, we do not reject the nulls

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

TABLE 3
MAIN RESULTS

	EXTENSIVE MARGIN			INTENSIVE MARGIN			
				All Sectors		Manufacturing	
	# Establishments (1)	# Establishments (2)	# Establishments (3)	Log(Employees) (4)	Log(Employees) (5)	Log(Employees) (6)	Log(Capital) (7)
τ_C × C-Corp	−.037***	−.031***	−.023***	−.0041***	−.0038***	−.0035***	−.0024***
	(.003)	(.003)	(.002)	(.0005)	(.0005)	(.0011)	(.0008)
τ_C × Pass-Through	−.002	−.000	−.002	−.0004	−.0001	−.0003	.0000
	(.003)	(.003)	(.002)	(.0010)	(.0010)	(.0023)	(.0015)
τ_P × C-Corp	−.003	−.001	−.002	−.0007	−.0003	−.0010	−.0002
	(.002)	(.002)	(.002)	(.0004)	(.0004)	(.0008)	(.0005)
τ_P × Pass-Through	−.016***	−.010***	−.010***	−.0024***	−.0019**	−.0026	−.0015
	(.003)	(.003)	(.002)	(.0009)	(.0009)	(.0022)	(.0015)
Sales tax rate	−.001	−.000	.000	−.0003	−.0003	.0000	−.0004
	(.005)	(.005)	(.003)	(.0007)	(.0007)	(.0016)	(.0011)
Log(UI contribution)	−.189***	−.183***	−.118***	−.0223***	−.0110***	−.0089**	−.0063**
	(.008)	(.008)	(.006)	(.0009)	(.0014)	(.0040)	(.0026)
Property tax share	−.386***	−.371***	−.175***	−.0128	−.0032	−.0366	−.0245
	(.018)	(.018)	(.026)	(.0107)	(.0107)	(.0248)	(.0165)

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

Tax incentives index	.002*	.002**	.002**	.0008***	.0009***	.0072***	.0018***
	(.001)	(.001)	(.001)	(.0001)	(.0001)	(.0004)	(.0002)
C-Corp	.348***	.352***	.290***	.0015	.0028	−.0010	−.0080
	(.015)	(.015)	(.010)	(.0051)	(.0051)	(.0163)	(.0105)
Log(GDP)		.225***			.2417***		
		(.025)			(.0054)		
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-state fixed effects	Yes	Yes	Yes	No	No	No	No
Establishment fixed effects	No	No	No	Yes	Yes	Yes	Yes
Regression type	OLS	OLS	Poisson	OLS	OLS	OLS	OLS
R^2	.73	.73	. . .	.88	.88	.92	.96
Observations	32,997,200	32,997,200	32,997,200	27,600,100	27,600,100	854,700	854,700

NOTE.—In cols. 1–3, the dependent variable is the number of establishments of a given firm in a given state and year. The number of establishments is set to zero if an active company has no operation in the state. In cols. 4–6, the dependent variable is the logarithm of the number of employees at the establishment. In col. 7, the dependent variable is the logarithm of the establishment's capital stock. Capital stock is constructed using the perpetual inventory method. C-Corp is a dummy variable that equals one if a company is a C corporation, and Pass-Through is a dummy variable that equals one if a company is an S corporation, partnership, or sole proprietorship for tax purposes. GDP is the state's gross domestic product (from the BEA). The other variables are defined in table 2. All regressions include dummy variables for Michigan, Ohio (post-2005), Texas (post-1991), and Washington, interacted with C-Corp and Pass-Through. In cols. 6–7, the sample is restricted to establishments in the ASM/CMF. The sample period is 1977–2011. Standard errors are clustered at the state level.

* Significant at the 10 percent level.

** Significant at the 5 percent level.

*** Significant at the 1 percent level.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

that $\beta_{C,P} = 0$ and $\beta_{P,C} = 0$. This is important for our analysis as it suggests that $\beta_{C,C}$ and $\beta_{P,P}$ are actually reflecting responses to the tax rates, not spurious correlations. If there were omitted factors driving both tax policy and the number of firm establishments in a state over time, there would have to be separate omitted factors explaining why corporate tax policy is correlated with C corporation business activity and not with pass-through business activity, and why personal income tax rates are correlated with pass-through business activity but not corporate activity.

Column 6 shows the results of the intensive margin for the manufacturing subsample. Here we find results similar to those in the full sample, with $\beta_{C,C}$ estimated as -0.35 percent. When we examine the impact on log(capital) in column 7, we find a coefficient of -0.24 percent, implying an elasticity that is 31 percent smaller than the elasticity of labor in the manufacturing sample. However, the standard errors are not small enough to reject the null hypothesis that the magnitude is the same as the effect on labor, especially given the likely measurement error in capital.

Table 4 augments the extensive margin regressions with the tax policies of other states in which the firm operates, as shown in equation (5). We see the original coefficients of interest $\beta_{C,C}$ and $\beta_{P,P}$ essentially unchanged from the baseline regressions in table 3. As predicted, the coefficients on the average tax rate on the other states where the firm operates have opposite signs. In particular, $\varphi_{C,C}$, the coefficient on $\tilde{\tau}_{C,-s} \times$ C-Corp, has a point estimate of 0.018 and is statistically significant at the 1 percent level. Similarly, $\varphi_{P,P}$, the coefficient on $\tilde{\tau}_{P,-s} \times$ Pass-Through, has a point estimate of 0.006 and is significant at the 5 percent level. The cross-terms $\varphi_{P,C}$ and $\varphi_{C,P}$ are statistically and economically insignificant.

Changes in the tax rates of other states where the parent firm has establishments therefore have about half the effect of the tax rates in the state of the establishment itself. So, for example, if all other states in which a firm operates increase the corporate tax rate by 100 basis points and state *s* maintains the level of its corporate tax rate, state *s* sees an establishment inflow amounting to 0.018 establishments per firm. This inflow to state *s* would then eliminate around half of the outflow from the other states and is the basis of our conclusion that around half of the baseline effects are driven by reallocation of productive resources to other states where the treated firms have establishments.[27] The coefficients estimated on the intensive margin in column 3 show a similar pattern.

While we view the other tax items primarily as controls in the analysis of the effect of the income tax variables, it is nonetheless instructive to consider their magnitude, which we do in the online appendix that accompanies this paper. Furthermore, a full presentation of a range of ad-

[27] Firm-level specifications that "net out" the reallocation by aggregating the number of establishments at the firm level confirm this finding.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

TABLE 4
REALLOCATION ACROSS STATES

	# ESTABLISHMENTS	LOG(EMPLOYEES)	
	(1)	(2)	(3)
$\tau_C \times$ C-Corp	−.037***	−.025***	−.0044***
	(.003)	(.002)	(.0005)
$\tau_C \times$ Pass-Through	−.002	−.002	−.0000
	(.003)	(.002)	(.0011)
$\tau_P \times$ C-Corp	−.003	−.002	−.0004
	(.002)	(.002)	(.0004)
$\tau_P \times$ Pass-Through	−.016***	−.012***	−.0024**
	(.003)	(.002)	(.0010)
$\tilde{\tau}_C$ (other states) × C-Corp	.018***	.010***	.0021***
	(.002)	(.003)	(.0006)
$\tilde{\tau}_C$ (other states) × Pass-Through	−.000	.001	−.0001
	(.002)	(.002)	(.0013)
$\tilde{\tau}_P$ (other states) × C-Corp	.001	.001	.0000
	(.002)	(.002)	(.0006)
$\tilde{\tau}_P$ (other states) × Pass-Through	.006***	.005*	.0011
	(.002)	(.003)	(.0014)
Controls	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Firm-state fixed effects	Yes	Yes	No
Establishment fixed effects	No	No	Yes
Regression type	OLS	Poisson	OLS
R^2	.73	. . .	.88
Observations	32,997,200	32,997,200	27,600,100

NOTE.—This table presents variants of the regressions in cols. 1, 3, and 4 of table 3. $\tilde{\tau}_C$ (other states) refers to the average corporate income tax rate in all other states in which the company has operations. The average is computed using the share of the company's employees in each state as weights. $\tilde{\tau}_P$ (other states) is computed analogously with respect to the personal income tax rate. The sample period is 1977–2011. Standard errors are clustered at the state level.

* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.

ditional details and robustness tests on our analysis may be found there. These details and robustness tests include persistence properties of the tax rates, capital stock calculations, estimation using net-of-tax rates, conditional logit estimates,[28] firm-level specifications that "net out" reallocation by aggregating at the firm level, estimations on a size-matched control sample, exclusion of firms that change legal forms of organization (LFO), direct estimates of the impact of state taxation on the LFO, predicted versus unpredicted components of state taxation, controlling for unobserved trends at the regional and industry levels, sample selection, functional form, size decompositions, the deductibility of state taxes from

[28] Earlier papers such as Carlton (1979, 1983) and Bartik (1985) use conditional logit methods to estimate the location decisions of newly formed firms.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

federal taxes, regressions focused on longer-term dynamics, the finding of larger effects for ex post permanent tax changes, an alternative specification to capture apportionment rules, controls for entity-level taxes in some states on pass-through entities, and more detailed general equilibrium analysis.

