The Effects of Unemployment Insurance Taxation on Multi-Establishment Firms

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Abstract

In the US states administer their own unemployment insurance programs, and cross-state variation leads to significant differences in tax costs faced by employers in different states. Leveraging the existing locations of multi-state manufacturing firms for identification, I find that high tax plants were more likely to exit during economic downturns and less likely to hire during the recovery. Moving a plant's outside option from a high tax state to a low tax state would increase likelihood of exit by 20% during the Great Recession. This suggests that decentralized administration of UI may contribute to jobless recoveries and additional misallocation.

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1 Introduction

Unemployment Insurance (UI) provides laid off workers with weekly benefits while they search for a new job, and is funded through payroll taxes on employers. The U.S. is unique in that UI is administered at the state rather than national level, producing variation in UI tax costs which has been growing over time: Maximum per-worker UI taxes range from less than \$400 to more than \$2000 per year across states. Since the Great Recession there has been a renewed interest in studying the effects of UI benefits on workers (Schmieder et al. (2012), Kroft and Notowidigdo (2016), Chodorow-Reich et al. (2018), among others). However, an equally important yet understudied question is how firms respond to UI taxation, since firms that lay off workers face future UI tax increases. A large literature studies the determinants of firm location decisions (Carlton (1983), Black and Hoyt (1989), Chirinko and Wilson (2008), Mast (2020), Slattery (2019)), but the loss of major employers from the closing of large manufacturing plants can also be detrimental to local populations. In 2003 Boeing cited the high cost of unemployment insurance taxes in Washington state as one reason for seeking to move some of its manufacturing to another state.[1] So do differences in state business tax costs affect firms' choices of where to close establishments during economic downturns?

This paper addresses both of these questions by studying how state-level differences in maximum UI taxes affect manufacturing firms with locations in more than one state. It provides the first evidence for multi-state firms of UI taxes influencing the choice of plant closures, and strategic labor demand responses in order to minimize overall UI tax burden. The study of multi-state firms is important because while employer tax rates are an increasing function of previous UI benefit claims (called "experience rating"), states only count UI claims within their own state when assigning employer tax rates. A firm's layoffs in one state does not affect its tax rates in the other states it operates in, and multi-state firms can minimize future UI tax costs by concentrating their layoffs in a single state. Furthermore, firms that exit from a state are no longer liable for any UI taxes, creating an additional

[1] "The Boeing State Fights to Build the Next Jet," *New York Times*, June 10, 2003.

incentive for multi-state firms to strategically exit from high tax states.

Suppose two firms are producing motor vehicle parts, and have plants located in three states in the industrial Midwest. Both firms have half of their employment headquartered in Illinois, and Firm A's remaining employment is located in Ohio (20%) and Indiana (30%) while Firm B's other two locations are in Ohio (20%) and Iowa (30%). During the Great Recession, both firms need to drastically downsize by cutting employment by 30%. Absent UI tax differences and assuming within-firm employment shares are correlated with productivity, both firms would find it optimal to shut down their smallest plants in Ohio and make the remaining cuts to employment through layoffs at their other locations. However, UI tax costs are not equal across these states: Ohio and Illinois have maximum UI taxes of around $850/year, while Indiana has one of the lowest in the nation at only $392/year. Iowa on the other hand has a relatively high maximum of $1824/year due to both a higher maximum tax rate and a larger taxable wage base. Since the UI tax cost of layoffs in Ohio is relatively cheaper than in Iowa, Firm B may find it more profitable to close their plant in Iowa instead of Ohio and avoid UI tax increases altogether. In this way, Firm A is more likely to exit from Ohio than Firm B is due to differing "outside options".

My research design compares manufacturing establishments in the same state and year, but owned by firms with locations in different combinations of states. Using microdata on the universe of employer establishments in the United States allows me to identify all locations of multi-state firms, which make up more than half of all manufacturing employment. I calculate the difference in maximum per-capita UI taxes between a plant in state s and the employment-weighted mean of all the firm's locations, and test whether differences in this measure causes firms to shut down their relatively high tax locations. This methodology allows me to include state-by-year fixed effects to control for other state policies or economic conditions that could also influence exit. From 1997–2014, a one standard deviation increase in relative UI tax costs increased the likelihood of exit by 5% relative to the mean (or 0.2 percentage points). This average effect is entirely driven by years when firms are experiencing negative shocks and are more likely to be cutting a large share of employment. During the Great Recession, one standard deviation increase in relative UI tax costs increased the likelihood of exit by 10% relative to the mean. These findings are robust to controlling for additional plant-level characteristics such as revenue TFP, capital assets, and labor share. Additionally, plants with greater capital assets per worker are less responsive to UI tax costs while plants with higher labor shares are more responsive.

A similar framework is used to study how multi-state firms adjust employment on the intensive margin. Because tax rates are typically a function of layoffs in the previous 3-5 years, a firm that laid off workers but did not exit during the Great Recession would experience a substantial increase in UI tax rates in 2011 and 2012. This makes hiring new labor more costly in years following recessions, and coincides with periods when firms are especially cash-constrained. I use a subsample of matched employer-employeee data to analyze the effect of UI tax costs on the hiring margin and find that in 2011, a $400 increase in relative tax costs decreased the probability of any hire by 1 percentage point, and decreased total hiring by 7%.

Higher maximum UI taxes should also incentivize employers to smooth employment over time, because they are essentially an adjustment cost for laying off workers. If a firm operates in both a high tax state and a low tax state, they may respond to small fluctuations in labor demand by adjusting employment more in the low tax state in order to keep employment stable in the high tax state. Looking at three separate periods of relative stability – before the 2001 recession, before the Great Recession, and after the Great Recession – I also find evidence that plants located in states with higher maximum UI taxes had lower measured employment volatility over each period.

While there is a large literature studying optimal unemployment insurance and the effects of UI generosity on labor supply,[2] the financing of UI benefits is a relatively under-

[2]Optimal design of benefits: Baily (1978), Chetty (2006), Kolsrud et al. (2018), Ganong and Noel (2019), Landais et al. (2018); Labor supply effects: Lalive (2008), Chetty (2008), Card et al. (2015), Farber et al. (2015), Johnston and Mas (2018)

studied topic.[3] Early papers such as Feldstein (1976), Topel (1983), and Card and Levine (1994) provide theory and evidence that greater experience rating decreases the prevalence of temporary layoffs, and Anderson (1993) shows that higher UI taxes stabilize seasonal fluctuations in labor demand. More recently, Johnston (2018) shows that UI tax increases greatly decreased hiring after the Great Recession.

The major contribution of this paper is the analysis of multi-establishment firms, as the previous literature has modeled all employers as single-unit firms. I propose an additional margin of adjustment available to multi-state firms: Exiting from a state in order to avoid UI tax increases associated with layoffs. My results show that this margin is economically important and can cause plants to shut down at higher rates than otherwise during economic downturns.

A second contribution of this paper relates to the study of state business taxation and firm location.[4] Suárez Serrato and Zidar (2016) find that firm owners are not perfectly mobile across states, and Moretti and Wilson (2017) provide evidence of large migration responses of star scientists to changes in state personal and corporate income tax rates. Giroud and Rauh (2019) show that state personal and corporate income tax rates affect the amount of business activity and capital reallocation within multi-establishment firms. While much of the existing literature has focused on the effect of corporate or personal income tax rates, this is to my knowledge the first paper to explicitly study the effect of UI taxes on firm location.[5] And as a payroll tax, firms are required to pay UI taxes regardless of whether they are profitable, producing additional financial constraints during economic downturns. Unlike most payroll taxes studied in the previous literature,[6] the fact that firm-specific UI tax costs vary from year-to-year makes them more difficult to fully pass onto workers due

[3] Saffer (1982), Wolcowitz (1984), Albrecht and Vroman (1999), Ratner (2013), Schoenherr et al. (2019) Also related is the literature on firing costs: Bentolila and Bertola (1990), Bertola (1992), Autor et al. (2006)

[4] Bartik (1985), Papke (1991), Holmes (1998), Goolsbee and Maydew (2000), Duranton et al. (2011), Rohlin et al. (2014)

[5] Appendix Figure A.2 compares total state tax revenues from corporate income and unemployment insurance over time, showing that they are relatively close in magnitude. The other major payroll taxes, Social Security (6.2%) and Medicare (1.45%), are invariant across states.

[6] Gruber (1997), Saez et al. (2012), Ku et al. (2018), Saez et al. (2019)

to downward wage rigidities. Anderson and Meyer (1997) and Anderson and Meyer (2000) find evidence that changes in UI tax rates at the state-industry level can be passed on to workers' wages but firm-level variation cannot. Johnston (2018) also found no effect of UI taxes on worker earnings.

Finally, this paper contributes to the literature on within-firm reallocation and causes of misallocation in the economy.[7] Hopenhayn and Rogerson (1993) illustrate in a macro model how labor market regulations in the form of firing costs can result in lower average productivity. Decker et al. (2016) finds evidence of declining reallocation rates across firms, and posit that rising adjustment costs could decrease firms responses to shocks. Foster et al. (2016) also show that during the Great Recession, plant closures were less productivity enhancing than in previous recessions. My findings show that state-level UI tax costs influence the employment and location decisions of multi-establishment firms, at the expense of plant-level productivity. Therefore, growing differences in UI tax costs over time could be one of the adjustment costs that contribute to misallocation at the firm level if firms are making employment and location decisions based on tax costs rather than productivity-related characteristics.

In the next section, I provide additional background on US Unemployment Insurance and variation in state UI taxes. Section 3 describes the data and construction of my analysis sample, and Section 4 presents the research design and identification strategy. Section 5 describes my main results on plant closures. Section 6 analyzes additional employment outcomes, and Section 7 concludes.

[7] Cooper and Haltiwanger (2006), Hsieh and Klenow (2009), Bartelsman et al. (2013), Asker et al. (2014), Giroud and Mueller (2015), Kehrig and Vincent (2017), Restuccia and Rogerson (2017), Syverson (2017)

2 Institutional Background

Over 90% of workers are covered by unemployment insurance, and every month there are more than a million new claimants[8]. Every year states collect $40-50 billion in UI tax revenues, and in 2009 during the Great Recession, over $80 billion in UI benefits were paid out to laid off workers. The first Unemployment Insurance program was enacted in Wisconsin in 1932, but UI was not widely adopted by states until the Social Security act of 1935 signed a federal mandate into law. Thus states have continued to administer their own UI programs under guidelines established by federal law, with benefit and tax schedules set at the state level. All firms establish state-specific UI accounts and there is no linkage of accounts across states for multi-state firms; thus the UI taxes firms face in each state are independent of their other locations.

Each state sets a taxable wage base W, and every employer in a state is assigned an employer-specific tax rate τ that is increasing in previous UI benefit claims. Thus each worker a firm employs has a UI tax cost of $\tau * W$, for the first W in annual earnings (ie: 4% of first $10,000 of wages equals a per-capita tax of $400 per worker). States use different formulas to calculate employer tax rates, but all are increasing functions of the dollar value of UI benefits paid out to previously laid off employees.[9] This incentivizes employers to keep employment stable, as otherwise firms could freely place workers on temporary layoff during periods of low demand. However, as a way to insure firms from particularly negative shocks, states also implement minimum and maximum tax rates. The tax rate schedule varies greatly between states, with the minimum rate usually ranging from 0–1% and the maximum rate ranging from 5.4 to more than 10%. New firms are charged a uniform "new

[8] Unemployment Insurance Data Summary (`https://workforcesecurity.doleta.gov/unemploy/content/data.asp`)

[9] The reserve-ratio formula (used in 29 states) assigns each firm an experience rating based on its UI reserves to payroll ratio over previous years; the benefit-ratio formula (used in 19 states) calculates experience ratings as a function of each firm's UI benefit claims to payroll ratio in previous years; and the benefit-wage-ratio formula (used in Delaware and Oklahoma) simply adjusts the experience rating so that the amount raised is approximately equal to the amount in UI benefits paid out to workers laid off from the firm. The last state, Alaska, uses a Payroll Formula that determines the tax rate based on declines in the employer's quarterly payroll.

employer rate" (which usually ranges from 2 to 4% depending on the state) for the first 2-3 years until an experience rating can be determined according to state formulas.

Besides differences in the maximum tax rate, the other major source of variation across states is the level of the taxable wage base. While some states have indexed their tax bases to average annual wages so that they automatically increase over time (referred to as "flexible" taxable wage bases), the federal government only mandates a minimum tax base of $7000. Therefore, employers in most states face imperfect experience rating in the sense that the marginal tax cost from an additional UI claimant is less than the value of UI benefits claimed. This produces an implicit subsidy for employers that heavily utilize layoffs, especially in states with lower maximum UI taxes. Additionally, the low taxable wage base in many states means that UI tax costs are also regressive for low-wage and part-time workers. The last time the Federal government increased the taxable wage base in 1982, the $7000 mandated tax base covered about 43% of total payroll. Today however, the same $7000 base covers less than 20%.

Figure 1 shows an example UI tax schedule from Texas: the employer-specific tax rate is an increasing function of previous UI benefit claims (the Benefit Ratio) and the taxable wage base in Texas is $9000. The tax is then levied as a per-worker payroll tax (ie: 5.4% on the first $9000 in wages). Importantly, UI taxes are capped at the maximum tax rate, so that even employers who frequently lay off workers are never liable for more than the maximum tax rate in the state. In this case, employers in Texas will pay a maximum of 6.25% * 9000 = $563.4 per worker per year. Therefore, employers in states with higher maximum rates and/or larger taxable wage bases will face on average larger UI tax costs per worker after economic downturns. Although there are multiple dimensions in which UI taxes can vary across states, the greatest differences arise from variation in the maximum tax rate and the taxable wage base. Therefore I define the maximum UI tax = max rate * taxable wage base as my summary measure of state UI tax costs. Though the maximum is not normally binding for employers that do not experience mass layoffs, it *is* the relevant cutoff for an employer considering the potential future tax increase from a major layoff. And as evidenced by trends in U.S. manufacturing employment (Appendix Figure A.3), manufacturing firms were downsizing significantly during this time.