B. Large Tax Changes and the Narrative Approach

In this section we focus on large tax changes, which we define as increases or decreases in tax rates that are at least 100 basis points. We identify 56 such changes in the corporate tax rate and 105 such changes in the personal tax rate, for a total of 161 changes.

Table 5 shows a difference-in-differences analysis of the large tax changes for the extensive margin, as in equation (6). We construct four samples for this analysis, for each of four different types of tax changes: corporate tax cuts, corporate tax increases, personal tax cuts, and personal tax increases. To do this, we select all firm-state-year observations for the treated states 3 years before and 3 years after the major tax changes of each of the four types. Compared to coefficients from table 3 ($\beta_{C,C} = -0.037$ and $\beta_{P,P} = -0.016$), columns 1, 3, 5, and 7 show coefficients of 0.027, −0.014, 0.018, and −0.005 for the effects of corporate tax cuts, corporate tax increases, personal tax cuts, and personal tax increases, respectively, on establishment counts. The first three of these are significant at the 1 percent level, while the coefficient on the personal tax increases is not statistically significant at conventional levels. Columns 2, 4, 6, and 8 show the impulse response of the tax changes. Around half of the impact is observed in the year of the treatment and the rest in the following year. The coefficients on Treatment (+1) are 0.031, −0.017, 0.028, and −0.003, respectively, with the first three once again significant at 1 percent and the personal tax increase impact not statistically significant. Figure 4 shows this dynamic response graphically by plotting the coefficients from $t - 2$ to $t + 2$ for each of the four types of tax changes.

In tables 6 and 7, we then implement the narrative approach in this sample as discussed in Section II.E. In columns 1, 2, 4, and 6 of table 7, we regress the number of establishments on the type of treatment: exogenous, endogenous, and unclassified. For categories in which the changes classified as exogenous came through the 1981 and 1986 federal tax reforms, we break those out separately in columns 3, 5, and 7. In all of the specifications, there is no statistically or economically distinguishable difference among the coefficients on the different types of tax changes. For large corporate tax cuts, large corporate tax increases, and large personal tax cuts, the effects on establishment counts are uniformly of the predicted sign, with a magnitude similar to that of the difference-in-differences specification, and statistically significant.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

TABLE 5
EXTENSIVE MARGIN: DIFFERENCE-IN-DIFFERENCES ANALYSIS OF LARGE TAX CHANGES

	# ESTABLISHMENTS							
	Large Cuts in τ_C		Large Increases in τ_C		Large Cuts in τ_P		Large Increases in τ_P	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	.027***		−.014***		.018***		−.005	
	(.005)		(.003)		(.004)		(.003)	
Treatment (−2)		−.002		.000		.005		.001
		(.004)		(.003)		(.003)		(.003)
Treatment (−1)		−.002		.004		.005		.003
		(.006)		(.003)		(.003)		(.004)
Treatment (0)		.017**		−.007*		.015***		−.002
		(.007)		(.004)		(.004)		(.005)
Treatment (+1)		.031***		−.017***		.028***		−.003
		(.008)		(.004)		(.005)		(.005)
Treatment (+2)		.030***		−.017***		.026***		−.005
		(.009)		(.005)		(.007)		(.005)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-state fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	.88	.88	.92	.92	.87	.87	.86	.86
Observations	1,748,600	1,748,600	3,144,600	3,144,600	3,561,900	3,561,900	4,697,400	4,697,400

NOTE.—This table estimates the treatment effect of large tax changes (increases or decreases in tax rates that are at least 100 basis points) on the number of establishments. In cols. 1 and 2, the treatments are large decreases in the corporate income tax rate. The sample includes all firm-state-year observations in the treated states 3 years before and after the treatments (i.e., the treatment group consists of C corporations; the control group consists of pass-through entities). In col. 1, Treatment is a dummy variable equal to one for C corporations in the years following the treatment. In col. 2, Treatment (−2) is a dummy variable equal to one for C corporations 2 years prior to the treatment. Treatment (−1), Treatment (0), Treatment (+1), and Treatment (+2) are defined similarly. The analysis in cols. 3–8 is conducted analogously with respect to large increases in the corporate income tax rate and large decreases/increases in the personal income tax rate, respectively. The sample period is 1977–2011. Standard errors are clustered at the state level.

* Significant at the 10 percent level.

** Significant at the 5 percent level.

*** Significant at the 1 percent level.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

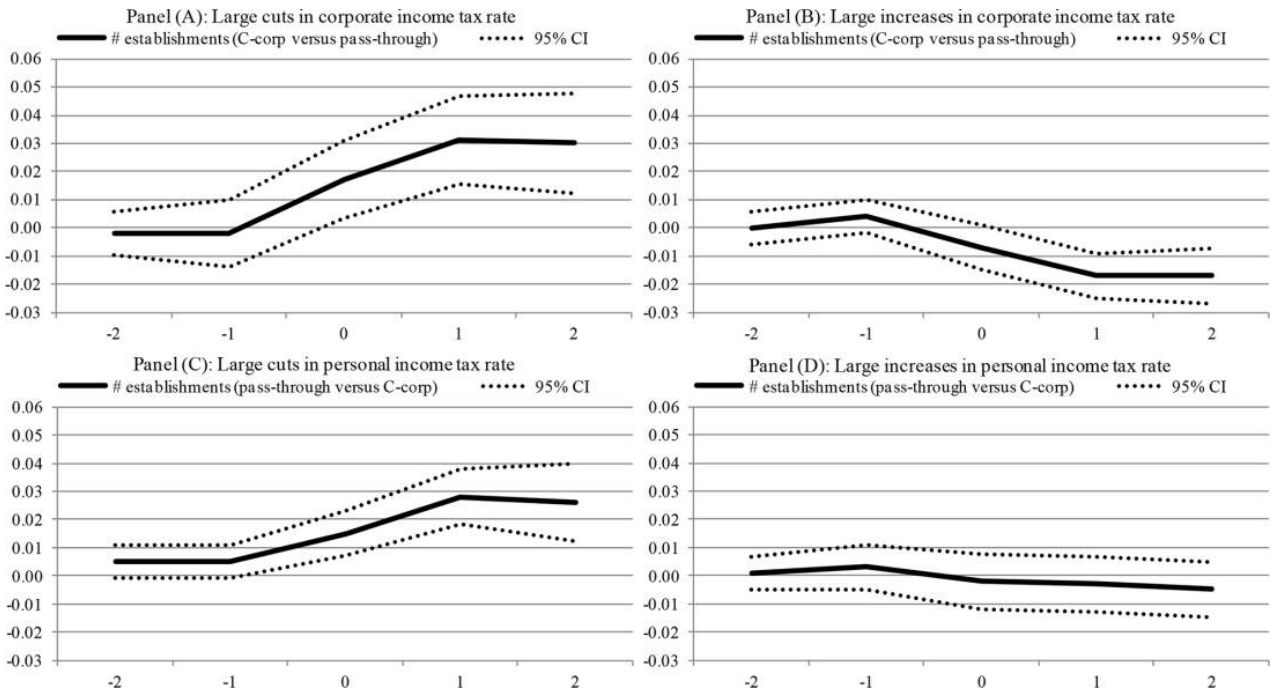

FIG. 4.—Extensive margin: dynamic effect of large tax changes. This figure plots the coefficients (and 95 percent confidence intervals) corresponding to the dynamic analysis provided in table 5. See the note to table 5 for details.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

TABLE 6
NARRATIVE APPROACH

	τ_C	τ_P
1. Offsetting a change in government spending (endogenous)	6	7
2. Offsetting some factor other than spending likely to affect output (endogenous)	6	5
3. Dealing with an inherited budget deficit (exogenous)	7	34
4. Achieving some long-run goal (exogenous)	18	24
5. Unclassified	19	35
Total	56	105

NOTE.—This table reports the number of large tax changes for each of the categories identified by Romer and Romer (2010).

Table 8 provides an analysis parallel to that in table 5 but on the intensive margin, with log(employees) on the left-hand side. As was the case for the extensive margin, the coefficient responses measured in the baseline specifications most closely match these 1 year after treatment, that is, in the coefficients on Treatment (+1). Here we find statistically significant coefficients on all categories except large decreases in the personal income tax. Figure 5 shows the dynamic response graphically by plotting the coefficients from $t - 2$ to $t + 2$ for each of the four types of tax changes.

In table 9 we conduct the textual analysis on the intensive margin with log(employees) as the dependent variable. Once again, in all of the specifications, there is no statistically or economically distinguishable difference among the coefficients on the different types of tax changes. For large corporate tax cuts, large corporate tax increases, and large personal tax increases, the effects on employment are uniformly of the predicted sign, of a magnitude similar to the difference-in-differences specification, and statistically significant.

C. *Reconciliation with Estimates from Studies of Aggregated Data*

Suarez Serrato and Zidar (2016) exploit variation in both state corporate tax rates and apportionment rules to calibrate a model of the incidence of state corporate taxes on workers and owners in a spatial equilibrium model. Their main goal is to estimate the incidence of the corporate tax rate and the welfare effects of tax policy changes. The elasticities we estimate are significantly smaller than those of Suarez Serrato and Zidar, who use a 10-year establishment elasticity of 4 estimated in aggregated panel data to calibrate their incidence model. We show in this section that this difference is due to three main factors: the fact that our identification strategy focuses only on existing firms, the fact that our fixed effects explicitly allow firms to operate in a given state at a given scale for nontax reasons, and the time horizon.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

TABLE 7
EXTENSIVE MARGIN: DIFFERENCE-IN-DIFFERENCES ANALYSIS OF LARGE TAX CHANGES

	# ESTABLISHMENTS						
	Large Cuts in τ_C	Large Increases in τ_C		Large Cuts in τ_P		Large Increases in τ_P	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treatment (exogenous)	.029***	−.016***		.019***		−.005	
	(.007)	(.005)		(.005)		(.005)	
Treatment (ERTA81)			−.014**				
			(.007)				
Treatment (TRA86)					.019***		−.007
					(.007)		(.017)
Treatment (other exogenous)			−.017***		.019**		−.004
			(.005)		(.008)		(.005)
Treatment (endogenous)	.033**	−.015**	−.015**	.018*	.018*	−.004	−.004
	(.013)	(.007)	(.007)	(.010)	(.010)	(.015)	(.015)
Treatment (unclassified)	.022**	−.014***	−.014***	.016***	.016***	−.003	−.003
	(.011)	(.003)	(.003)	(.005)	(.005)	(.006)	(.006)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-state fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	.88	.92	.92	.87	.87	.86	.86
Observations	1,748,600	3,144,600	3,144,600	3,561,900	3,561,900	4,697,400	4,697,400

NOTE.—This table presents variants of the regressions in cols. 1, 3, 5, and 7 of table 5, decomposing the treatment into exogenous, endogenous, and other types of treatments using the methodology of Romer and Romer (2010). ERTA81 refers to the Economic Recovery Tax Act of 1981; TRA86 refers to the Tax Reform Act of 1986. The sample period is 1977–2011. Standard errors are clustered at the state level.

* Significant at the 10 percent level.

** Significant at the 5 percent level.

*** Significant at the 1 percent level.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

TABLE 8
INTENSIVE MARGIN: DIFFERENCE-IN-DIFFERENCES ANALYSIS OF LARGE TAX CHANGES

	Log(Employees)							
	Large Cuts in τ_C		Large Increases in τ_C		Large Cuts in τ_P		Large Increases in τ_P	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	.0032***		−.0034***		.0009		−.0022***	
	(.0007)		(.0006)		(.0006)		(.0004)	
Treatment (−2)		−.0007		.0007		.0002		.0003
		(.0010)		(.0007)		(.0007)		(.0006)
Treatment (−1)		−.0016		.0011		−.0003		.0002
		(.0011)		(.0007)		(.0008)		(.0006)
Treatment (0)		.0015		−.0018**		.0007		−.0011
		(.0011)		(.0008)		(.0009)		(.0007)
Treatment (+1)		.0027**		−.0045***		.0008		−.0027***
		(.0012)		(.0009)		(.0010)		(.0007)
Treatment (+2)		.0033***		−.0051***		.0014		−.0031***
		(.0011)		(.0011)		(.0011)		(.0008)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Establishment fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	.94	.94	.95	.95	.93	.93	.94	.94
Observations	1,326,800	1,326,800	1,950,600	1,950,600	2,420,100	2,420,100	3,364,500	3,364,500

NOTE.—This table presents variants of the regressions in table 5, except that the analysis is conducted at the intensive margin, that is, at the establishment-year level. The dependent variable is the logarithm of the number of employees at the establishment. The sample period is 1977–2011. Standard errors are clustered at the state level.

* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

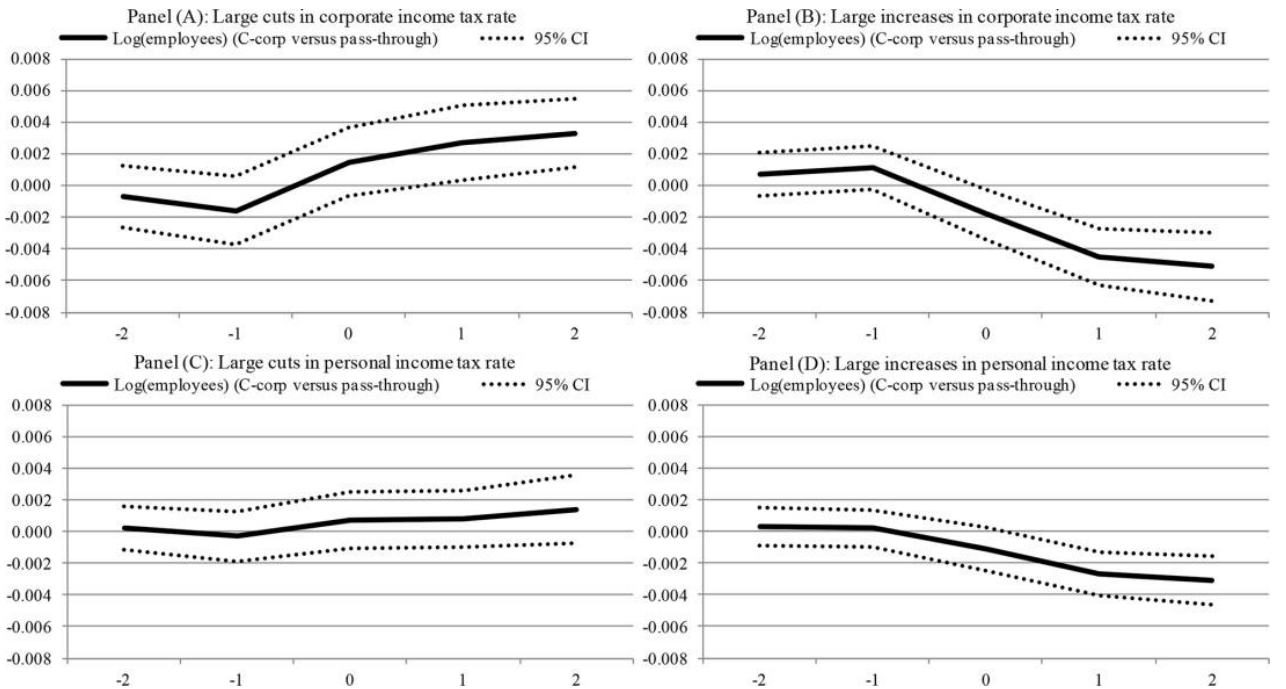

FIG. 5.—Intensive margin: dynamic effect of large tax changes. This figure plots the coefficients (and 95 percent confidence intervals) corresponding to the dynamic analysis in table 8. See the note to table 8 for details.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

TABLE 9
INTENSIVE MARGIN: DIFFERENCE-IN-DIFFERENCES ANALYSIS OF LARGE TAX CHANGES—TEXTUAL ANALYSIS

	LOG(EMPLOYEES)						
	Large Cuts in τ_C	Large Increases in τ_C		Large Cuts in τ_P		Large Increases in τ_P	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treatment (exogenous)	.0030***	−.0036***		.0009		−.0022***	
	(.0009)	(.0006)		(.0008)		(.0005)	
Treatment (ERTA81)			−.0043***				
			(.0016)				
Treatment (TRA86)					.0010		−.0018
					(.0012)		(.0019)
Treatment (other exogenous)			−.0035***		.0009		−.0023***
			(.0007)		(.0008)		(.0006)
Treatment (endogenous)	.0037*	−.0029***	−.0028***	.0008	.0008	−.0018*	−.0019*
	(.0022)	(.0008)	(.0008)	(.0009)	(.0009)	(.0010)	(.0010)
Treatment (unclassified)	.0033*	−.0031**	−.0032**	.0009	.0009	−.0021**	−.0021**
	(.0017)	(.0013)	(.0013)	(.0013)	(.0013)	(.0010)	(.0010)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Establishment fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	.94	.95	.95	.93	.93	.94	.94
Observations	1,326,800	1,950,600	1,950,600	2,420,100	2,420,100	3,364,500	3,364,500

NOTE.—This table presents regressions similar to those in table 8, except that the analysis is conducted at the intensive margin, that is, at the establishment-year level. The dependent variable is the logarithm of the number of employees at the establishment. The sample period is 1977–2011. Standard errors are clustered at the state level.

* Significant at the 10 percent level.

** Significant at the 5 percent level.

*** Significant at the 1 percent level.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

A key feature of our analysis is that we study variation within firms, both in the geographic distribution of firm establishments and in the number of employees at a given establishment, and do so relative to firms with nontreated LFOs. Econometrically, this can be seen in our inclusion of state-firm fixed effects in the extensive margin regressions and establishment fixed effects in the intensive margin regressions, combined with our specification that estimates different effects for C corporations versus pass-through entities.