At the outset UI coverage at the firm level was much more restrictive than it is today, but various reforms have liberalized the program over time so that at its height in 1985 it covered 96% of wage and salary workers (Price (1985)). Coverage is required for all employees who work at least 1 day a week for 20 weeks in a year, or have a quarterly payroll of $1500 or more; this definition covers even part-time work and brief job spells. Although certain types of workers (medical interns in hospitals, students working at school, agricultural workers on small farms) are exempt from unemployment insurance taxation, most business establishments will be subject to these taxes. The other major exemption from UI taxation are self-employed independent contractors, who are exempt from other payroll tax costs and employer benefits as well.

2.1 Variation in UI Taxes Across States

Figure 2 shows the degree of variation in maximum UI taxes across states in the US, with the maximum per-capita tax ranging from less than $400/year in low UI tax states such as Indiana and Florida, to over $2000/year in high UI tax states such as Minnesota and Utah. Although many low tax states are located in the South, there is still a large degree of variation in the Industrial Belt where manufacturing has traditionally been concentrated. Figure 3 shows that maximum UI taxes are highly correlated with the actual levels of UI taxes paid by employers, and are therefore a good proxy for UI tax costs across states. On the other hand, the variation in maximum UI taxes is not very correlated with other state-level costs such as average wages, corporate income tax rates, and union membership.[10]

Furthermore, the variation in maximum UI taxes has been growing over time as some states index their taxable wage bases to average wages while low tax states keep their taxes

[10] See Appendix Figure A.4

at the \$7000 federally mandated minimum, which hasn't been updated since 1982. While two-third of US states automatically index their maximum weekly UI benefits to rise in proportion to average annual wages, only 16 states index their taxable wage base the same way.[11] I will refer to these states with flexible taxable wage bases as "Flex" states. Appendix Figure A.5 shows the distribution of Flex states across the nation. While they are predominantly concentrated in the Northwest, they also include states such as Iowa, New Jersey, North Carolina, and Oklahoma. Figure 4 tracks average maximum UI taxes over time, and shows the growing divergence in UI taxes between these 16 Flex states versus the rest in the last two decades. The gap in average maximum taxes between these two groups of states has grown from a mere \$45 (2014 dollars) in 1983, to \$611 in 1997 and a whopping \$1130 by 2014. The consequences of this divergence are also apparent in Figure 5, which shows that average industry UI taxes in Flex states increased by much more after the Great Recession. Since low tax states are capped by their relatively low maximum UI taxes, they experienced less of a spike in taxes in 2011 and 2012. For firms making large layoffs during the Great Recession, they would predict a much higher potential UI tax increase in Flex state locations versus non-Flex locations.

A potential concern is whether the degree of UI taxation in a state is closely tied to the generosity of UI benefits. While it is true that maximum benefit levels and maximum UI taxes are correlated, Appendix Figure A.6 shows that variation in UI taxes is not solely driven by variation in benefits. For example, although Iowa's maximum UI tax is over four times greater than Indiana's, the two states have similar maximum weekly UI benefits. Additionally, states' total UI tax revenues are not necessarily proportional to UI benefit outlays, as high maximum taxes generally result in larger than average UI trust funds. State UI trust fund balances ranged from 0% to more than 3% of total wages right before the Great Recession, and during the Great Recession thirty-three states depleted their trust funds and were forced to borrow from the federal government. Of these 33 states, only seven

[11] In 2012 Rhode Island became an additional state to implement a flexible taxable wage base.

had maximum UI taxes in the top third of states leading up to 2008.[12]

3 Data

The manufacturing sector exhibits a number of features that make it attractive to study. Most importantly, manufacturing industries have high utilization of UI benefits.[13] Secondly, manufacturing produces largely tradable goods, causing their plants to be less affected by local economic conditions that would also influence labor demand. It can also be verified using the Census of Manufactures that many locations of multi-establishment manufacturing firms are in fact producing the same product codes, so operations across states are likely to be substitutable. Lastly, in recent decades US manufacturing employment has experienced an unprecedented decline due to import competition and technological change (Fort et al. (2018)). Given that manufacturing firms are downsizing and shutting down plants, differences in potential UI tax costs will be more salient for these firms, and the impacts of plant closures potentially more detrimental to local populations. Nevertheless, this paper's findings on manufacturing firm behavior likely extend to other sectors with multi-state firms operating in tradable services (such as warehousing/transportation and business support services, to name a few).

3.1 U.S. Census Bureau Data

This paper combines multiple administrative datasets from the U.S. Census Bureau: the Longitudinal Business Database (LBD), the Census of Manufacturers (CMF), and the Longitudinal Employer-Household Dynamics (LEHD). The LBD covers the universe of private non-farm business establishments, and constitutes the main analysis sample. It includes

[12] "Understanding the Unemployment Trust Fund Crisis of 2010," National Employment Law Project, April 2010.

[13] Appendix Figure A.1 shows that in the March CPS, Construction and Manufacturing are the two most overrepresented industries for UI claimants. This paper does not study the behavior of multi-state Construction firms since they make up a dramatically smaller share of total employment in the Construction sector.

annual information such as March employment, total payroll, NAICS industry, and first/last years of operation. It also includes firm identifiers that allow me to identify all of the establishments of a multi-establishment firm. The firm identifier in the LBD is broader than a tax EIN, and accounts for actual ownership rather than just EIN's used for tax purposes. Being able to observe all of a firm's locations across the U.S. will be crucial to my research design, which relies on comparing differences in maximum UI tax costs across each firm's locations in different states. Appendix Table A.1 shows that while 97% of manufacturing firms in the United States are single-state firms, multi-state firms make up more than half of overall manufacturing employment.

The CMF is a census of manufacturing plants that reports additional information about plant-level characteristics. Because it is collected at 5-year intervals (with an Annual Survey of Manufacturers collected in between), I restrict to the 2007 CMF when merging with my main analysis sample to study other plant-level characteristics. The LEHD is a matched employer-employee dataset that provides quarterly earnings sourced directly from states' UI records. With unique person identifiers, workers are able to be matched to job spells both within and across states. However, this project only has access to data from 23 out of the 50 states.[14] Together they make up about 48% of total U.S. manufacturing employment, and the ability to observe job spells will allow me to construct additional measures of hires to complement the main analysis using the LBD.

Unfortunately, the Census Bureau data does not include information on employer tax rates or UI taxes paid. An ideal research design would allow me to use differences in statutory maximum UI taxes to instrument for observed differences in state UI tax costs. Due to data limitations (unobservable true UI tax costs), this paper instead reports reduced form estimates of the effect of differences in statutory maximums. However, given that I am focusing on responses to negative shocks and manufacturing decline, the maximum UI tax is a relevant dimension for firms because any mass layoff would likely push the firm up to

[14] The 23 states I have access to are: AZ, AR, CA, CO, DE, FL, IL, IN, IA, KS, ME, MD, MO, MT, NV, NM, OK, OR, PA, SC, TN, WA, and WV, of which 7 are flexible wage base states.

the state's maximum tax rate.

3.2 Sample Construction and Summary Statistics

In state UI records, each UI account is identified by a state employer identification number (SEIN). In practice, large multi-establishment firms that own multiple locations within a state often have a different SEIN for each industry they operate in. This enables a diversified firm to potentially face different employer-specific tax rates for different establishments, even within the same state. Therefore when I restrict my analysis to manufacturing plants, any non-manufacturing plants dropped should not influence the firm's UI tax costs for their manufacturing employment.

To construct my main analysis sample, I define firms at the Firm ID and 3-digit NAICS industry level. So if a large corporation operates establishments in a variety of industries, I treat its manufacturing operations in each 3-digit NAICS as a unique firm.[15] I view this as a conservative step in ensuring that the plants I am comparing in my research design are more substitutable for each other than other establishments the firm may own. I analyze the period 1997–2014 so that it is broad enough to encompass two economic downturns: the 2001 recession and the Great Recession of 2008-2009, yet also coincides with the recent divergence in UI tax costs across states. The additional restrictions I make require: (1) Firms to be located in more than one state at some point from 1997–2014; (2) Firms with multiple establishments in a state to be aggregated to the state level; (3) Establishments to have employed 10 or more employees at some point. In the end my sample still represents over half of manufacturing employment in the United States, as multi-state firms account for a large share of US manufacturing. The level of observation is a Firm ID, 3-digit NAICS industry, State, and Year, and is what I will refer to as a "plant" from here on out. By aggregating establishments to the state level, it allows Exit to be defined as complete exit from a state

[15] There are 21 unique 3-digit NAICS industries in the manufacturing sector. My results are also robust to combining all manufacturing industries within the same firm, or all establishments within the same EIN.

rather than shutting down one out of many establishments within the state.[16] Appendix subsection A.3 provides additional details regarding the construction of my analysis sample.

Table 1 reports summary statistics for my main analysis sample of multi-state firms from 1997–2014, and the matched LEHD subsample (2000–2013). The left half reports summary statistics at the annual establishment level, while the right half reports summary statistics for observations aggregated to the firm level (for a total of approximately 14,500 firms throughout the sample period). The bottom panel of the table reports job-level variables after matching to the LEHD.[17] Comparing the two panels, one can see that the majority of firms only have locations in 2 states, although at the establishment level large firms receive more weight. Age is topcoded at 23 because 1975 is the first year observable in the LBD, although at the start of my sample the majority of firms have already been in operation since 1975. This provides the rationale for taking existing firm locations as given in my research design, as the majority of manufacturing plants were established during a period when when there was relatively little cross-state variation in UI taxes. Additionally, about 60% of firms (defined by 3-digit NAICS industry) operate in a single 6-digit NAICS industry, indicating that the plants I am comparing should be highly substitutable.

Appendix Figure A.7 shows the distribution of the main sample of multi-state firms across the United States. Multi-state manufacturing is concentrated in the Industrial Belt and the South. Relative to the overall number of manufacturing establishments, California, Michigan and New York are under-represented (they tend to have more single-unit or single-state firms than multi-state ones), while states like Arizona, Colorado, Maryland, Oklahoma, South Carolina, and Utah are over-represented. The most common pair of states to be found in the same firm is California and Texas due to their large populations. But also included in common state pairs are Illinois-Ohio, Ohio-Pennsylvania, and Indiana-Ohio, highlighting the concentration of manufacturing in the industrial Midwest.

[16] To the extent that firms may be vertically integrated and own multiple types of manufacturing plants within the same state, I have also checked that my results are robust to defining Exit at the state-by-EIN rather than state-by-NAICS3 level.

[17] Details regarding the matching method in Appendix subsection A.4

4 Research Design

4.1 Conceptual Framework

Basing employer-specific UI tax rates on past UI claims is a key feature discouraging employers from abusing unemployment insurance, as otherwise firms could freely place workers on temporary layoff during periods of low demand. Employers foresee that laying off workers who are likely to claim UI benefits will cause their UI tax rates in future years to rise in response. This margin is especially relevant for employers facing a large (and possibly permanent) negative demand shock, as was the case for manufacturing during the last few decades due to import competition, technological change, and the Great Recession.

Since the tax rate depends on the employer's history of UI benefits charged, we can define the employment history vector $\vec{N} = (..., L_{-2}, L_{-1})$, where L_t denotes the employment level in year t, and $L_0 = (1 - \delta)L_{-1} + h - l$, where δ is the voluntary quit rate and h denotes the employer's hires and l layoffs. This natural attrition through voluntary quits allows for the employer to choose inaction, which lowers employment levels without requiring layoffs (as only the claiming of UI benefits leads to UI tax increases). For simplicity assume the production function is defined by $F(L_0)$ (abstracting from Capital investment) and the employer takes prices p and wages w as given. While it is possible that employers could pass through UI tax costs to workers in the form of lower wages, the transient quality of firm-specific tax rates makes this difficult to do in practice, and I will assume no pass-through. The employer then maximizes profits using the following value function:

$$V(p, \vec{N}, L_0) = \max_{L_0}\{pF(L_0) - wL_0 - \tau_s(\vec{N})L_0 + \beta \int V(p', \vec{N}')dG(p'|p)\}$$

UI taxation enters into the firm's problem in two ways. First, large per-capita UI taxes $\tau_s(\vec{N})$ lower the optimal level of employment in the current period. However, the future tax costs of any adjustments to employment today also reduce the firm's desire to lay off workers in the current period, as τ_s' is a function of past UI claims. Thus, the two counteracting forces cause the effect on overall employment to be theoretically ambiguous as ex ante the firm is reluctant to lay off workers due to future tax costs (+) but ex post the firm would like to lay off (or not hire) workers to reduce tax burden (-). This then leads to the result that higher maximum UI taxes promotes more stable employment, as large fluctuations from year to year would translate to greater future UI tax costs for the firm. Additionally, this framework predicts decreased hiring of new workers in response to higher UI taxes since each new worker imposes an additional tax cost with no added benefit relative to a recalled worker.

If we extend to a multi-state firm problem with differences in the state tax function $\tau_s(.)$, large enough shocks to demand could push the firm to exit completely from relatively high cost states. By exiting from state s, (1) No UI tax cost is imposed for the workers laid off from the plant closure (since there is no more payroll to tax), and (2) Cutting employment from state s instead of the firm's other locations prevents its UI taxes from increasing in other states. Thus, all else equal multi-state firms would prefer to make small intensive margin adjustments in low tax states, while a large demand shock would favor making adjustments on the extensive margin (shutdowns) in high tax states.[18] This non-monotonic response to the size of the labor demand shock points to the importance of studying plant exit as an outcome in addition to overall employment effects.

4.2 Identification

My identification strategy leverages the richness of establishment-level microdata by focusing on multi-establishment firms with locations in more than one state. Recall the opening example of two similar multi-state firms: Suppose two firms are producing motor vehicle parts, and have plants located in three states in the industrial Midwest. Firm A is located in Ohio (20%), Indiana (30%), and Illinois (50%), while Firm B is located in Ohio

[18] Since U.S. manufacturing has been in steady decline for the last few decades, extensive margin responses should largely be on the exit and not the entry margin. Additionally, the potential for state tax incentives makes it difficult to separately identify the effect of UI on plant openings.

(20%), Iowa (30%), and Illinois (50%). The Great Recession hits, and both firms need to drastically downsize by cutting employment by 30%. However, UI tax costs are not equal across these states: Ohio and Illinois have maximum UI taxes of around $850/year, while Indiana has one of the lowest in the nation at only $392/year. Iowa, on the other hand, has a relatively high maximum of $1824/year due to both a higher maximum tax rate and a larger taxable wage base.