In table 10 we investigate the impact of the fixed effects on the results. Column 1 shows the extensive margin when we remove firm-state fixed effects and include only state fixed effects in their place. Here the effect is approximately three times as large as our baseline specifications, at −0.103 compared to −0.037. This coefficient, however, reflects a number of factors above and beyond the responses of existing firms to tax policy. First, the balance between C corporations and pass-through entities of new (not

TABLE 10
FIXED EFFECTS

	# Establishments				
				State Trends	
	State Fixed Effects (1)	State and Firm Fixed Effects (2)	State-Firm Fixed Effects (3)	State-Year Fixed Effects (4)	State-Year and Firm Fixed Effects (5)
$\tau_C \times$ C-Corp	−.103***	−.053***	−.037***	−.052***	−.033***
	(.013)	(.004)	(.003)	(.005)	(.004)
$\tau_C \times$ Pass-Through	−.018	−.005	−.002		
	(.012)	(.005)	(.003)		
$\tau_P \times$ C-Corp	−.010	−.003	−.003		
	(.012)	(.004)	(.002)		
$\tau_P \times$ Pass-Through	−.034***	−.019***	−.016***	−.018***	−.009**
	(.011)	(.004)	(.003)	(.004)	(.004)
Controls	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	. . .	. . .
Firm-state fixed effects	No	No	Yes	No	No
Firm fixed effects	No	Yes	. . .	No	Yes
State fixed effects	Yes	Yes	. . .	. . .	. . .
State-year fixed effects	No	No	No	Yes	Yes
R^2	.02	.28	.73	.02	.28
Observations	32,997,200	32,997,200	32,997,200	32,997,200	32,997,200

NOTE.—This table presents variants of the regressions in cols. 1 and 4 of table 3. The sample period is 1977–2011. Standard errors are clustered at the state level.

* Significant at the 10 percent level.

** Significant at the 5 percent level.

*** Significant at the 1 percent level.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

only existing) firms will be reflected in this coefficient, and we do not wish to attribute future entry of different types of firms to tax policy alone.[29] More generally, this specification does not allow for any nontax reasons why a given firm would choose to locate in a given state. The fact that in this column the pass-through entity establishment count appears negatively correlated with corporate rates (coefficient of −0.018 with a *t*-statistic of 1.50) suggests that this specification is likely affected by omitted variables bias.

Adding firm fixed effects separately from the state fixed effects reduces the coefficient to −0.053. This specification now has the advantage of identifying only off of changes within existing firms across states and time. However, it still does not allow for nontax reasons that a given firm might choose to locate in a given state, but rather only allows a firm's average scale across states to be independent of tax policy. Similar estimates are obtained in a specification with state-by-year fixed effects. This specification also does not model nontax reasons why a given firm might choose to locate in a given state, and it attributes future entry to tax policy, but it does have the advantage of estimating the result only off of the difference between the establishment counts of C corporations and pass-through entities in the state.

In sum, our study focuses on estimating the effects of tax changes on the employment and capital utilization decisions of existing firms and allows for firms to choose to operate at a given scale in a given state for nontax reasons. Measures of the impact of tax policy on new firms, which we argue would be much more difficult to identify, would need to be added to these measures if one wanted to measure the total impact of tax policy on state economic activity.

Figure 6 further shows that extending the time horizon to study a cumulative 10-year effect as in Suarez Serrato and Zidar (2016) also substantially increases the estimates. Specifically, adding 10 lags of tax policy, cumulating the effect, and recalling that C corporations have an average of seven establishments per state generates an elasticity estimate of 1.2. These estimates, however, rely on the much stronger identifying assumption that factors other than taxes are not changing for treated firms relative to control firms over a substantially longer period of time. Removing the state-by-firm fixed effects that underpin our identification strategy, as we did in table 10, and estimating the full 10-year model further increases the elasticity estimate to 3.

[29] As an example, new firms that raise venture capital generally must be incorporated as C corporations, and these firms may have tended to cluster in states such as California that have seen larger increases in individual taxes than corporate taxes.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

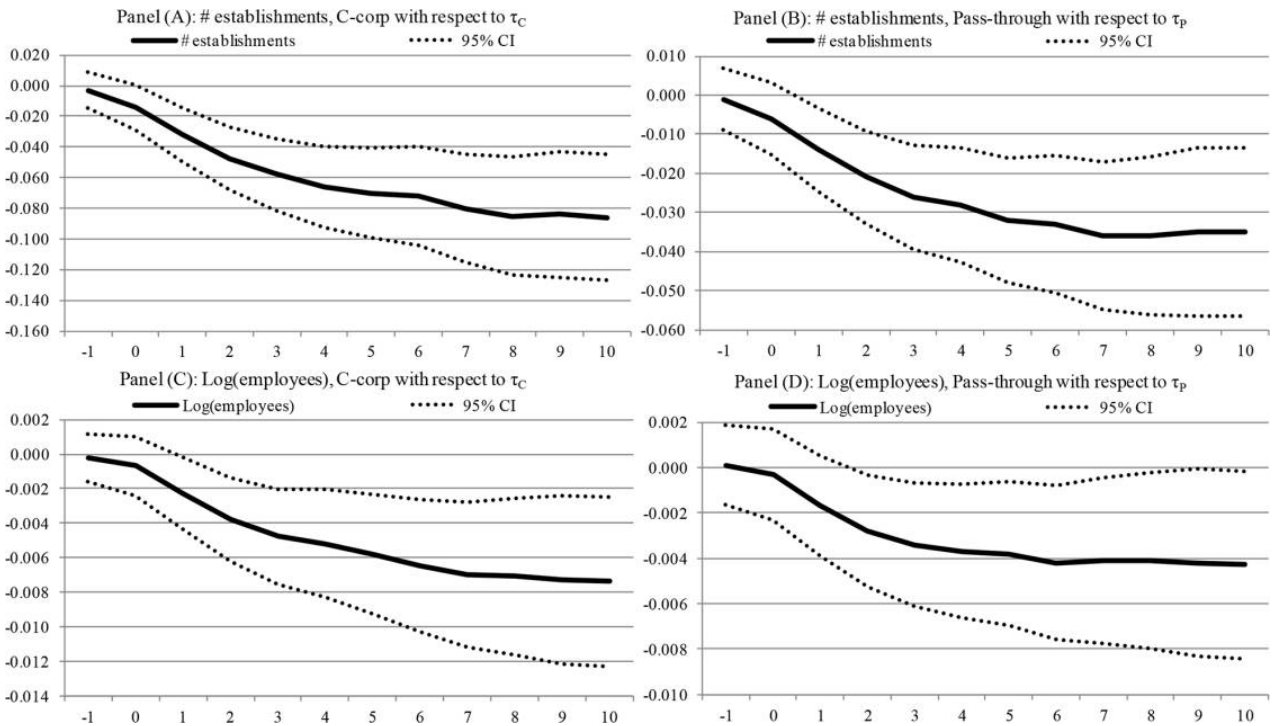

FIG. 6.—10-year dynamics. Panel A plots the cumulative coefficients (and 95 percent confidence intervals) of $\tau_C \times$ C-Corp in an extended version of the baseline regression at the extensive margin, in which we include 10 lags and one lead of $\tau_C \times$ C-Corp. Panel B is analogous with respect to $\tau_P \times$ Pass-Through; panels C and D are analogous with respect to the intensive margin regression.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

D. *Apportionment Factors and Throwback Rules*

In table 11 we present the results of the apportionment factor analysis described in Section II.B. Column 1 incorporates the fact that if a state has a high sales apportionment factor, then changes in the state tax rate would be expected to have a smaller effect on the firm's decision to relocate plants and employees than if the state has a higher weighting on pay-

TABLE 11
APPORTIONMENT FACTORS AND THROWBACK RULES

	# ESTABLISHMENTS		LOG(EMPLOYEES)	
	(1)	(2)	(3)	(4)
$\tau_C \times$ C-Corp	−.015**	−.013**	−.0016*	−.0013*
	(.006)	(.005)	(.0008)	(.0008)
$\tau_C \times$ Pass-Through	−.001	−.002	−.0004	−.0001
	(.007)	(.006)	(.0014)	(.0016)
$\tau_P \times$ C-Corp	.000	−.000	−.0003	−.0003
	(.005)	(.004)	(.0008)	(.0009)
$\tau_P \times$ Pass-Through	−.009	−.006	−.0012	−.0007
	(.007)	(.006)	(.0012)	(.0013)
$[\tau_C \times (1 - \alpha_{sales})] \times$ C-Corp	−.048***		−.0053***	
	(.005)		(.0009)	
$[\tau_C \times (1 - \alpha_{sales})] \times$ Pass-Through	−.002		−.0002	
	(.005)		(.0015)	
$[\tau_P \times (1 - \alpha_{sales})] \times$ C-Corp	−.002		−.0001	
	(.005)		(.0009)	
$[\tau_P \times (1 - \alpha_{sales})] \times$ Pass-Through	−.016**		−.0025*	
	(.007)		(.0013)	
$[\tau_C \times (1 - \alpha_{sales} \times (1 - I_{throwback}))] \times$ C-Corp		−.029***		−.0033***
		(.005)		(.0008)
$[\tau_C \times (1 - \alpha_{sales} \times (1 - I_{throwback}))] \times$ Pass-Through		−.002		−.0001
		(.006)		(.0019)
$[\tau_P \times (1 - \alpha_{sales} \times (1 - I_{throwback}))] \times$ C-Corp		−.003		−.0003
		(.006)		(.0008)
$[\tau_P \times (1 - \alpha_{sales} \times (1 - I_{throwback}))] \times$ Pass-Through		−.013**		−.0019*
		(.006)		(.0010)
Controls	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Firm-state fixed effects	Yes	Yes	No	No
Establishment fixed effects	No	No	Yes	Yes
R^2	.73	.73	.88	.88
Observations	32,997,200	32,997,200	27,600,100	27,600,100

NOTE.—This table presents variants of the regressions in cols. 1 and 4 of table 3, accounting for apportionment factors and throwback rules. α_{sales} denotes the sales apportionment factor; $I_{throwback}$ is an indicator variable equal to one if the state has a throwback (or throwout) rule. The sample period is 1977–2011. Standard errors are clustered at the state level.

* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

roll and property. Indeed, relocating plants and employees has only a limited effect on the firm's tax burden if that tax burden is determined largely by the location where the goods are sold, not the location where the production is located. In column 1, the state tax rate τ_C is therefore interacted with $1 - \alpha^i_{\text{sales}}$, whereby we note once again that we do not actually observe the location to which the firm's output is sold.

The baseline effect on a firm's establishments in a state with a 100 percent sales apportionment factor is measured by the first coefficient, which is -0.015. The effect in a state with a 33 percent sales apportionment factor (the minimum) would be $-0.015 - 0.66 \times 0.048 = -0.047$. Dividing these point estimates (-0.015 and -0.047) by 7.06, which is the average number of establishments a C corporation has in a state, the coefficients in table 11 imply that the effect of an increase in the tax rate on the number of establishments would range from 0.21 percent to 0.67 percent depending on the size of the apportionment factor.[30] If firms generally tend to sell out of the state, then this difference is explained by the differential incentives facing firms in high versus low sales apportionment states. A similar spread is estimated for pass-through entities. Column 3 shows similar results on the intensive margin of employment, with elasticities ranging from -0.16 percent when α^i_{sales} is 100 percent to -0.51 percent when α^i_{sales} is 33 percent.

In columns 2 and 4, the state tax rate τ_C is interacted with $1 - \alpha^i_{\text{sales}}(1 - I_{\text{throwback}})$. If firms primarily sell not only out of state but also to states with no corporate tax or where they have no nexus, then throwback rules dampen the effect discussed in the previous paragraph. That is, throwback rules limit the extent to which increases in sales apportionment factors reduce the incentives for firms to relocate establishments and employees. These results mirror those in columns 1 and 3, albeit with somewhat smaller magnitudes, perhaps because the assumptions needed about the location of sales do not always hold in the data.

E. Marginal Effective Tax Rates versus Statutory Rates

In table 12, we use the marginal ETR in lieu of the statutory rate. As discussed in Section I.B, the statutory rate may be more appropriate for considering extensive margin effects, while the ETR may be more appropriate for intensive margin effects. We compute the ETR using the procedure of Gruber and Rauh (2007). The left panel of table 12 examines all sectors. For ease of comparison, columns 1 and 3 reproduce our results from table 3. In columns 2 and 4, we then use the ETR. As is shown, the estimates based on the ETR change little at the extensive margin (col. 2). Importantly, and in line with the model of Devereux and Griffith (1998), the

[30] This compares to the main coefficient in table 3 of $\beta_{C,C} = -0.037$, which at the mean represented an effect of -0.52 percent in the number of establishments.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

ETR yields stronger results at the intensive margin (col. 4). Specifically, the elasticities are 17–37 percent larger compared to those obtained with the statutory rate.

In columns 5–10, we repeat this analysis for the manufacturing sector. Using the detailed data in the ASM/CMF, we can refine the ETR by accounting for the fact that firms with nonpositive profits have an ETR of zero. Specifically, we compute firm profits as the sum of plant-level profits (shipments minus all the cost items in the ASM/CMF) across all plants of the firm. We then set ETR to zero if firm profits are nonpositive ("income-adjusted ETR"). As is shown, the results for manufacturing mirror those for the full sample; that is, using the ETR matters little at the extensive margin (cols. 6 and 7) but yields stronger elasticities at the intensive margin (col. 9). The intensive margin elasticities are even stronger when we use the income-adjusted ETR (col. 10), and similar patterns are observed when studying capital (cols. 11–13).

IV. Heterogeneous Treatment Effects and General Equilibrium

A. *Heterogeneous Treatment Effects*

Firms in certain industries would be expected to be more sensitive to changes in tax rates. We examine these heterogeneous treatment effects in table 13, where the main tax variables of interest are interacted with three additional industry-level covariates: footloose industry, tradable industry, and labor-intensive industry. The *tradable industry* variable is the geographical Herfindahl index of firm activity from the study by Mian and Sufi (2014), who calculate the index on the basis of the share of each four-digit North American Industry Classification System (NAICS) industry's employment that falls within a county. Firms that are in more tradable industries supply their products from fewer counties and therefore must trade their products in order to reach a broader geography of demand. Firms in these tradable industries would be expected to respond more to tax policy than firms in which supply meets demand in the same location, such as local providers of services. The *footloose industry* variable is an alternative measure of concentration at the state level that also accounts for the state's share of overall activity. The index is defined for each four-digit NAICS industry i as $1 - \Sigma_p|s_{ip} - s_p|$, where s is an activity share and p is a state. An industry whose activities are less concentrated in a state than would be reflected in the state's share of overall activity s_p would be expected to have lower costs of moving and a higher value of this index.[31] The variable *labor-intensive industry* is the average ratio of labor and

[31] We construct this index using employment as the activity measure. The index has a mean of 0.31. We thank Steve Davis for suggesting this measure.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

TABLE 12
MARGINAL EFFECTIVE TAX RATES

	All Sectors				Manufacturing								
	Extensive Margin # Establishments		Intensive Margin Log(Employees)		Extensive Margin # Establishments			Intensive Margin (Employment) Log(Employees)			Intensive Margin (Capital) Log(Capital)		
	Baseline (1)	ETR (2)	Baseline (3)	ETR (4)	Baseline (5)	ETR (6)	ETR (Income-Adjusted) (7)	Baseline (8)	ETR (9)	ETR (Income-Adjusted) (10)	Baseline (11)	ETR (12)	ETR (Income-Adjusted) (13)
$\tau_C \times$ C-Corp	−.037***		−.0041***		−.022**			−.0035***			−.0024***		
	(.003)		(.0005)		(.009)			(.0011)			(.0008)		
$\tau_C \times$ Pass-Through	−.002		−.0004		.003			−.0003			.0000		
	(.003)		(.0010)		(.007)			(.0023)			(.0015)		
$\tau_P \times$ C-Corp	−.003		−.0007		.001			−.0010			−.0002		
	(.002)		(.0004)		(.005)			(.0008)			(.0005)		
$\tau_P \times$ Pass-Through	−.016***		−.0024***		−.013*			−.0026			−.0015		
	(.003)		(.0009)		(.007)			(.0022)			(.0015)		
$ETR_C \times$ C-Corp		−.039***		−.0056***		−.024**	−.023**		−.0048***	−.0058***		−.0031**	−.0035***
		(.005)		(.0009)		(.010)	(.010)		(.0015)	(.0012)		(.0013)	(.0012)
$ETR_C \times$ Pass-Through		−.002		−.0006		−.002	.001		−.0005	−.0005		.0003	.0001
		(.004)		(.0010)		(.009)	(.008)		(.0027)	(.0026)		(.0022)	(.0020)

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

$ETR_P \times$ C-Corp		−.002		−.0010		−.000	−.001		−.0006	−.0004		−.0006	−.0007
		(.004)		(.0010)		(.005)	(.005)		(.0014)	(.0014)		(.0010)	(.0010)
$ETR_P \times$ Pass-Through		−.016**		−.0028**		−.013	−.013		−.0028	−.0030		−.0018	−.0020
		(.006)		(.0012)		(.010)	(.009)		(.0028)	(.0025)		(.0023)	(.0020)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-state fixed effects	Yes	Yes	No	No	Yes	Yes	Yes	No	No	No	No	No	No
Establishment fixed effects	No	No	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
R^2	.73	.73	.88	.88	.77	.77	.77	.92	.92	.92	.96	.96	.96
Observations	32,997,200	32,997,200	27,600,100	27,600,100	5,325,600	5,325,600	5,325,600	854,700	854,700	854,700	854,700	854,700	854,700

NOTE.—This table presents variants of the baseline regressions in table 3. For ease of comparison, the baseline regressions are reproduced in cols. 1, 3, 5, 8, and 11. ETR is the marginal effective tax rate, which is computed using the procedure of Gruber and Rauh (2007). ETR (income-adjusted) sets ETR to zero if the firm's profits (the sum of shipments minus costs across all of the firm's plants) are negative. Standard errors are clustered at the state level.