Due to the size of the shock, both firms find it optimal to close down one of their smaller (ie: less productive) manufacturing plants. Firm A closes down its smallest plant in Ohio, and makes the remaining cuts to employment in Indiana, incurring small UI tax increases in Indiana due to the layoffs. Firm B, however, decides to shut down its plant in Iowa instead, as UI taxes are more expensive in Iowa than its other two locations. Even if all of the workers in Iowa have been laid off, Firm B faces no UI tax increases because it no longer has any employment in Iowa to tax. So even though Firm A and Firm B have similar manufacturing plants in Ohio, Firm A is more likely to exit from Ohio than Firm B is because Firm A's 2nd largest plant is located in the low tax Indiana rather than high tax Iowa.

To parametrize the extent of this variation, I propose a measure of an establishment's UI tax costs relative to the rest of the firm. I proxy for UI tax costs using state maximum UI taxes to avoid the potential endogeneity of firm-specific UI tax rates. Defining the maximum UI tax as the maximum tax rate multiplied by the taxable wage base, I first compute each firm's employment weighted average UI tax out of all of its current locations. Then I calculate each establishment's deviation from the mean:

$$Dev_{fst} = Maxtax_{st} - \sum_{i \in f} \frac{Emp_{ift}}{TotEmp_{ift}} Maxtax_{it}$$

i indexes states where firm f has locations

Therefore, Dev_{fst} is positive for establishments located in states with relatively high maximum UI taxes compared to the other locations of the firm, and is negative otherwise.

From the previous example, Firm A's Ohio plant would have a Dev = \$113 in 2008, while Dev = -\$317 for the Ohio plant in Firm B. Conceptually, establishments with large positive deviations have cheaper "outside options" from a tax perspective if they were to exit completely from the state.

I weight by current employment when constructing this measure because plant employment shares within the firm are highly correlated with exit. Firms will rarely shut down a plant that makes up over 50% of its employment, and moving operations to a low tax location is only feasible if the low tax plant actually has substantial existing operations. Nevertheless I test sensitivity to defining Dev_{fst} (1) using an unweighted mean, and (2) leaving out the own plant when calculating the mean. These two alternative measures produce qualitatively similar estimates, but are less precise because they do not account for plant employment shares. Additionally, isolating the cross-sectional variation by fixing Dev_{fst} to be the same value over time - such as the value from the plant's first year in sample - produces qualitatively similar estimates. I inflation adjust Dev_{fst} to be in terms of 2014 dollars, and in order to account for the fact that high UI maximums are rarely binding, I cap $Maxtax_{st}$ at \$2000. This way no single state has the absolute highest maximum tax, and for firms that are located in only the highest tax states, they are assigned a Dev_{fst} equal to zero. As described in section 2.1, the bulk of my identifying variation derives from the fact that some firms will have locations in high tax ("Flex") states whose UI tax costs have risen substantially over time, while other firms have locations in low tax states whose UI tax costs have fallen in real terms since the 1980's.

To assess whether cross-sectional variation in UI tax costs are correlated with other state costs of doing business, Appendix Table A.2 shows the results of cross-sectional regressions of state maximum UI taxes on various state-level costs and characteristics. Regressions are estimated for 2000, 2004, and 2008, to assess changes in correlations over time. No characteristic is statistically significant across all three years, and in 2008 - the year in which the largest firm response was observed - no characteristic is significantly correlated with maximum state UI taxes. Therefore, it is unlikely that the Dev_{fst} measure is picking up other cost differences across states. In additional analyses not reported in the paper, I also confirm robustness of my main results to controlling for state union membership deviations and minimum wage deviations.

4.3 Estimating Equation

In this paper the main outcome of interest is Establishment Exit, an indicator for whether the plant (aggregated to the state level if firms have multiple establishments within the same state) shuts down or reports zero employment in March of year t+1. This highlights the incentive for multi-state firms to exit from a state in order to avoid UI tax increases due to layoffs. To the extent that a plant is repurposed (ie: switch from manufacturing to non-manufacturing) this will not be coded as an exit since the physical location will still be the same. The following linear probability model is estimated on the main analysis sample of plants from 1997–2014.

$$Exit_{fst} = \beta_1 Dev_{fst} + \beta_2 EmpShare_{fst} + \sum_n \alpha_n I(\#States = n)_{ft} + \delta_{st} + \gamma_j + \epsilon_{fst} \quad (1)$$

In the equation, f denotes firm, j denotes 3-digit NAICS industry, s denotes state, and t denotes year. β_1 is the coefficient of interest, and I control for plant employment share since it is correlated with both Dev_{fjst} and Exit. I also include fixed effects that control for the number of states that the firm is currently located in since number of locations is correlated with both the tax deviation and exit rates. Importantly, I include state-by-year fixed effects to control for any other economic policies that may be varying at the state level, and industry fixed effects to control for differences in regional industry concentration. This ensures that the coefficient of interest β_1 is not driven by correlation between Exit and state policies/conditions or industry shocks.[19]

This research design relies on the cross-sectional distribution of firm locations, and exploits the fact that the gap between high tax and low tax states has grown over time. An identifying assumption is that the location decisions of each firm's existing plants are uncorrelated with sensitivity to UI tax costs. For example, the firms that locate in high tax states do not do so because they are less sensitive to demand shocks. This is a reasonable assumption to make because the majority of manufacturing firms and plants have been in operation for decades; their plant locations would have been determined during a time when UI tax costs did not differ as much across states.[20] In 1983, the last time the federally mandated taxable wage base was raised to $7000, the average taxable wage base across all 51 states was only $7875, as all but 18 states were at the federal mandate of $7000. Furthermore, in Appendix Table A.6 I show that my results are robust to restricting to firms that have had no new establishment entry since 1992.

Another assumption is that state UI maximums are uncorrelated with state-level economic conditions that might separately affect firms' labor demand and shut down decisions. Throughout my sample period state maximum UI taxes were actually negatively correlated with state unemployment rates.[21] And Appendix Figure A.8 shows that in 2009 maximum UI taxes were also uncorrelated with UI benefit claims, so firm responses are not likely to be driven by labor supply. Additionally, if states with high UI tax costs were actually home to more productive or less sensitive manufacturing plants this would bias against finding a firm response, leading me to underestimate the effect of UI tax differences. Another way firms could respond is by lowering the wages of their workers to counteract UI tax increases. While unlikely due to the downward stickiness of wages and the absence of earnings effects in Johnston (2018), this would also work against finding an employment response.

[19] Firm fixed effects are difficult to estimate in a pooled regression with a binary outcome, so are excluded from this specification. They are however included in cross-sectional estimates in section 5.4.

[20] Approximately two thirds of the firms in my sample had no new locations opened after 1992.

[21] $100 in maximum tax correlated with 0.03 percentage points lower unemployment, p-value=0.044

4.4 Interaction with Industry Job Losses

In order to provide additional evidence that what I identify are responses to UI taxes, I interact Dev_{fst} with annual industry job losses at the national level. Because establishment exit is a major extensive margin adjustment, we would only expect firms to exit in response to large and semi-permanent negative shocks that require them to significantly cut employment. And while firm-level shocks are unobservable to the researcher, industry job losses can proxy for years in which firms are more likely to be making large cuts to employment. U.S. Manufacturing has been on the decline since the early 2000's, but the industry was hit especially hard by the Great Recession of 2008-09. During the Great Recession, firms across the nation were forced to lay off workers, and these workers claimed unemployment benefits en masse.

The Business Employment Dynamics provides national quarterly job loss rates for each 3-digit NAICS industry. I interact Dev_{fst} with Δ_{jt}, the z-score of industry job losses in the following year (October of year t to September of t+1) as a proxy for negative labor demand shocks. I include this interaction term as an additional RHS variable, to test whether firm responses were driven by economic downturns.

$$\begin{aligned} Exit_{fst} = \beta_1 Dev_{fst} + \beta_2 \Delta_{jt} * Dev_{fst} + \beta_3 EmpShare_{fst} + \\ \sum_n \alpha_n I(\#States = n)_{ft} + \delta_{st} + \gamma_{jt} + \epsilon_{fst} \end{aligned} \tag{2}$$

Once again, f denotes firm, j denotes 3-digit NAICS industry, s denotes state, and t denotes year. Measuring industry job losses as z-scores allows for β_2 to be interpreted as an additive component to β_1; it tests whether firms respond differentially in boom/bust years. Appendix Figure A.9 plots the z-scores of industry job losses over time for a selection of 3-digit manufacturing industries. On average the largest spike occurs during the Great Recession and smaller spikes in 2001–2002, while years with the lowest z-scores were in

2011-2014. However there is also variation in the timing of job losses across manufacturing industries. For example, apparel manufacturing had the largest job losses in the early 2000's, and a relatively smaller z-score during the Great Recession. Fabricated metal manufacturing, on the other hand, had an extremely large spike during the Great Recession. The $\Delta_{jt} * Dev_{fst}$ interaction term will account for differential responses across these two industries during the 2001 Recession versus the Great Recession.

5 Main Results on Plant Closures

5.1 Evidence from Raw Exit Rates

I first present nonparametric evidence using raw exit rates. The goal is to highlight the differential firm response in the 16 flexible wage base ("Flex") states that index their UI taxes to rise with wage growth. When making the decision of which locations to exit from, firms operating plants in Flex states can foresee their taxable wage bases automatically increasing every year, leading to greater UI tax costs over time.

Focusing on the subsample of firms that have locations in both a high tax Flex state and at least one non-Flex state during the same year (56% of my analysis sample), Figure 6 plots annual establishment exit rates separately for Flex states versus the others. The exit rates track each other quite closely until a divergence in 2008 and 2009. Plants in a Flex state were 32% more likely to shut down than plants in any other state, a statistically significant difference in means. In contrast, Figure 7 shows that the remaining firms which are located in only Flex states or only non-Flex states show no discernable difference in exit rates during 2008–2009. This placebo test shows that the Great Recession didn't happen to impact Flex states differentially from non-Flex states. Rather, the firms that had cheaper outside options were more likely to exit from their Flex state locations during the Great Recession in response to greater future UI tax costs.

5.2 Pooled Regression Results

My main analysis pools all states and years into one reduced form regression specification. Taking each firm's pre-determined combination of establishment locations as given, I estimate the causal effect of greater relative UI tax costs on Establishment Exit using Equation 1. Table 2 reports pooled regressions estimates, where Exit is a dummy for if the plant (aggregated to state-level) shut down or reported zero employment in the following year. Estimates of the preferred specification are shown in Column 2, where relative to a mean exit rate of about 4%, one standard deviation ($400) increase in Dev_{fst} increases the likelihood of exit by 5%.[22] The estimates are stable to the inclusion of various controls, including a control for distance (coordinates for the centroid of state) to the state with the firm's largest employment share. Column 4 also shows robustness to reweighting by $1/(\#States)$, since unweighted regressions will overweight the effect of large firms. This shows that responses to UI tax costs were not just concentrated in large firms with multiple locations, but rather were a phenomenon affecting small firms as well.

Given the observed firm responses above, I next provide evidence for the mechanism through which this effect operates. Table 3 reports regression estimates with the $Dev_{fst} * \Delta_{jt}$ interaction. The coefficient on Dev_{fst} is very similar to before, showing the average effect over the sample period, while the interaction term has an additional positive coefficient. Because the additive interaction term is constructed to have mean zero, this shows that the effects are driven by firms responding to UI tax differences in years when their industry experiences large job losses. It is precisely during these years that many firms will have been hit with large negative and semi-permanent shocks that requires them to adjust their employment levels. And for a plant located in a high tax state, the future UI tax savings from exit - up to $2000 per worker - are equivalent to 5% of annual wages for the average worker. This constitutes a substantial cost that cannot be avoided, and can prove especially

[22]Going from Column 1 to Column 2 shows an increase in the estimated coefficient after controlling for state-by-year fixed effects, likely due to differences in economic conditions in high tax versus low tax states.

burdensome for cash-constrained firms.

In 2008 industries had an average job loss Δ of 2, which translates to one standard deviation increase in Dev_{fst} causing the likelihood of exit to increase by 10% during the Great Recession. This cannot be a purely mechanical relationship as overall exit rates did not vary as much as job losses did over this period.[23] It is also worth noting that these estimates likely suffer from attenuation bias given the unobservability of true UI tax costs faced by each firm.

Column 4 of Table 3 also reports results using Employment Growth as the outcome, where Employment Growth is defined as $100 * \frac{Emp_{t+1} - Emp_t}{\frac{1}{2}(Emp_t + Emp_{t+1})}$, and is equal to -200 if a plant exits completely. This measure combines both the intensive and extensive margins of employment adjustment, and shows that the negative employment effects of shutdowns outweighs any potential disincentivizing effects on layoffs. These estimates imply a labor demand elasticity of about 1.1 during years with excess industry job losses, which falls within the range of labor demand elasticities estimated in the previous literature.[24] If firms were able to pass through some of the future UI tax costs onto workers through lower wages, we would expect these labor demand elasticities to be underestimates of the true response. However, pass-through is likely to be minimal due to downward wage rigidities, and Johnston (2018) found no evidence of lower earnings using administrative data from Florida.

Appendix subsection A.2 describes a complementary difference-in-differences analyses during the Great Recession that takes an event study approach. It exploits the differences in state UI taxes driven by flexible wage base states, with two sets of comparisons: one within-state and one within-firm. These results provide additional evidence that firms are reallocating plant closures in response to differences in maximum UI taxes.

[23]Appendix Figure A.10 plots annual establishment exit rates, which hover around the sample mean of 4%.

[24]To calculate the implied labor demand elasticity I assume \$100 in Dev_{fst} translates to a \$100 difference in future UI tax costs. This represents a 0.23% wage increase relative to the average payroll of \$44,360, which I then discount by 5% to reflect the lagged tax schedule.

5.3 Robustness

To investigate whether my results are sensitive to the way I define the UI tax deviation Dev_{fst}, I also report estimates using two alternate specifications. In Table 4, I replace Dev_{fst} with a dummy variable $Firm\_Min_{fst}$, equal to one for the plants in the firm with the lowest maximum UI tax in year t. In line with my previous estimates, the negative coefficients indicate that Exit is less likely to occur when the plant is the lowest cost plant in the firm. In Table 5, I replace Dev_{fst} with $Dev2_{fst} = Maxtax_{st} - min_{i \in f}(Maxtax_{it})$, the difference between the own state's maxtax and the firm's overall minimum maxtax. These estimates are likely to be attenuated because the state with the minimum maxtax may not actually account for a sizeable share of the firm's employment, reducing the firm's ability to reallocate towards that location. My results are also robust to calculating tax deviations in terms of the state average UI taxes rather than the maximum UI taxes, addressing the concern that the maximums in high tax states may not be binding.

As another robustness test, I construct a placebo Dev_{fst} measure replacing each state's maximum UI tax with the maximum of the alphabetically preceding state. Appendix Table A.3 shows that estimates using these placebo measures are statistically insignificant and close to zero. Appendix Table A.4 reports estimates controlling for lagged log employment (in year t-2), and in doing so limits the sample to establishments that have been in operation for at least 2 years. This is desirable because new firms may face many temporary tax incentives that drive their location decision, and new employers face a "new employer" tax rate for the first few years until sufficient layoff history can be established. As an additional comparison to the oft-studied state corporate income tax, I construct a $CorpDev_{fst}$ measure equal to the payroll-weighted deviation from the firm's mean state corporate tax rate. My estimates are robust to the inclusion of $CorpDev_{fst}$, as well as an indicator for the location where the firm faces the highest corporate tax rate.[25]

[25] One might worry about employment changes interacting with state payroll apportionment for corporate income taxation, but the majority of states - especially states where the bulk of manufacturing firms are located - place double or total weight on sales. With single sales factor apportionment, a firm's corporate

My results are also robust to additional sample restrictions. Appendix Table A.5 reports estimates restricting the sample to firms that only operate in a single 6-digit NAICS industry, thereby ensuring that plants within the firm are producing the same goods and are more substitutable. The estimates are less precise due to the reduction in sample size, but are of similar signs and magnitudes. Restricting to firm-years where all plants in the firm have no non-manufacturing operations in the same state produces similar estimates. This addresses the concern that manufacturing plant closures may be the result of consolidations with non-manufacturing plants. Results are also robust to restricting to firm-years where the firm's existing plants were all opened before the start of the sample period, in case firms with high UI tax burdens are more likely to open new plants in low tax states (Appendix Table A.6). Furthermore, my results are not only driven by the Great Recession. Appendix Table A.7 shows that breaking the sample period into two subperiods, 1997–2005 and 2006–2014, produces similar estimates of the response to the 2001 Recession and China trade shock in the first period, and the Great Recession in the second.

5.4 Other Plant Characteristics

In order to benchmark the estimated effects of UI taxes to the effects of other plant-level characteristics, I also match my main analysis sample to the 2007 Census of Manufacturers. I merge 2007 values of plant-level TFPR, Total Assets, and Labor Share to corresponding plants in 2008 to study their effects on shutdown during the Great Recession (when the largest firm responses occurred).[26] I include them as additional controls in the following

income tax liability is solely based on in-state sales rather than payroll or property.

[26]Because the Census of Manufacturers is only collected every 5 years, these plant-level characteristics are unavailable for the whole sample period.

regression specification:

$$
\begin{aligned}
Exit_{fs} = \beta_1 Dev_{fs} + \beta_2 ln(TFP)_{fs} + \beta_3 ln(Assets)_{fs} + \beta_4 LaborShare_{fs} + \\
\beta_6 EmpShare_{fs} + \sum_n \alpha_n I(\#States = n)_f + \delta_s + \gamma_j + \epsilon_{fs}
\end{aligned} \tag{3}
$$

The sample is restricted to year 2008, and f denotes firm, j denotes 3-digit NAICS industry, and s denotes state. Measures of TFP are obtained from Foster et al. (2016), $Assets$ is calculated as total capital assets per worker, and $LaborShare$ is calculated as (total wage and salaries + benefits) divided by value-added.

Table 6 reports the results of this analysis. Column 2 shows that even after controlling for these additional plant characteristics, the coefficient on Dev_{fst} is large and statistically significant. This is highly suggestive of misallocation since firms are shutting down plants on the basis of UI tax costs rather than other productivity-related characteristics. These results are also robust to controlling for firm fixed effects, showing that firm differences or firm-specific location behavior are not driving UI tax responses. Additional pairwise interactions in Columns 5-7 shows that while the interaction with log TFP is insignificant, the negative interaction with assets per worker suggests that plants with large capital investments are less responsive to UI tax differences - consistent with larger capital adjustment and shutdown costs for these plants. Meanwhile, the positive interaction with labor share confirms that plants more reliant on labor for production are also more responsive to UI tax differences.

6 Additional Employment Outcomes

6.1 Using LEHD Data to Study Hiring

The conceptual framework from section 4.1 predicts that higher UI taxes should lead employers to be more reluctant to hire new workers since higher per-capita labor costs decrease the optimal level of employment. Since the LBD only provides annual employment levels, it is difficult to discern whether changes in employment are coming from greater separations, fewer hires, or both. Therefore, I turn to employer-employee data from the LEHD to identify new hires at the establishment level. As mentioned previously, the LEHD data includes a subset of 23 states yet still accounts for almost 50% of US manufacturing. Manufacturing shares are also very similar in LEHD compared to non-LEHD states (11.5% vs 12%), and maximum UI taxes average \$863 and \$983 respectively.

Since experience rating causes employer-specific UI tax rates to increase in the years following large layoffs, a firm that laid off workers during the Great Recession would experience a substantial increase in their UI tax rates in 2011 and 2012 (see Figure 5). This timing also coincides with years the firm may be particularly cash-constrained, and because UI tax bases are lower than average wages employers would face the majority of their tax burden in the first and second quarters of the year. I test whether firms are more sensitive to hiring in years when UI taxes are high. I define new hires as employees with no earnings at the firm in year t-1, and positive earnings in year t. The outcomes of interest include $AnyHire_{fst}$, an indicator for whether the SEIN[27] has any new hires during the year, as well as $Log(1 + Hires)_{fst}$, where Hires denotes the cumulative number of new hires during the year. My estimating equation takes the following form:

$$\begin{aligned} AnyHire_{fst} = \sum_{k=2000}^{2013} \beta_k Dev_{fst} * I(t = k) + \beta_2 EmpShare_{fst} + \\ \sum_{n} \alpha_n I(\#States = n)_{ft} + \delta_{st} + \gamma_j + \epsilon_{ist} \end{aligned} \tag{4}$$

In the equation f denotes firm, j denotes 3-digit NAICS industry, s denotes state, and t denotes year. Yearly coefficients β_k are estimated for Dev_{fst}, in order to compare hiring

[27] For the most part, SEIN's in my matched sample are synonymous with my prior establishment definition since I aggregate LBD establishments to the state level. However, it is possible that some SEIN's in the LEHD will also include employment in non-manufacturing locations that were dropped when constructing my main LBD analysis sample.

responses over the business cycle. I also include the same previous controls for plant employment share, state-by-year fixed effects, 3-digit NAICS industry fixed effects, and fixed effects for the number of states the firm is located in.

It is also worth noting that after the Great Recession, a number of states also temporarily increased their maximum UI taxes in 2010 and/or 2011 to replenish their UI trust funds. This caused tax costs in some states to rise by even more than expected during this period; For example, Indiana's maximum UI tax more than doubled from \$400 to \$900 in 2011, and Oklahoma's maximum rose from \$820 to \$1395. Thus in some states firms were simultaneously hit with both legislated tax increases and the mechanical increases due to previous layoffs. This creates an additional burden on cash-constrained firms due to the front-loading of UI tax payments described earlier.

Figure 8 shows that precisely in the years following recessions, plants with higher relative UI tax costs were less likely to hire new workers. In 2011, plants with \$400 greater relative UI tax costs had a 1 percentage point lower probability of having any hire, and had 7% lower total hiring. This translates to a short-run labor demand elasticity of up to 6.5, although it is likely an overestimate since new hires will have lower earnings than the average annual earnings of \$37,380 used to calculate the implied elasticity. This provides evidence that the increase in UI taxes after the Great Recession contributed to the slow pace of hiring after 2009, and could partially explain the recent phenomena of "jobless recoveries" where employment fails to recover at the same pace as output.

6.2 Employment Volatility

Theory predicts that establishments in high-tax states should also experience lower employment volatility due to the incentives for smoothing employment. If a firm owns plants in both a high tax and a low tax state, they can smooth employment in the high tax state by responding to small fluctuations in labor demand through employment adjustments in the low tax plant. I test this prediction in the cross-section on a balanced panel of plants within my sample. In order to ensure that measures of employment volatility only pick up intensive margin employment adjustments and not plant entry/exit, I further restrict to firms that do not open or close any plants over the length of a 4-5 year subpanel. I study three separate time periods of relatively stable employment (leaving out recession years): 1997–2000, 2003–2007, and 2010–2014. The outcome of interest, SD_{fs} is constructed by taking the standard deviation of logged annual employment over each period, in order to measure the magnitude of employment fluctuations over the panel.

Unlike my previous research designs which exploit within-state variation in relative UI tax costs, I now conduct a within-firm comparison to test whether firms are more likely to smooth employment for their higher tax plants. If a firm operates in both a high tax state and a low tax state, they may respond to fluctuations in demand by adjusting employment more in the low tax plant in order to avoid layoffs in the high tax plant. Since the outcome measures volatility over time, each plant only has one observation in the following regression, and $Maxtax_s$ is calculated as the state average over the period.

$$SD_{fs} = \beta Maxtax_s + \delta_f + \epsilon_{fs} \tag{5}$$

In the equation f denotes firm and s denotes state. I control for firm fixed effects, and β is the coefficient of interest. These results are also robust to controlling for average log employment, as well as using the state's average tax rather than the maximum tax over each period. Table 7 reports the estimates of my model over the three sample periods. On average a \$500 increase in maximum UI taxes is associated with 4-5% lower volatility relative to the mean. While the estimated magnitudes are small, probably due to measurement error in using maximum UI taxes instead of true UI tax costs, they are nonetheless statistically significant and consistent over all three panels. These estimates suggest that firms also respond to differences in state UI taxes when adjusting employment on the intensive margin from year-to-year.

7 Conclusion

Cross-state disparaties in UI taxes have been increasing over time, yet there have been no federal reforms aimed at ensuring state UI trust funds are properly funded. Thus many states have unsustainably low UI tax schedules and were forced to borrow from the federal government in order to pay out benefits during the Great Recession. Given that now the state of UI trust fund solvency across the US is extremely unbalanced and many state tax systems are in need of reform, studying how businesses respond to differences in UI taxation across states is of great policy relevance.[28]

This paper studies how multi-state manufacturing firms respond to these differences in state-level UI taxation. Because employer tax rates are an increasing function of previous UI claims, firms needing to make mass layoffs can expect them to result in large increases to their future UI tax costs. But for firms located in more than one state, bunching layoffs together and exiting completely from a state allows them to avoid UI tax increases associated with those layoffs, providing an additional incentive to strategically exit from high tax states. I find evidence that this is an economically important margin of adjustment for multi-state firms, and swamps any intensive margin response.

By comparing plants located in the same state and year, I find that firms respond to UI tax differences by reallocating plant closures towards states with higher relative UI tax costs. These effects are concentrated during economic downturns, when firms are cash constrained and more likely to be cutting employment. My estimates imply that during the Great Recession, moving a manufacturing plant's outside option from a high tax state ($2000 maximum) to a low tax state ($500 maximum) would have increased its likelihood of exit by 20%. Alternatively, if a manufacturing plant was the lowest UI tax location in the firm its likelihood of exit dropped by 15%. This suggests that in the absence of differential state UI tax costs, low tax states such as Indiana, Florida, and California would have suffered

[28]As of 2019, 24 states are still below the federally recommended minimum solvency standard (https://oui.doleta.gov/unemploy/docs/trustFundSolvReport2019.pdf)

even greater manufacturing losses, and high tax states such as Iowa, New Jersey, and North Carolina would have been much less affected.

These results are robust to controlling for other plant-level characteristics such as productivity, capital assets, and labor share. Additionally, plants with greater capital assets are less responsive while plants with greater labor share are more responsive. I also find evidence of decreased hiring after the Great-Recession, and lower employment volatility in high tax states during non-recession periods. These findings show that state-level administration of UI taxation introduces a wedge that contributed to the slow pace of hiring after the Great Recession, and to misallocation in the economy.[29]

In Appendix subsection A.1, I propose a stylized two-period model of a multi-state firm to illustrate effects of counterfactual UI tax systems. Changing to a counterfactual tax system with standardized UI tax costs but state-level experience rating and administration, establishment exit would equalize across states but result in greater exit overall. However, if the system instead assigned UI experience rating at the national level so that firms who exit from one state are still liable for UI tax increases, counterfactual exit rates could fall while also raising more UI tax revenue. This highlights an unintended consequence of decentralized administration, as the current UI tax system has become a factor influencing the plant closures of multi-state manufacturing firms. A first step towards reform could involve the creation of a more national experience rating system for multi-state firms, akin to apportionment formulas used in corporate income taxation.

This paper's findings provide economic and policy implications that extend beyond just the manufacturing industry or multi-state firms. Industries such as employment services and retail trade have large shares of multi-state firms and also produce many UI claimants. And when thinking about the other "outside options" available to employers, the rise in

[29] My estimates for UI tax deviation are about one tenth the size of the effect Foster et al. (2016) found for establishment-level TFPR. They find that mature establishments with measured productivity one standard deviation above the mean are 4 percentage points less likely to exit than establishments one standard deviation below the mean. However, the difference in magnitudes may in part be due to sample composition, as the overall exit rates in my sample hover around 4 percent relative to the 7 percent in their sample of mature firms which also includes single-establishment units.

outsourcing and contract work provides another potential way for employers to lower their UI tax burden. The role of state UI tax costs in encouraging substitution towards contractors and third-party employment services is an important area for further research.