* Significant at the 10 percent level.

** Significant at the 5 percent level.

*** Significant at the 1 percent level.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

TABLE 13
CROSS-SECTIONAL HETEROGENEITY

	# Establishments	Log(Employees)
$\tau_C \times$ C-Corp	−.013**	−.0014
	(.005)	(.0012)
$\tau_C \times$ C-Corp × Footloose industry	−.031***	−.0040***
	(.011)	(.0015)
$\tau_C \times$ C-Corp × Tradable industry	−.089***	−.0082**
	(.035)	(.0035)
$\tau_C \times$ C-Corp × Labor-intensive industry	−.042***	−.0051***
	(.013)	(.0009)
$\tau_C \times$ Pass-Through	.001	−.0001
	(.001)	(.0002)
$\tau_C \times$ Pass-Through × Footloose industry	−.000	−.0003
	(.010)	(.0010)
$\tau_C \times$ Pass-Through × Tradable industry	−.005	−.0007
	(.010)	(.0010)
$\tau_C \times$ Pass-Through × Labor-intensive industry	−.004	−.0005
	(.010)	(.0006)
$\tau_P \times$ C-Corp	.000	−.0005
	(.001)	(.0020)
$\tau_P \times$ C-Corp × Footloose industry	−.002	−.0005
	(.009)	(.0010)
$\tau_P \times$ C-Corp × Tradable industry	−.006	−.0009
	(.010)	(.0007)
$\tau_P \times$ C-Corp × Labor-intensive industry	−.010	−.0005
	(.007)	(.0005)
$\tau_P \times$ Pass-Through	−.005**	−.0008
	(.002)	(.0005)
$\tau_P \times$ Pass-Through × Footloose industry	−.014**	−.0026**
	(.006)	(.0012)
$\tau_P \times$ Pass-Through × Tradable industry	−.023*	−.0050**
	(.012)	(.0021)
$\tau_P \times$ Pass-Through × Labor-intensive industry	−.018***	−.0024**
	(.006)	(.0011)
Controls	Yes	Yes
Year fixed effects	Yes	Yes
Firm-state fixed effects	Yes	No
Establishment fixed effects	No	Yes
R^2	.73	.88
Observations	32,997,200	27,600,100

NOTE.—This table presents variants of the regressions in cols. 1 and 4 of table 3. Footloose industry is the footlooseness index at the four-digit NAICS level; tradable industry is the geographical Herfindahl index of Mian and Sufi (2014) at the four-digit NAICS level; labor-intensive industry is the average ratio of labor and pension expense to sales across all Compustat companies in the same two-digit SIC industry. The sample period is 1977–2011. Standard errors are clustered at the state level.

* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.

pension expense to sales across all Compustat (publicly traded) firms in the same two-digit Standard Industrial Classification (SIC) industry.

The first row of coefficients shows small and statistically weak responses to the corporate tax rate for C corporations that operate in nontradable

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

and nonfootloose industries with low labor intensity. At sample average values of footloose industry, tradable industry, and labor intensity for C corporations, the overall magnitude of the response of C corporations to the corporate tax rate would be −0.035 on the extensive margin and −0.41 percent on the intensive margin. At sample average values of footloose industry, tradable industry, and labor intensity for pass-through entities, the overall magnitude of the response of these entities to the corporate tax rate would be −0.015 on the extensive margin and −0.24 percent on the intensive margin. These are similar to the full sample estimates from table 3. In particular, C corporations respond more strongly to taxation when they are in footloose or tradable industries (reflecting their ability to meet demand in less local locations) or when they are in labor-intensive industries (reflecting the higher cost of moving labor than capital).

Table 14 explores the hypothesis that multinational firms would perhaps be expected to show larger effects as they also have the ability to move operations abroad. This analysis requires that we restrict the sample

TABLE 14
PUBLIC COMPANIES

	# ESTABLISHMENTS		LOG(EMPLOYEES)	
	(1)	(2)	(3)	(4)
$\tau_C \times$ C-Corp	−.044***		−.0048***	
	(.009)		(.0016)	
$\tau_P \times$ C-Corp	−.003		−.0005	
	(.004)		(.0012)	
$\tau_C \times$ C-Corp × Domestic		−.035***		−.0040**
		(.010)		(.0016)
$\tau_C \times$ C-Corp × Multinational		−.056***		−.0052***
		(.011)		(.0016)
$\tau_P \times$ C-Corp × Domestic		−.003		−.0005
		(.004)		(.0012)
$\tau_P \times$ C-Corp × Multinational		−.002		−.0004
		(.004)		(.0012)
Multinational		.245***		.0211***
		(.031)		(.0020)
Controls	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Firm-state fixed effects	Yes	Yes	No	No
Establishment fixed effects	No	No	Yes	Yes
R^2	.83	.83	.92	.92
Observations	3,370,600	3,370,600	8,428,900	8,428,900

NOTE.—This table presents variants of the regressions in cols. 1 and 4 of table 3, restricting the sample to public companies. Public companies are those with coverage in Standard & Poor's Compustat. Compustat is matched to the LBD using the SSEL-Compustat Bridge maintained by the US Census Bureau. Multinational is a dummy variable equal to one if the company has nondomestic segments in the Compustat Segment file. The sample period is 1977–2011. Standard errors are clustered at the state level.

* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

to publicly traded firms, for which we can identify nondomestic segments using the Compustat Segment file. Since public firms must be C corporations, the analysis will also be limited to the effects of tax rates on C corporations.

Columns 1 and 3 of table 14 show that public firms have a larger response to the state corporate tax rate than the average C corporation in the full sample. As is the case in the full sample, they do not respond to the personal tax rate. Columns 2 and 4 show substantially larger responses for multinational firms than for domestic firms, with coefficients that are 30–60 percent larger and elasticities of more than 0.5 for multinational public corporations. These firms may be more sophisticated in their tax planning, however.

Finally, we note that owners of pass-through entities whose businesses have nexus in other states will have to declare all of their income in their home state tax return but generally have the ability to claim a tax credit in their home state for any "foreign-state tax" that they pay in the states of nonresidence. Some differential predictions therefore emerge for pass-through entity owners residing in high-tax states (with satellites in low-tax states) versus pass-through entity owners residing in low-tax states (with satellites in high-tax states). The former group should be overall less sensitive to rates, and particularly insensitive to the rates of the low-tax states where they have satellites, as the foreign-state tax they pay will be taken as a full credit against the home-state tax. The latter group should be more sensitive to rates, particularly to the rates of the high-tax states where they have satellites, as the foreign tax they pay cannot be fully used as a credit against their relatively low home-state taxes.[32] Pass-through entities in which the owner is in the lower-tax states show 1.4–1.8 times stronger coefficient responses on both the extensive and intensive margins, consistent with the theory.

B. General Equilibrium

In this section, we examine the question of the overall effects of state-level corporate tax changes. One way in which the overall effects could be smaller than we measure in the analysis above is through general equilibrium effects. That is, the establishments and employees that the multistate firms in our sample drop in response to tax increases might perhaps be picked up by the firms that are not in our sample: smaller, single-state establishments or, conversely, establishments and employees that firms in our sample add in response to tax cuts could be taken from the smaller, single-state firms. The firms that are in the main sample of multistate firms

[32] These issues to some extent parallel considerations in the international taxation of multinationals. See Hines (1997, 2009) for reviews.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

with more than 100 employees represent only 15.4 percent of the universe of US private-sector establishments in the LBD, but they represent 68.6 percent of LBD employment.

To study this question, we conduct employment count analysis on the US census data aggregated to the level of state-LFO-year in two subsamples: the establishments of multistate firms with more than 100 employees that make up the primary sample for our paper and the complementary group of smaller and single-state establishments. The results in column 1 of table 15 echo the main results in table 3, in the collapsed sample of multistate firms with more than 100 employees. This column 1 shows total employment effects of −0.4 percent for C corporations with respect to the corporation tax and −0.2 percent for pass-through entities with respect to the personal tax, respectively. The analysis with "other establishments" in column 2 shows coefficients that are similar in sign, smaller in magnitude, and not statistically significant. The other establishments therefore do not pick up the labor released by the larger, multistate establishments in response to the tax increases. If they did, we would expect oppositely signed coefficients. If anything, the single-state firms respond in the same direction, although the effects are less than half the magnitude and are not statistically significant.

TABLE 15
General Equilibrium

	Log(Employees)	
	Establishments of Multistate Firms with More than 100 Employees (1)	Other Establishments (2)
$\tau_C \times$ C-Corp	−.0039**	−.0014
	(.0016)	(.0010)
$\tau_C \times$ Pass-Through	.0006	.0003
	(.0015)	(.0011)
$\tau_P \times$ C-Corp	−.0003	.0003
	(.0009)	(.0006)
$\tau_P \times$ Pass-Through	−.0018**	−.0006
	(.0008)	(.0006)
Controls	Yes	Yes
Year fixed effects	Yes	Yes
LFO-state fixed effects	Yes	Yes
R^2	.92	.89
Observations	3,600	3,600

Note.—This table presents state-level analogues of the regressions in table 3. The unit of observation is the state-LFO-year. Employment is aggregated at the state-LFO-year level using all establishments in our sample (col. 1) and all other LBD establishments (col. 2). The sample period is 1977–2011. Standard errors are clustered at the state level.