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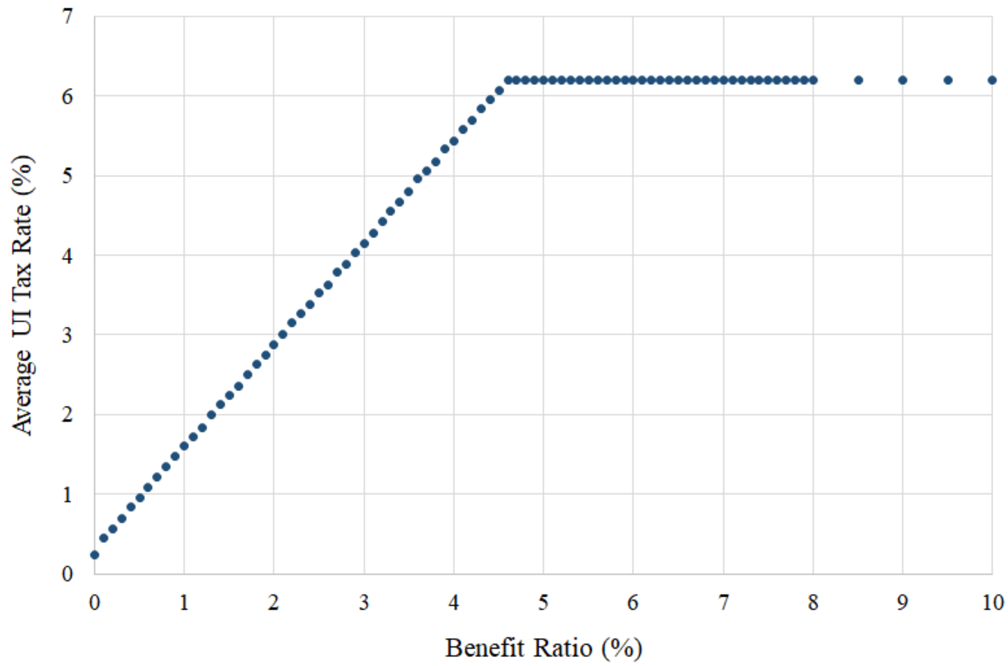
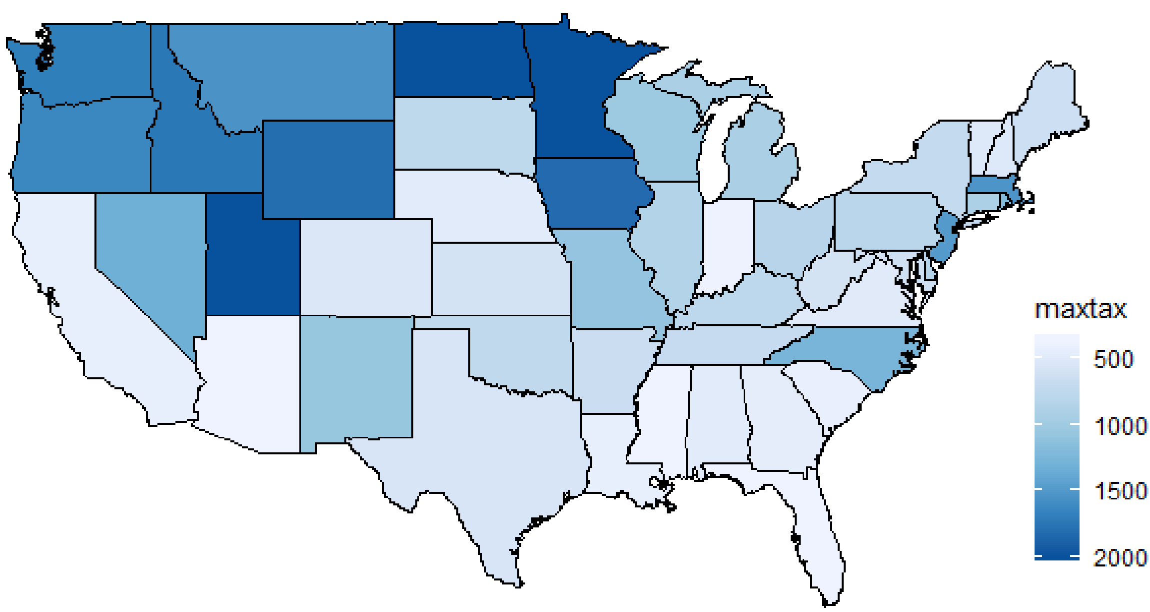
FIGURES

Figure 1: Empirical UI Tax Schedule for Texas (2009)



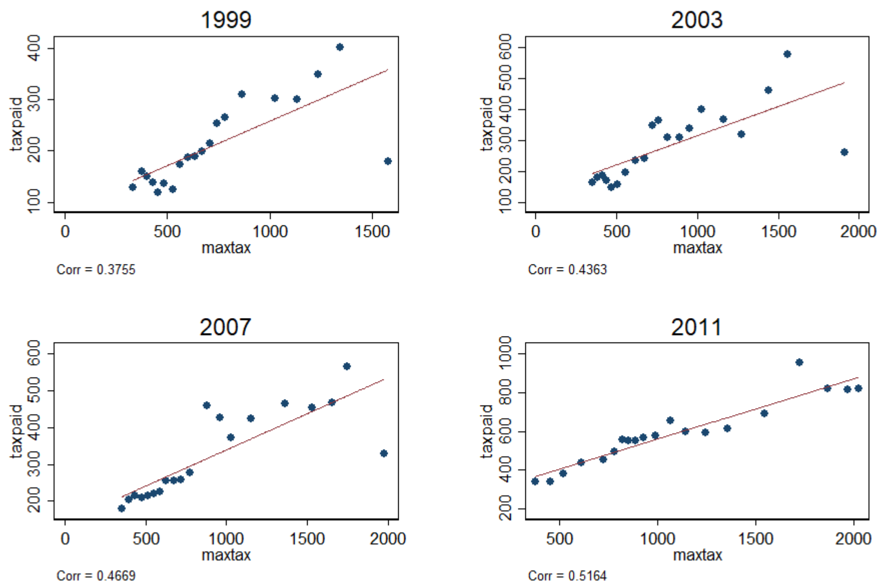
Source: US Dept of Labor ETA 204 Experience Rating Report

Figure 2: Maximum Per-Capita UI Tax (2008)



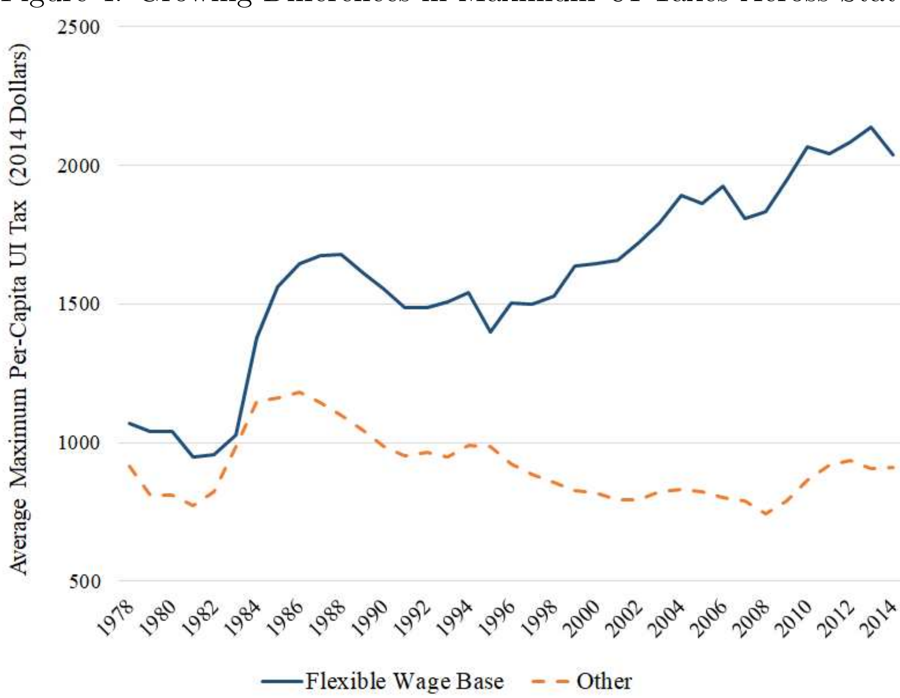
Source: US Dept of Labor *Significant Measures of State UI Tax Systems, 2008*

Figure 3: Correlation between Maximum UI Taxes and Industry Taxes Paid



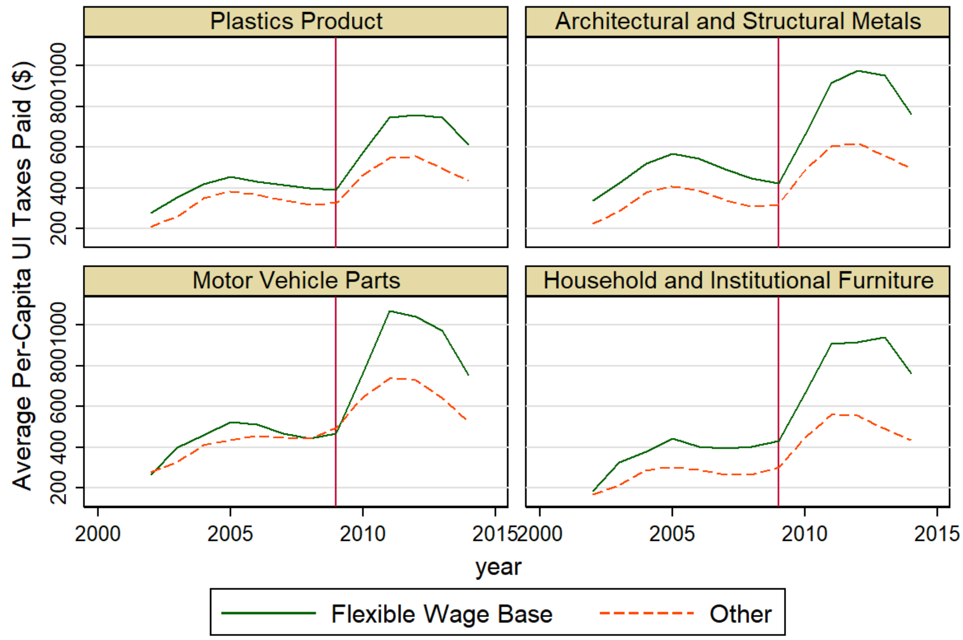
Binned scatterplots, controlling for 4-digit NAICS. Taxpaid equals annual UI contributions divided by average employment, at state by 4-digit NAICS level.

Figure 4: Growing Differences in Maximum UI Taxes Across States



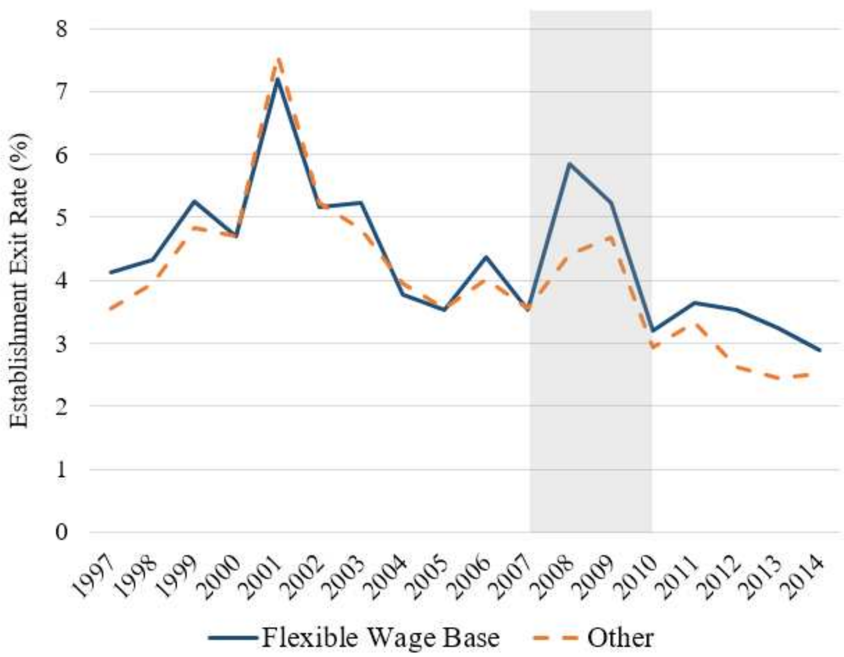
Plots unweighted average maximum UI taxes across the two groups of states, inflation adjusted to 2014 dollars. Excluded from the figure are flexible wage base states Alaska and Hawaii.

Figure 5: Average Industry Per-Capita UI Taxes



Tax paid equals annual UI contributions divided by average employment, at state by 4-digit NAICS level. Annual employment weighted averages are plotted for Flex states and non-Flex states.

Figure 6: Exit Rates for Flex State Plants versus Other Plants

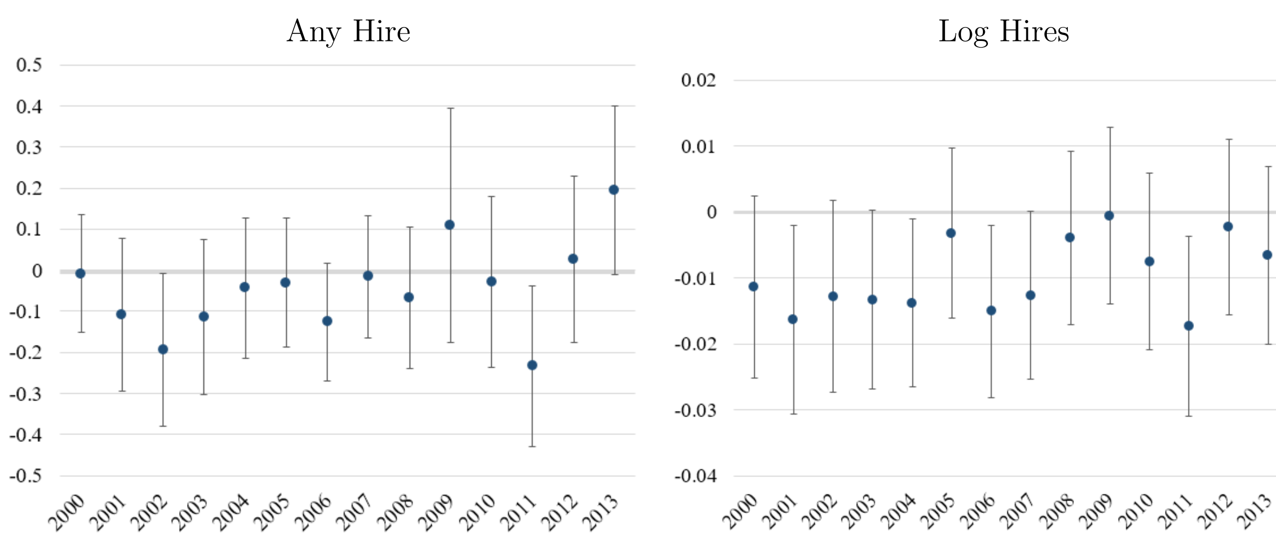


Restricted to firms with locations in both a Flex state and non-Flex state in that year.