* Significant at the 10 percent level.

** Significant at the 5 percent level.

*** Significant at the 1 percent level.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

V. Conclusions

In this paper we have estimated economic responses to state-level business taxation by multistate firms on both the extensive and intensive margins, allowing each firm to have nontax reasons to locate in each state. Even under this strict formulation, we find evidence consistent with substantial responses of these firms to state tax rates for the relevant tax rules. Corporate entities reduce the number of establishments per state and the number of employees and amount of capital per plant when state tax rates increase. Pass-through entities respond similarly to changes in state-level personal tax rates, although in somewhat smaller magnitude. Our specifications suggest that around half of these responses are due to reallocation of business activity to lower-tax states.

We have implemented a number of techniques and robustness tests to validate that the results are not due to spurious correlations between tax rate changes and state business activity. Most importantly, the lack of cross-correlations between corporate tax rates and pass-through entity behavior, as well as vice versa, supports the identifying assumption in these regressions that there are not state-level trends in general business activity that follow changes in tax policy for reasons unrelated to the tax policy changes themselves. Responses begin upon implementation of the tax policy, and we find no evidence of trends prior to the treatment.

One key implication of our results is that firms apparently respond to state taxes as much through reallocating labor as they do through reallocating capital. In the context of inframarginal decisions in traditional incidence models, these findings would seem to suggest a very low elasticity of substitution between factors of production. Indeed, traditional incidence models have viewed capital as the mobile factor, while less mobile labor remains and bears the burden of the tax through lower wages. Our findings point instead toward the ability of firms to hire and fire workers in response to state tax policy, moving their utilization of labor to those jurisdictions where they also move their capital to take advantage of lower taxes on capital. The results point to a strong response on the labor quantity margin. This could be due in part to direct labor mobility, or it could reflect slack in labor force participation. Employees can be drawn into or pushed out of the local labor force by tax-induced shifts in labor demand by businesses. Further research is necessary to explore these channels.

Three additional topics left for further study are as follows. First, our work does not calculate the effects of changes in state tax policy on taxable income, neither the direct impacts nor the offsets due to the reallocation of economic activity. Second, the differential taxation of C corporations and pass-through entities could distort competition by giving an advantage to one type of firm or another. Investigating the impact of state taxation on the product market would shed light on this phenomenon.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

Third, we have controlled for non-income-based state and local taxes, such as unemployment insurance, sales taxes, and property taxes, but more work remains to be done on the impact of changes in these taxes and their structure on business activity.

References

Aronson, Richard, and John L. Hilley. 1986. *Financing State and Local Governments*. Washington, DC: Brookings Inst.

Auerbach, Alan J. 2006. "Who Bears the Corporate Tax? A Review of What We Know." In *Tax Policy and the Economy*, vol. 20, edited by James M. Poterba, 1–14. Cambridge, MA: MIT Press (for NBER).

Baker Tilly. 2014. "Pass-Through Entities and Personal Income Taxes." *Baker Tilly Insights*, October 28.

Bania, Neil, Jo Anna Gray, and Joe A. Stone. 2007. "Growth, Taxes, and Government Expenditures: Growth Hills for U.S. States." *Nat. Tax J.* 60 (2): 193–204.

Bartik, Timothy J. 1985. "Business Location Decisions in the United States: Estimates of the Effects of Unionization, Taxes, and Other Characteristics of States." *J. Bus. and Econ. Statis.* 3 (1): 14–22.

———. 1991. *Who Benefits from State and Local Economic Development Policies?* Kalamazoo, MI: Upjohn Inst. Employment Res.

Becker, Randy A., and John Haltiwanger. 2006. "Micro and Macro Data Integration: The Case of Capital." In *A New Architecture for the U.S. National Accounts*, edited by Dale W. Jorgenson, J. Steven Landefeld, and William D. Nordhaus, 541–610. Chicago: Univ. Chicago Press.

Brüllhart, Marius, Mario Jametti, and Kurt Schmidheiny. 2012. "Do Agglomeration Economies Reduce the Sensitivity of Firm Location to Tax Differentials?" *Econ. J.* 122 (563): 1069–93.

Carlton, Dennis W. 1979. "Why Do Firms Locate Where They Do? An Econometric Model." In *Interregional Movements and Regional Growth*, edited by William Wheaton. Washington, DC: Urban Inst.

———. 1983. "The Location and Employment Choices of New Firms: An Econometric Model with Discrete and Continuous Endogenous Variables." *Rev. Econ. and Statis.* 65 (3): 440–49.

Congressional Budget Office. 2012. "Taxing Business through the Individual Income Tax." Publication no. 4298, Congressional Budget Office, Washington, DC.

Cooper, Michael, John McClelland, James Pearce, et al. 2015. "Business in the United States: Who Owns It and How Much Tax Do They Pay?" Working Paper no. 21651, NBER, Cambridge, MA.

Coughlin, Cletus C., Joseph V. Terza, and Vachira Arromdee. 1991. "State Characteristics and the Location of Foreign Direct Investment within the United States." *Rev. Econ. and Statis.* 73 (4): 675–83.

Davis, Steven J., and John Haltiwanger. 1992. "Gross Job Creation, Gross Job Destruction, and Employment Reallocation." *Q.J.E.* 107 (3): 819–63.

Devereux, Michael P., and Rachel Griffith. 1998. "Taxes and the Location of Production: Evidence from a Panel of US Multinationals." *J. Public Econ.* 68 (3): 335–67.

———. 2003. "Evaluating Tax Policy for Location Decisions." *Internat. Tax and Public Finance* 10 (2): 107–26.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

Devereux, Michael P., Rachel Griffith, and Helen Simpson. 2007. "Firm Location Decisions, Regional Grants and Agglomeration Externalities." *J. Public Econ.* 91 (3–4): 413–35.

Devereux, Michael P., Ben Lockwood, and Michela Redoano. 2008. "Do Countries Compete over Corporate Tax Rates?" *J. Public Econ.* 92 (5–6): 1210–35.

Duranton, Gilles, Laurent Gobillon, and Henry G. Overman. 2011. "Assessing the Effects of Local Taxation Using Microgeographic Data." *Econ. J.* 121 (555): 1017–46.

Fajgelbaum, Pablo D., Eduardo Morales, Juan-Carlos Suarez Serrato, and Owen M. Zidar. 2019. "State Taxes and Spatial Misallocation." *Rev. Econ. Studies* 86 (1): 333–76.

Fox, William F. 1981. "Fiscal Differentials and Industrial Location: Some Empirical Evidence." *Urban Studies* 18 (1): 105–11.

———. 1986. "Tax Structure and the Location of Economic Activity Along State Borders." *Nat. Tax J.* 39 (4): 387–401.

Fullerton, Don. 1984. "Which Effective Tax Rate?" *Nat. Tax J.* 37 (1): 23–41.

Gabe, Todd M., and Kathleen P. Bell. 2004. "Tradeoffs between Local Taxes and Government Spending as Determinants of Business Location." *J. Regional Sci.* 44 (1): 21–41.

Gale, William G., Aaron Krupkin, and Kim Rueben. 2015. "The Relationship between Taxes and Growth at the State Level: New Evidence." *Nat. Tax J.* 68 (4): 919–42.

Goolsbee, Austan. 1998. "Taxes, Organizational Form and the Deadweight Loss of the Corporate Income Tax." *J. Public Econ.* 69 (1): 143–52.

———. 2004. "The Impact of the Corporate Income Tax: Evidence from State Organizational Form Data." *J. Public Econ.* 88 (11): 2283–99.

Goolsbee, Austan, and Edward L. Maydew. 2000. "Coveting Thy Neighbor's Manufacturing: The Dilemma of State Income Apportionment." *J. Public Econ.* 75 (1): 125–43.

Gordon, Roger, and Julie B. Cullen. 2006. "Tax Reform and Entrepreneurial Activity." In *Tax Policy and the Economy*, vol. 20, edited by James M. Poterba, 41–71. Cambridge, MA: MIT Press (for NBER).

Gordon, Roger, and Jeffrey K. MacKie-Mason. 1990. "Effects of the Tax Reform Act of 1986 on Corporate Financial Policy and Organizational Form." In *Do Taxes Matter?* edited by Joel Slemrod. Cambridge, MA: MIT Press.

———. 1994. "Tax Distortions to the Choice of Organizational Form." *J. Public Econ.* 55 (2): 279–306.

———. 1997. "How Much Do Taxes Discourage Incorporation?" *J. Finance* 52 (2): 477–505.