Figure 7: No Difference in Exit Rates for Firms in Only Flex or Non-Flex

Restricted to firms with locations in only Flex states or only non-Flex states in that year.

Figure 8: Yearly Coefficients on Dev_{fst}



Estimated yearly coefficients on Dev_{fst} for regression controlling for Employment Share, Multi FE, and State-by-Year FE. Error bars denote 95% confidence intervals. Mean of Any Hire equals 96.2, and mean of Log Hires equals 3.19. SD of Dev equals 3.96. Full regression table in Table A.8.

TABLES

Table 1: Summary Statistics of Main Analysis Sample (1997–2014)

	Establishment-Year Level (N=475000)			Firm Level (N=14500)		
	Mean	Pseudo-Median	SD	Mean	Pseudo-Median	SD
March Employment	275.1	105.5	815.5	204.3	114.3	342.5
Average Payroll ($)	44,360	40,230	25,970	42,840	40,090	17,400
# of States	6.5	4	6.6	3.7	2	3.5
Age (topcoded at 23)	15.75	19	7.826	20.55	23	5.106
# Years in Sample	12.5	13.5	5.4	10.3	9.4	6
Maximum UI Tax ($)	961.2	874.1	439.2	960	916.4	275.6
Tax Deviation ($)	4.748	0	385.9	-2.75	-0.365	118.4
I (Estab Exit)	0.039			0.586		
I (Same Industry)	0.485			0.605		
2000–2013 Matched LEHD Sample (N= 115000)						
Annual Employment	310.7	119.9	902.8			
Avg Annual Earnings ($)	37,380	34,310	20,850			
Median Q1 Earnings ($)	9.057	8.304	6.457			
Median Job Tenure (Qtrs)	18.65	19.63	4.282			

Left panel reports summary statistics at level of firm-state-year. Right panel reports statistics at level of firm. Exit equals one if establishment disappears or reports zero employment in t+1. Same Industry equals one if firm operates in only one 6-digit NAICS industry throughout whole period. Bottom panel reports LEHD variables at firm-state-year level.

Table 2: Establishment Exit (1997–2014)

Exit multiplied by 100	(1) Exit	(2) Exit	(3) Exit	(4) Exit
Dev_{fst} ($\$100's$)	0.0368***	0.0512***	0.0503***	0.0583***
	(0.0135)	(0.0150)	(0.0149)	(0.0174)
$\text{Employment Share}_{fst}$	-10.04***	-10.03***	-10.06***	-9.028***
	(0.165)	(0.165)	(0.194)	(0.210)
Distance_{fst}			-0.00246	-0.00543
			(0.00376)	(0.00461)
R^2	0.016	0.018	0.021	0.022
Mean of Exit	3.935	3.935	3.935	4.461
SD of Dev	3.859	3.859	3.859	3.280
State-by-Year FE		Yes	Yes	Yes
Industry-by-Year FE			Yes	Yes
Multi-by-Year FE			Yes	Yes
Age Bins			Yes	Yes
Weighting				Yes
# of Unique Firms	14500	14500	14500	14500
N	475000	475000	475000	475000

Regressions include State, Year, Multi, and 3-digit industry FE's. Multi is a categorical variable for # of states firm is located in. Exit=100 if establishment disappears or reports zero employment in t+1. Distance defined as straight line distance from the state with firm's largest employment share, and is equal to zero if no plant has employment share greater than 20%. All columns are unweighted except for Column 4, which weights by 1/(# of plants in the firm). Standard errors clustered at firm level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Interaction with Industry Job Losses (1997–2014)

Dep Vars multiplied by 100	(1) Exit	(2) Exit	(3) Exit	(4) Empl Growth
Dev_{fst} (\$100′s)	0.0513***	0.0513***	0.0595***	-0.132***
	(0.0150)	(0.0149)	(0.0174)	(0.0390)
$\text{Dev}_{fst} * \Delta_{jt}$ (\$100′s)	0.0276**	0.0283**	0.0326**	-0.0576**
	(0.0111)	(0.0111)	(0.0147)	(0.0280)
Employment Share_{fst}	-10.03***	-10.06***	-9.026***	8.745***
	(0.165)	(0.194)	(0.210)	(0.474)
Distance_{fst}		-0.00245	-0.00540	-0.00106
		(0.00376)	(0.00461)	(0.00978)
R^2	0.021	0.021	0.022	0.025
Mean of Dep Var	3.935	3.935	4.461	-10.58
SD of Dev	3.859	3.859	3.280	3.859
Multi FE	Yes	Yes	Yes	Yes
State-by-Year FE	Yes	Yes	Yes	Yes
Industry-by-Year FE	Yes	Yes	Yes	Yes
Multi-by-Year FE		Yes	Yes	Yes
Age Bins		Yes	Yes	Yes
Weighting			Yes	
# of Unique Firms	14500	14500	14500	14500
N	475000	475000	475000	475000

Dependent variables are multiplied by 100. Multi is a categorical variable for # of states firm is located in. Exit=100 if establishment disappears or reports zero employment in t+1. Main effect of Δ is absorbed by industry-by-year FE's. Distance defined as straight line distance from the state with firm's largest employment share, and is equal to zero if no plant has employment share greater than 20%. All columns are unweighted except for Column 3, which weights by 1/(# of plants in the firm). Standard errors clustered at firm level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Indicator for Firm Minimum (1997–2014)

Dep Vars multiplied by 100	(1) Exit	(2) Exit	(3) Exit	(4) Exit	(5) Empl Growth
Firm_Min_{fst}	-0.323***	-0.317***	-0.311***	-0.370***	0.550**
	(0.0965)	(0.0963)	(0.0962)	(0.104)	(0.237)
$\text{Firm\_Min}_{fst} * \Delta_{jt}$		-0.106	-0.160**	-0.192**	0.308
		(0.0743)	(0.0794)	(0.0870)	(0.197)
$\text{Employment Share}_{fst}$	-10.04***	-10.04***	-10.07***	-9.199***	8.746***
	(0.165)	(0.165)	(0.194)	(0.221)	(0.474)
Distance_{fst}			-0.00236	-0.00375	-0.00135
			(0.00376)	(0.00441)	(0.00978)
R^2	0.018	0.021	0.021	0.022	0.025
Mean of Dep Var	3.935	3.935	3.935	4.308	-10.58
Mean of Firm_Min	0.363	0.363	0.363	0.701	0.363
Multi FE	Yes	Yes	Yes	Yes	Yes
State-by-Year FE	Yes	Yes	Yes	Yes	Yes
Industry-by-Year FE		Yes	Yes	Yes	Yes
Multi-by-Year FE			Yes	Yes	Yes
Age Bins			Yes	Yes	Yes
Weighting				Yes	
# of Unique Firms	14500	14500	14500	14500	14500
N	475000	475000	475000	475000	475000

Dependent variables are multiplied by 100. Multi is a categorical variable for # of states firm is located in. Exit=100 if establishment disappears or reports zero employment in t+1. Main effect of Δ is absorbed by industry-by-year FE's. Distance defined as straight line distance from the state with firm's largest employment share, and is equal to zero if no plant has employment share greater than 20%. All columns are unweighted except for Column 4, which weights by 1/(# of plants in the firm) if $Firm\_Min$ equals zero and assigns weight of one otherwise. Standard errors clustered at firm level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Tax Deviation from Firm Minimum (1997–2014)

Dep Vars multiplied by 100	(1) Exit	(2) Exit	(3) Exit	(4) Exit	(5) Empl Growth
Dev2_{fst} ($\$100's$)	0.0389***	0.0372***	0.0369***	0.0363***	-0.0583**
	(0.0113)	(0.0114)	(0.0113)	(0.0119)	(0.0281)
$\text{Dev2}_{fst} * \Delta_{jt}$ ($\$100's$)		0.00380	0.0132*	0.0133	-0.0362*
		(0.00734)	(0.00787)	(0.00917)	(0.0199)
Employment Share_{fst}	-10.04***	-10.04***	-10.08***	-9.039***	8.753***
	(0.165)	(0.165)	(0.194)	(0.210)	(0.474)
Distance_{fst}			-0.00264	-0.00569	-0.000933
			(0.00376)	(0.00461)	(0.00977)
R^2	0.018	0.021	0.021	0.021	0.025
Mean of Dep Var	3.935	3.935	3.935	4.461	-10.58
SD of Dev2	5.334	5.334	5.334	5.139	5.334
Multi FE	Yes	Yes	Yes	Yes	Yes
State-by-Year FE	Yes	Yes	Yes	Yes	Yes
Industry-by-Year FE		Yes	Yes	Yes	Yes
Multi-by-Year FE			Yes	Yes	Yes
Age Bins			Yes	Yes	Yes
Weighting				Yes	
# of Unique Firms	14500	14500	14500	14500	14500
N	475000	475000	475000	475000	475000

Dependent variables are multiplied by 100. Multi is a categorical variable for # of states firm is located in. Exit=100 if establishment disappears or reports zero employment in t+1. Main effect of Δ is absorbed by industry-by-year FE's. Distance defined as straight line distance from the state with firm's largest employment share, and is equal to zero if no plant has employment share greater than 20%. All columns are unweighted except for Column 4, which weights by 1/(# of plants in the firm). Standard errors clustered at firm level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Comparing to Other Plant Characteristics (2007 CMF)

Exit multiplied by 100	(1) Exit	(2) Exit	(3) Exit	(4) Exit	(5) Exit	(6) Exit	(7) Exit
Dev_{fs} ($\$100's$)	0.146**	0.144**	0.0636**	0.0607*	0.145**	0.142**	0.148**
	(0.0681)	(0.0681)	(0.0323)	(0.0323)	(0.0681)	(0.0678)	(0.0683)
$\ln(\text{TFP})_{fs}$		-0.225		0.577	-0.729**		
		(0.317)		(0.481)	(0.291)		
$\ln(\text{Assets})_{fs}$		-0.300*		-0.290		-0.481***	
		(0.167)		(0.256)		(0.158)	
LaborShare_{fs}		1.032***		1.485***			1.209***
		(0.274)		(0.346)			(0.242)
$\text{Dev}_{fs} * ln(TFP)_{fs}$					-0.00513		
					(0.0631)		
$\text{Dev}_{fs} * Assets_{fs}$						-0.0677*	
						(0.0347)	
$\text{Dev}_{fs} * LaborShare_{fs}$							0.122**
							(0.0585)
$\text{Employment Share}_{fs}$	-12.24***	-12.40***	-12.57***	-12.74***	-12.30***	-12.20***	-12.47***
	(0.725)	(0.731)	(0.728)	(0.735)	(0.726)	(0.726)	(0.729)
R^2	0.022	0.023	0.436	0.437	0.022	0.022	0.024
Mean of Exit	4.257	4.257	4.257	4.257	4.257	4.257	4.257
SD of Dev	4.202	4.202	4.202	4.202	4.202	4.202	4.202
Multi FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes			Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE			Yes	Yes			
# of Unique Firms	5800	5800	5800	5800	5800	5800	5800
N	21500	21500	21500	21500	21500	21500	21500

Sample consists of LBD plants in 2008 that could be matched to the 2007 CMF, and have more than one location. Plant characteristics are normalized to have mean zero. SD of ln(TFP), ln(Assets), and LaborShare are 0.592, 1.079, and 0.725, respectively. Multi is a categorical variable for # of states firm is located in. Exit=100 if establishment disappears or reports zero employment in t+1. Standard errors clustered at firm level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Employment Volatility

	1997–2000			2003–2007			2010–2014		
	(1) SD	(2) SD	(3) SD	(4) SD	(5) SD	(6) SD	(7) SD	(8) SD	(9) SD
Maximum UI Tax	-0.00188**	-0.00149*		-0.00155***	-0.00160***		-0.00103***	-0.000853**	
($100's)	(0.000902)	(0.000882)		(0.000574)	(0.000573)		(0.000394)	(0.000384)	
State Average UI Tax			-0.00373**			-0.00239			-0.00313**
($100's)			(0.00176)			(0.00166)			(0.00130)
Log(Emp)		-0.0268***			-0.0291***			-0.0267***	
		(0.00363)			(0.00335)			(0.00310)	
R^2	0.554	0.563	0.554	0.541	0.553	0.541	0.528	0.538	0.528
Mean of SD	0.171	0.171	0.171	0.179	0.179	0.179	0.175	0.175	0.175
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# of Unique Firms	2500	2500	2500	2000	2000	2000	2500	2500	2500
N	6700	6700	6700	6300	6300	6300	7400	7400	7400

SD is defined as the standard deviation of Log(Emp) over the 4-5 year panel. RHS variables are the mean values over the 4-5 year panel. Standard errors clustered at firm level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A ONLINE APPENDIX

A.1 Model of Multi-State Firm

I propose a simple two-period model of a multi-state firm to rationalize the establishment exit behavior I have documented. This will also allow me to illustrate the effect of two counterfactual UI tax systems. The first counterfactual, mandating uniform tax schedules across states, shuts down the ability for firms to reallocate employment from high tax to lower tax states. The second counterfactual, establishing a system with national experience rating, would cause any plant closures to count against the firms' remaining locations, thereby shutting down the firm's ability to exit from a state in order to avoid paying UI taxes.

Each firm operates in two locations, state a and state b, producing a single homogeneous good. They face a downward sloping demand function, governed by parameters σ and ρ. The ρ is an industry specific demand shifter through which negative shocks are propogated to firms. Each manufacturing plant faces decreasing returns to scale ($\alpha < 1$), which drives productive firms to operate more than one manufacturing plant. These decreasing returns can be thought of as capacity constraints, transportation costs, etc. For simplicity I will abstract from capital stock, and assume it feeds into the plant-specific productivity A_s.

$$P = \rho Q_{tot}^{-\frac{1}{\sigma}} \qquad \text{where } Q_{tot} = \sum_s Q_s \text{ and } \rho = \rho_j + \epsilon$$

$$Q_{fs} = A_{fs} L_{fs}^{\alpha} \quad \text{where } A_{fs} = \mu_f + \upsilon_{fs}$$

Plant-level costs are then composed of a fixed cost of operation, C, and per-capita labor costs, composed of a fixed wage w and unemployment insurance taxes τ_s. I assume at baseline that τ_s is equal across states, as maximum UI taxes are not binding during good times. The firm then chooses the optimal level of employment to maximize profit:

$$\pi = \rho(Q_a + Q_b)^{(1-\frac{1}{\sigma})} - (w + \tau_a)L_a - (w + \tau_b)L_b - 2 * C$$

At the optimum, relative employment at each plant is a function of the relative labor costs:

$$\frac{L_a^*}{L_b^*} = (\frac{w + \tau_a}{w + \tau_b} \frac{A_b}{A_a})^{\frac{1}{\alpha - 1}}$$

Thus, baseline employment shares in each state pin down the relative productivities. I assume a multivariate normal distribution of plant productivies with equal means for high and low tax states, since the empirical mean of employment shares are close to 50% in Flex versus non-Flex states.

For simplicity, I consider a two-period model with perfect foresight and no labor mobility across states. After facing a negative demand shock to ρ in period 1, firms decide whether to exit from each state in order to maximize total profit $\pi_1 + \beta * \pi_2$. In the absence of UI taxes τ, negative demand shocks should cause the firm to adjust employment proportionally in both plants, maintaining the same relative employment share across plants.

UI taxation enters the problem through tax increases in period 2. If a firm lays off workers but does not exit from any state in period 1, their UI taxes will increase in period 2 to $\tau_s^{hi} > \tau_0$, with $\tau_a^{hi} > \tau_b^{hi}$. If a firm instead shuts down a plant in period 1, that plant remains closed in period 2 and the firm's UI taxes in the surviving plant will increase by less in period 2, to $\tau_s^{low} > \tau_0$ since the surviving plant will have suffered fewer layoffs (likewise, $\tau_a^{low} > \tau_b^{low}$). Therefore, expected UI tax increases in period 2 could drive a firm to close down a plant in period 1 when it would not have otherwise, and to favor closing plants in state a over state b due to the higher UI taxes.

For a reasonable range of parameter values, simulating a population of two-state firms facing negative demand shocks shows that implementing a UI tax system with standardized UI taxes but state-level experience rating could cause exit rates to equalize across locations but result in higher overall exit than before (due to greater UI tax savings from plant closures). However, a counterfactual tax system that implemented experience rating at the national level instead (thereby shutting down firms' ability to avoid UI taxes through exit) could result in lower exit rates while simultaneously raising more UI tax revenue.

A.2 Difference-in-Differences Approach

To provide additional evidence that firms are responding to differences in state UI tax costs, I estimate a simple within-state difference-in-differences model to isolate the effect of UI tax costs from other state-level policies or economic conditions. For the within-state analysis, I focus on the 16 Flex states, because establishments in those states faced the largest increases in UI tax costs. I then define plants as "Treatment" if in 2005 they are the location with the highest maximum UI tax out of all the states the firm is located in (analogous with having a large positive *Dev* measure). Consider another pair of firms Firm B and Firm C, who each have plants located in Iowa. Like before, Firm B's other locations are in Indiana and Illinois (making Iowa the highest maxtax plant), while Firm C has another location in Minnesota which has maxtax $>$ \$2000. Firm B would be labeled a Treatment plant while Firm C would be Control. And if negative demand shocks drive the strategic plant closures of high tax locations, we would expect a differential change in exit rates during the Great Recession of 2008-2009.

Because Exit is mechanically equal to zero in the years up until closure, a pre-trend cannot be estimated for plants observed in 2007. To estimate a pseudo "pre-trend" I restrict my sample to establishments observed in 2005, and follow them for 7 years until 2011, defining 2006-2007 as a pre-period and 2008-2011 as the post-period. I define treatment using the firm's baseline composition in 2005, to limit potentially endogenous changes in firm locations due to establishment entry/exit. I then estimate a linear regression specification including yearly indicators interacted with the Treatment dummy:

$$Exit_{ist} = \sum_{k=2005}^{2011} \beta_k Treat_i * I(t = k) + \gamma_{st} + \delta_i + \epsilon_{ist} \tag{6}$$

In the specification above, i indexes establishment, s indexes state, and t indexes year.

The outcome of interest is an indicator for whether the plant shuts down or reports zero employment in March of year t+1. Included are state-by-year fixed effects to control for economic conditions or other state policies, as well as establishment fixed effects. Figure A.11 plots the yearly coefficients on Treatment, relative to the baseline difference in 2005. There is a statistically significant increase in 2008 and 2009, showing that the gap in exit rates between Treatment and Control plants increased by 2-3 percentage points during the Great Recession. This is quite a large effect given that the overall exit rate during this period was only around 4%.

Given that we observe a difference in exit rates between treatment and control plants within Flex states, we would expect to observe a parallel pattern of exit from these Flex states when comparing within firm rather than within state. Figure A.12 plots the estimates from an analogous difference-in-differences model studying firms that have locations in both Flex and non-flex states, providing evidence of increased exit precisely from Flex states during the Great Recession.

A.3 Additional Details of LBD Sample

My main analysis sample is constructed from the LBD and spans the years 1997–2014. To ensure that each establishment's NAICS industry remains constant over the sample period, I define industry using the modal NAICS code. Though rare, some establishments change 3-digit NAICS over the course of the sample (3-digit is finest level of industry I use in my analysis), and I have checked that my main results are robust to dropping these establishments from my sample. For establishments that shut down prior to 2002, only SIC codes were collected (NAICS information was only available in 2002 and later), so in order to assign them a NAICS code I create a crosswalk between 4-digit SIC and 4-digit NAICS codes based on the most frequent SIC to NAICS pairs in the 1997 CMF (which reported both SIC and NAICS codes).

After dropping single-unit firms and government-owned businesses, I also drop any establishments not in NAICS sectors 31-33, which are the manufacturing industries. Collectively manufacturing made up about 17% of U.S. employment in 1997, but was down to 11% in 2014. And as stated previously, I redefine firms as Firm ID-by-3-digit NAICS industry. Next I aggregate all establishments to the Firm ID-by-3-digit NAICS-by-State level so that each firm only has one location in each state. This ensures that I define Establishment Exit as complete exit from a state, rather than the closure of one establishment out of multiple. In the final sample, only 23.5% of these "plant"-level observations were aggregates of more than one establishment. I then drop any plants that never employ more than 10 workers at a time, to ensure that the plants studied have actual manufacturing capacity.

Finally, to restrict my sample to multi-state firms I require all firms to have locations in more than one state in at least one year from 1997 to 2014. I still keep any years in which these firms only operated in a single state (provided they were multi-state in an earlier/later year), in order to help identify fixed effects in my regression models. It should be noted that in my sample, firms with only one location are not synonymous with single-unit firms, as the former may be affiliated with a firm ID with establishments in other non-manufacturing industries. Additionally, if an establishment starts off as a single-unit firm before becoming acquired by a multi-unit firm (or starts off in a multi-unit and is then converted into a single-unit due to closure), I will only include the years in which the they are designated a multi-unit firm.

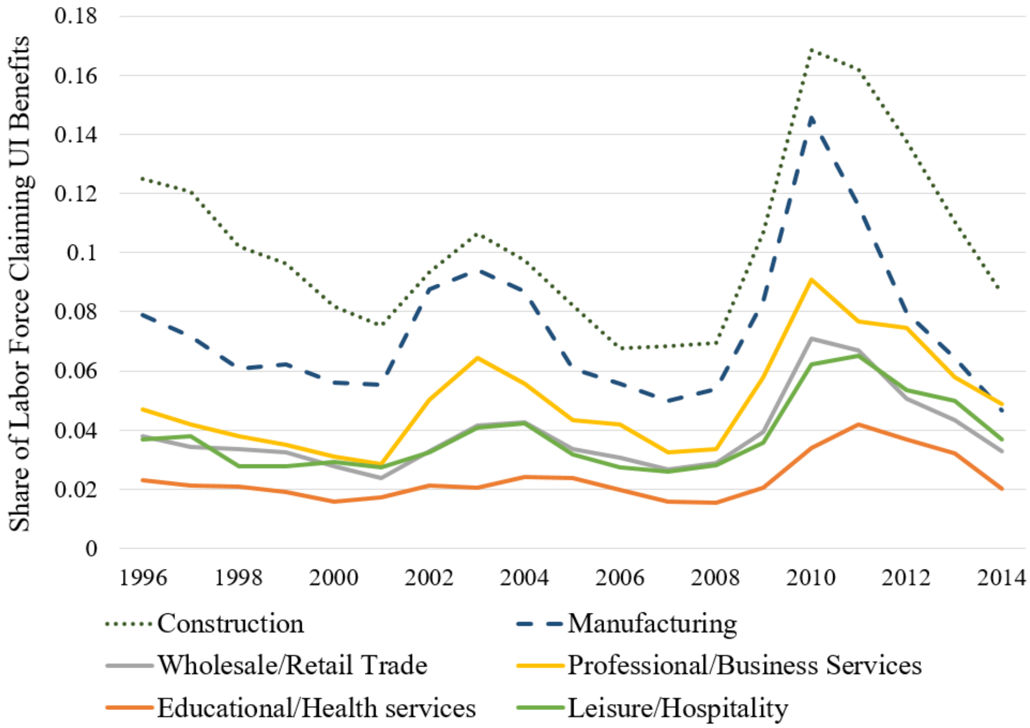
A.4 Additional Details of LEHD Sample

Unfortunately, matching LBD establishments to the subset of states for which I have LEHD data for reduces my sample, as the LEHD states represent approximately 48% of total manufacturing employment. Nevertheless, because my research design compares firms with differing outside options, I can still use previously calculated tax deviation measures (from the entire sample) for identification. While LEHD coverage begins in some states as early as 1990, other states do not begin reporting to the LEHD until much later. Therefore, I restrict my LEHD sample to the period 2000–2013 in order to maximize coverage while still incorporating the last two recessions.

For multi-establishment firms, matching LEHD data to the LBD is not very straightforward due to the fact that LEHD employers are defined at the SEIN rather than establishment level. A portion of LEHD employers cannot be matched to the LBD at all (especially in years the employer exits), and some SEIN's will match to multiple LBD establishments, and vice versa. To keep matches conservative, I restrict to SEIN's with current manufacturing NAICS codes and require a match on both Firm ID and EIN. If an LBD "plant" (aggregated at the state level) matches to multiple SEINs, I aggregate the matched SEINs to the state level as well to ensure that only one observation is created. However, if the LBD observation was only made up of a single establishment yet matched to multiple SEINs, I drop that observation instead. I also drop any matched observations employing fewer than 5 workers during the year. The resulting matched sample includes almost 60% of the firms in the main LBD sample.

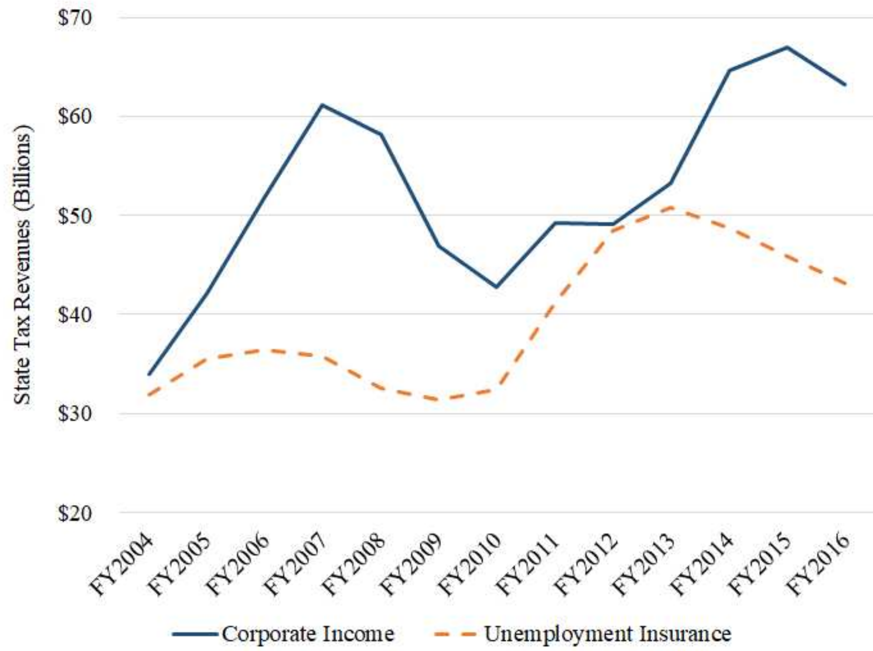
APPENDIX TABLES AND FIGURES

Figure A.1: UI Claimants in March CPS, by Sector



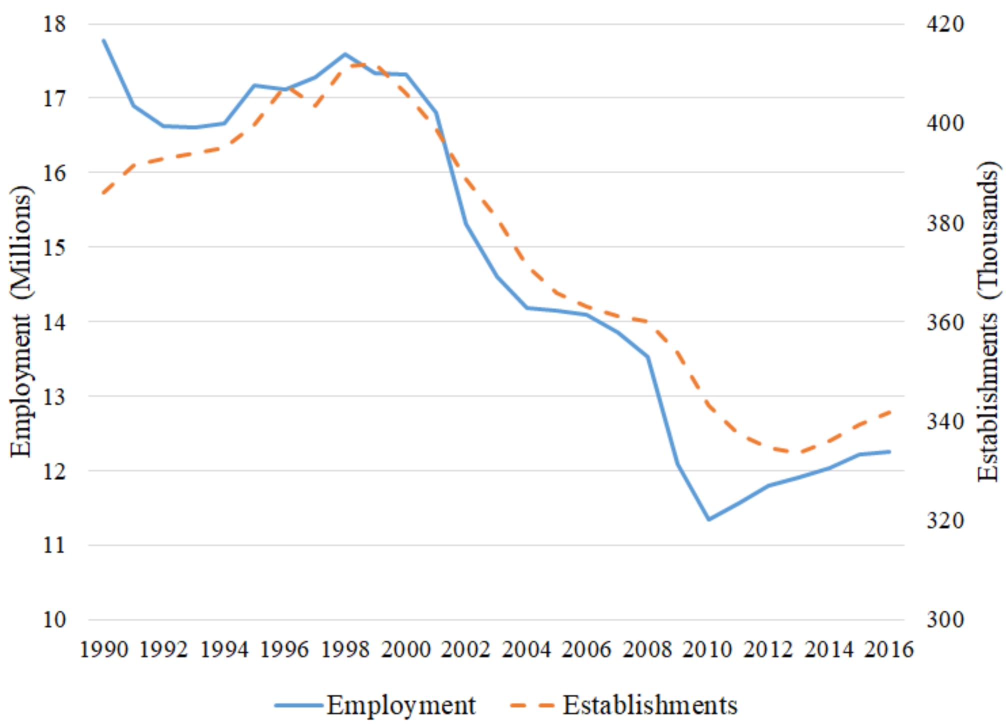
Source: March Current Population Survey. Limited to workers in the labor force aged 18-64.