Gordon, Roger, and John D. Wilson. 1986. "An Examination of Multijurisdictional Corporate Income Taxation under Formula Apportionment." *Econometrica* 54 (6): 1357–73.

Gravelle, Jane G. 1994. *The Economic Effects of Taxing Capital Income*. Cambridge, MA: MIT Press.

Gravelle, Jane G., and Laurence J. Kotlikoff. 1988. "Does the Harberger Model Greatly Understate the Excess Burden of the Corporate Income Tax?" Working Paper no. 2742, NBER, Cambridge, MA.

———. 1989. "The Incidence and Efficiency Costs of Corporate Taxation When Corporate and Noncorporate Firms Produce the Same Good." *J.P.E.* 97 (4): 749–80.

———. 1993. "Corporate Tax Incidence and Inefficiency When Corporate and Noncorporate Goods Are Close Substitutes." *Econ. Inquiry* 31 (4): 501–16.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

Gravelle, Jennifer. 2013. "Corporate Tax Incidence: Review of General Equilibrium Estimates and Analysis." *Nat. Tax. J.* 66 (1): 185–214.
Grieson, Ronald E. 1980. "Theoretical and Empirical Analysis of the Effects of the Philadelphia Income Tax." *J. Urban Econ.* 8 (1): 123–37.
Grieson, Ronald E., William Hamovitch, Albert M. Levenson, and Richard D. Morgenstern. 1977. "The Effect of Business Taxation on the Location of Industry." *J. Urban Econ.* 4 (2): 170–85.
Gruber, Jonathan, and Joshua Rauh. 2007. "How Elastic Is the Corporate Income Tax Base?" In *Taking Corporate Income in the 21st Century*, edited by Alan J. Auerbach, James R. Hines, and Joel Slemrod. Cambridge: Cambridge Univ. Press.
Grubert, Harry, and John Mutti. 2000. "Do Taxes Influence Where U.S. Corporations Invest?" *Nat. Tax J.* 53 (4): 825–40.
Guimaraes, Paulo, Octavio Figueiredo, and Douglas Woodward. 2003. "A Tractable Approach to the Firm Location Decision Problem." *Rev. Econ. and Statis.* 85 (1): 201–4.
———. 2004. "Industrial Location Modeling: Extending the Random Utility Framework." *J. Regional Sci.* 44 (1): 1–20.
Gupta, Sanjay, and Lillian Mills. 2002. "Corporate Multistate Tax Planning: Benefits of Multiple Jurisdictions." *J. Accounting and Econ.* 33 (1): 117–39.
Hall, Robert E., and Dale W. Jorgenson. 1967. "Tax Policy and Investment Behavior." *A.E.R.* 57 (3): 391–414.
Harberger, Arnold. 1962. "The Incidence of the Corporate Income Tax." *J.P.E.* 70 (3): 215–40.
Hausman, Jerry, Bronwyn Hall, and Zvi Griliches. 1984. "Econometric Models for Count Data with an Application to the Patents-R&D Relationship." *Econometrica* 52 (4): 909–38.
Hellerstein, Jerome, Walter Hellerstein, and John Swain. 2014. *State Taxation.* 3rd ed. Valhalla, NY: Thomson Reuters.
Helms, L. Jay. 1985. "The Effect of State and Local Taxes on Economic Growth: A Time Series–Cross Section Approach." *Rev. Econ. and Statis.* 67 (4): 574–82.
Hines, James R. 1996. "Altered States: Taxes and the Location of Foreign Direct Investment in America." *A.E.R.* 86 (5): 1076–94.
———. 1997. "Tax Policy and the Activities of Multinational Corporations." In *Fiscal Policy: Lessons from Economic Research*, edited by Alan J. Auerbach, 401–45. Cambridge, MA: MIT Press.
———. 2009. "Reconsidering the Taxation of Foreign Income." *Tax Law Rev.* 62 (2): 269–98.
Holcombe, Randall G., and Donald L. Lacombe. 2004. "The Effect of State Income Taxation on Per Capita Income Growth." *Public Finance Rev.* 32 (3): 292–312.
Holmes, Thomas J. 1998. "The Effect of State Policies on the Location of Manufacturing: Evidence from State Borders." *J.P.E.* 106 (4): 667–705.
Horstmann, Ignatius, and James Markusen. 1992. "Endogenous Market Structures in International Trade (Natura Facit Saltum)." *J. Internat. Econ.* 32 (1–2): 109–29.
Jarmin, Ron S., and Javier Miranda. 2003. "The Longitudinal Business Database." Working Paper no. 02-17, Center Econ. Studies, US Census Bur., Washington, DC.
Klassen, Kenneth J., and Douglas Shackelford. 1998. "State and Provincial Corporate Tax Planning: Income, Sales, Assets, and Compensation Management." *J. Accounting and Econ.* 25 (3): 385–406.
Kotlikoff, Laurence J., and Lawrence H. Summers. 1987. "Tax Incidence." In *Handbook of Public Economics*, edited by Alan J. Auerbach and Martin S. Feldstein, 1043–92. Amsterdam: North-Holland.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).

Ladd, Helen F. 1993. "State Responses to the TRA86 Revenue Windfalls: A New Test of the Flypaper Effect." *J. Policy Analysis and Management* 12 (1): 82–103.
Lichtenberg, Frank R. 1992. *Corporate Takeovers and Productivity*. Cambridge, MA: MIT Press.
Ljungqvist, Alexander, and Michael Smolyansky. 2016. "To Cut or Not to Cut? On the Impact of Corporate Taxes on Employment and Income." Finance and Economics Discussion Paper no. 2016-006, Board Governors Fed. Reserve System, Washington, DC.
McLure, Charles E. 1980. "The State Corporate Income Tax: Lambs in Wolves' Clothing." In *The Economics of Taxation*, edited by Henry J. Aaron and Michael J. Boskin. Washington, DC: Brookings Inst.
———. 1981. "The Elusive Incidence of the Corporate Income Tax: The State Case." *Public Finance Q.* 9 (4): 395–413.
Mertens, Karel, and Morten O. Ravn. 2014. "A Reconciliation of SVAR and Narrative Estimates of Tax Multipliers." *J. Monetary Econ.* 68 (suppl.): S1–S19.
Mian, Atif, and Amir Sufi. 2014. "What Explains the 2007–2009 Drop in Employment?" *Econometrica* 82 (6): 2197–2223.
Mofidi, Alaeddin, and Joe A. Stone. 1990. "Do State and Local Taxes Affect Economic Growth?" *Rev. Econ. and Statis.* 72 (4): 686–91.
Moretti, Enrico, and Daniel Wilson. 2017. "The Effect of State Taxes on the Geographical Location of Top Earners: Evidence from Star Scientists." *A.E.R.* 107 (7): 1858–1903.
Newman, Robert J. 1983. "Industry Migration and Growth in the South." *Rev. Econ. and Statis.* 65 (1): 76–86.
Papke, Leslie. 1987. "Subnational Taxation and Capital Mobility: Estimates of Tax-Price Elasticities." *Nat. Tax J.* 40 (2): 191–203.
———. 1991. "Interstate Business Tax Differentials and New Firm Location: Evidence from Panel Data." *J. Public Econ.* 45 (1): 47–68.
Rathelot, Roland, and Patrick Sillard. 2008. "The Importance of Local Corporate Taxes in Business Location Decisions: Evidence from French Micro Data." *Econ. J.* 118 (527): 499–514.
Reed, W. Robert. 2008. "The Robust Relationship between Taxes and U.S. State Income Growth." *Nat. Tax J.* 61 (1): 57–80.
Romer, Christina D., and David H. Romer. 2010. "The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks." *A.E.R.* 100 (3): 763–801.
Shoven, John B. 1976. "The Incidence and Efficiency Effects of Taxes on Income from Capital." *J.P.E.* 84 (6): 1261–84.
Suarez Serrato, Juan-Carlos, and Owen M. Zidar. 2016. "Who Benefits from State Corporate Tax Cuts? A Local Labor Markets Approach with Heterogeneous Firms." *A.E.R.* 106 (9): 2582–2624.
Swain, John, and Walter Hellerstein. 2013. "State Jurisdiction to Tax 'Nowhere' Activity." *Virginia Tax Rev.* 33 (2): 209–68.
Wasylenko, Michael. 1991. "Empirical Evidence on Interregional Business Location Decisions and the Role of Fiscal Incentives in Economic Development." In *Industry Location and Public Policy*, edited by Henry W. Herzog Jr. and Alan M. Schlottmann. Knoxville: Univ. Tennessee Press.
Wasylenko, Michael, and Therese McGuire. 1985. "Jobs and Taxes: The Effect of Business Climate on States' Employment Growth Rates." *Nat. Tax J.* 38 (4): 497–511.
Yagan, Daniel. 2015. "Capital Tax Reform and the Real Economy: The Effects of the 2003 Dividend Tax Cut." *A.E.R.* 105 (12): 3531–63.

This content downloaded from 198.091.037.002 on September 24, 2019 14:28:19 PM
All use subject to University of Chicago Press Terms and Conditions (http://www.journals.uchicago.edu/t-and-c).