Figure A.2: State Business Tax Revenues (FY2004–FY2016)



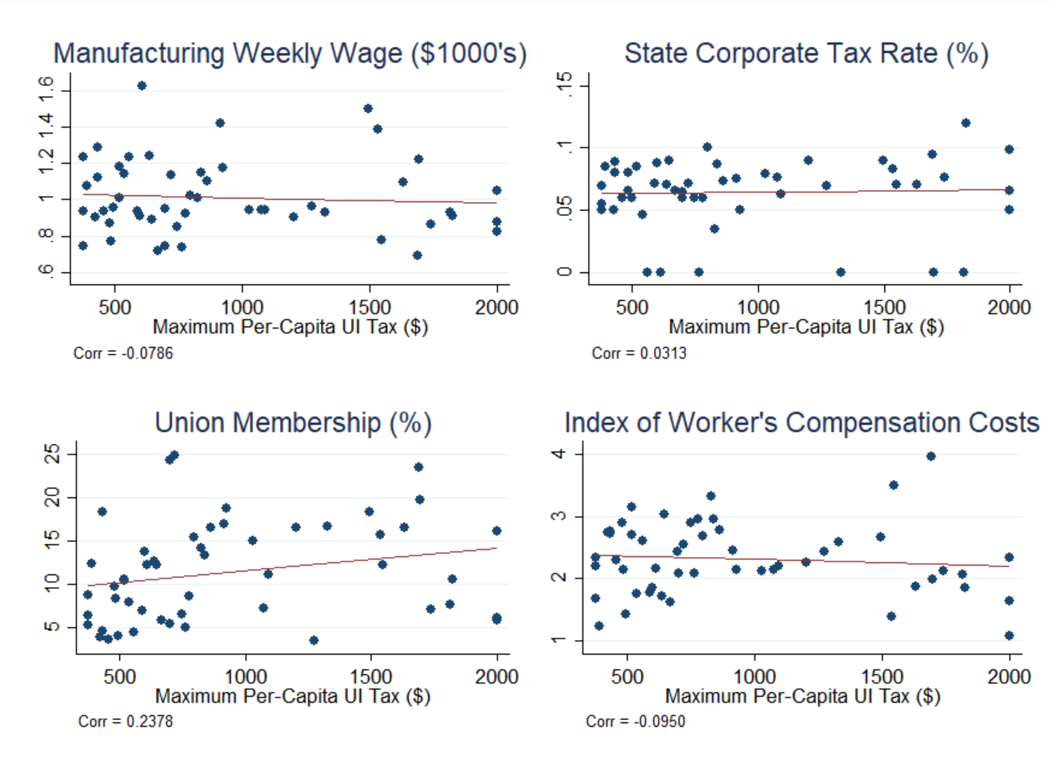
Source: *Total state and local business taxes*, Ernst & Young LLP estimates based on data from the U.S. Census Bureau, state and local government finances

Figure A.3: Decline in U.S. Manufacturing Employment



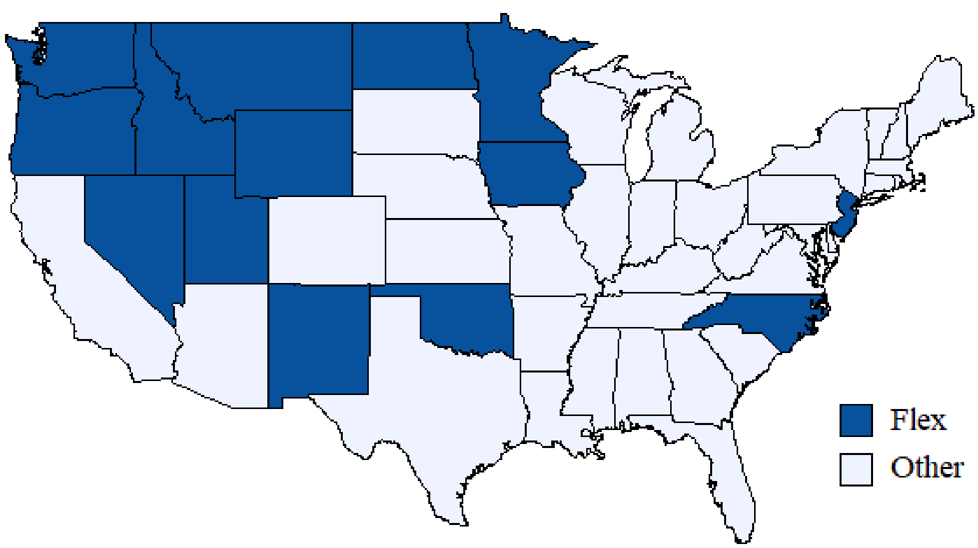
Source: Quarterly Census of Employment and Wages

Figure A.4: No Correlation b/w Max UI Taxes and Other State Costs (2008)



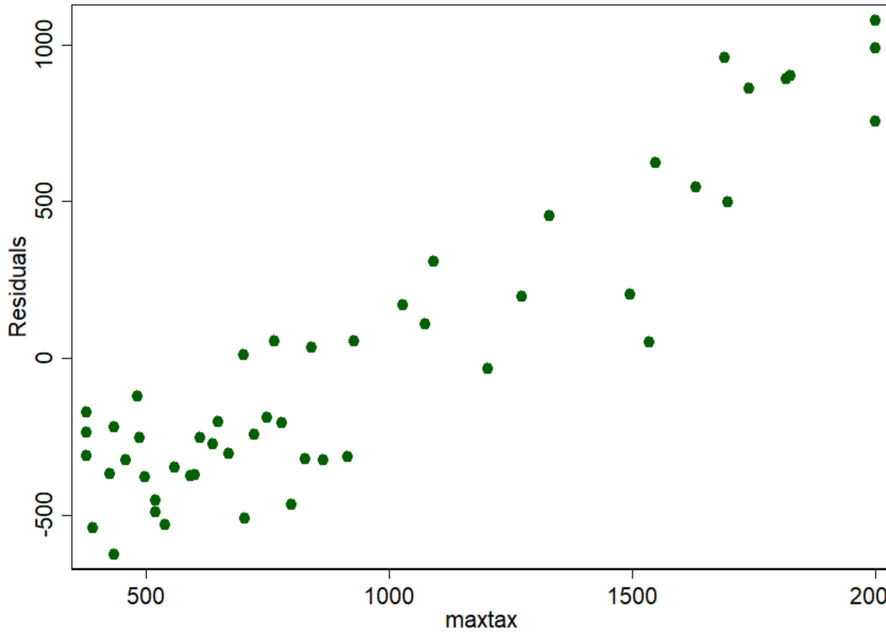
Sources: Manufacturing wages from QCEW, Corporate tax rates from Suárez Serrato and Zidar (2016), Union membership from BLS, and Worker's Comp from *Insurance Journal*

Figure A.5: Flexible Taxable Wage Base States



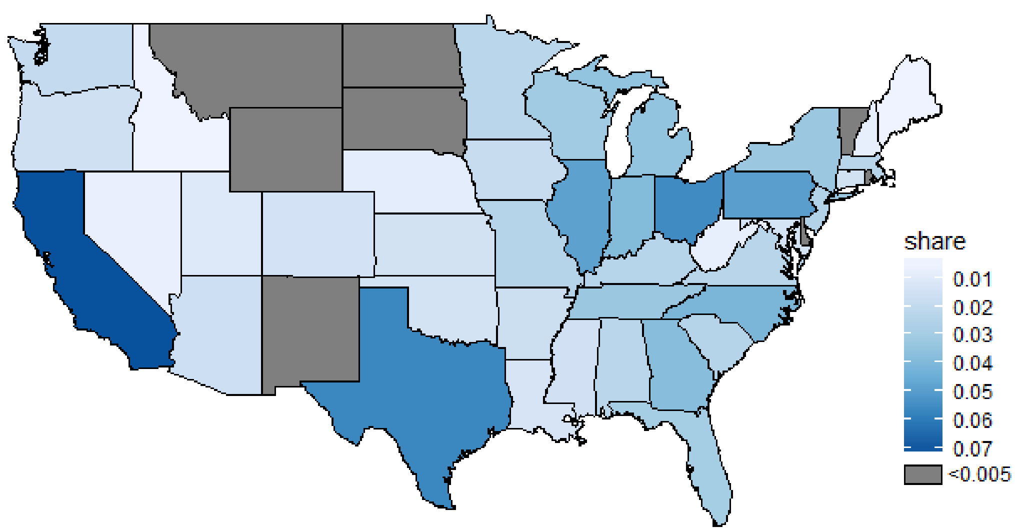
14 Flex states: ID, IA, MN, MT, NV, NJ, NM, NC, ND, OK, OR, UT, WA, and WY. Not pictured are flexible wage base states Alaska and Hawaii.

Figure A.6: Residual Variation in Maximum UI Taxes (2008)



Scatterplot of residuals from a regression of state maximum UI taxes on weekly maximum UI benefits using data from 2008. The positive correlation between residuals and maximum taxes shows that not all of the variation in maxtax can be accounted for by the maximum benefit level.

Figure A.7: Distribution of Multi-State Firms (1997–2014)



Plots the share of plants in main analysis sample located in each state. Smallest 10 states plus DC are omitted.

Figure A.8: No Correlation b/w Max UI Taxes and UI Benefit Claims (2009)

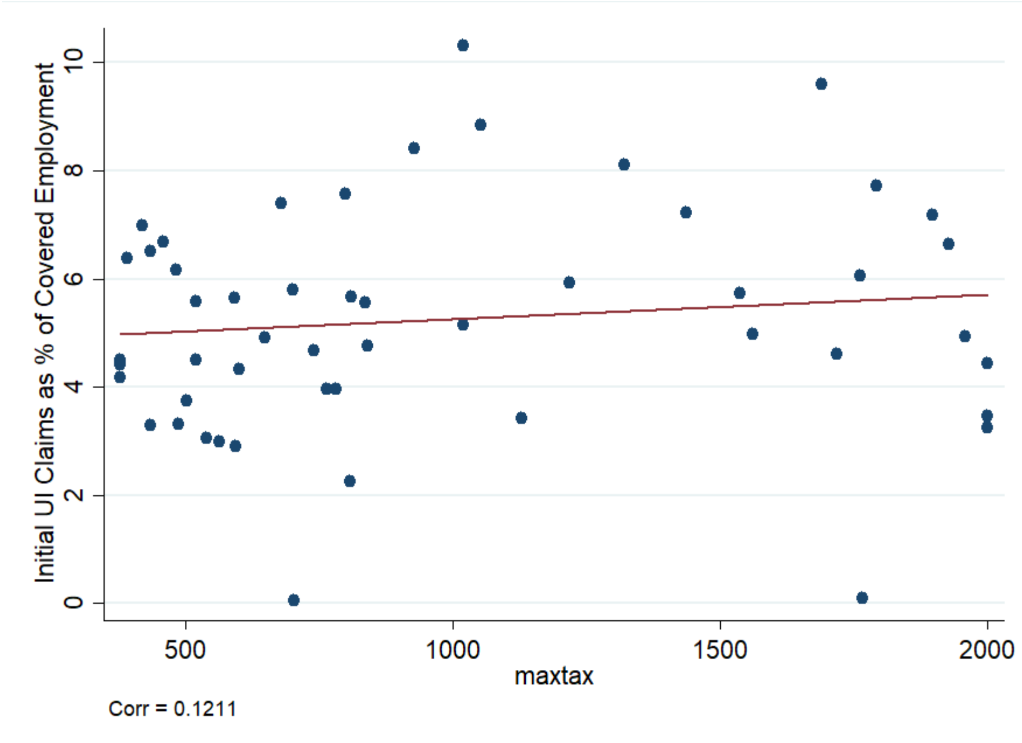
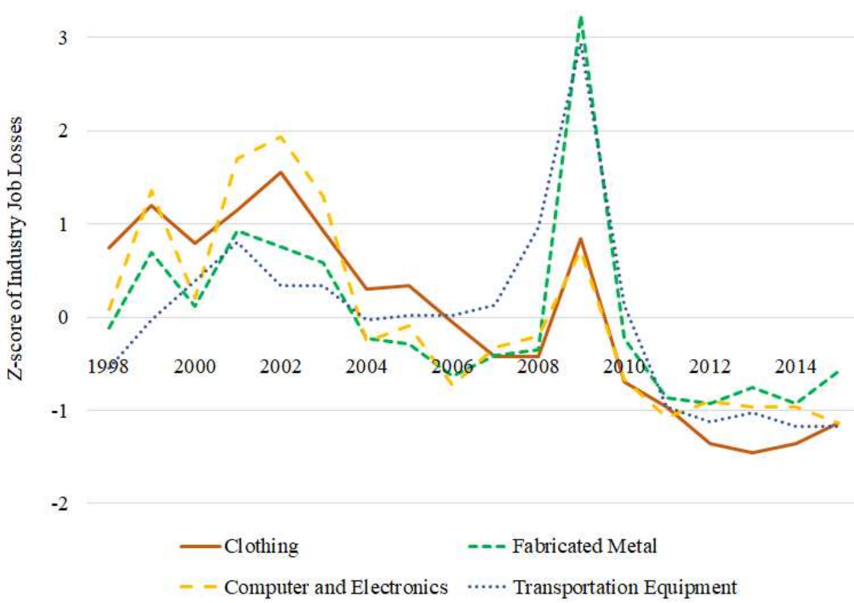
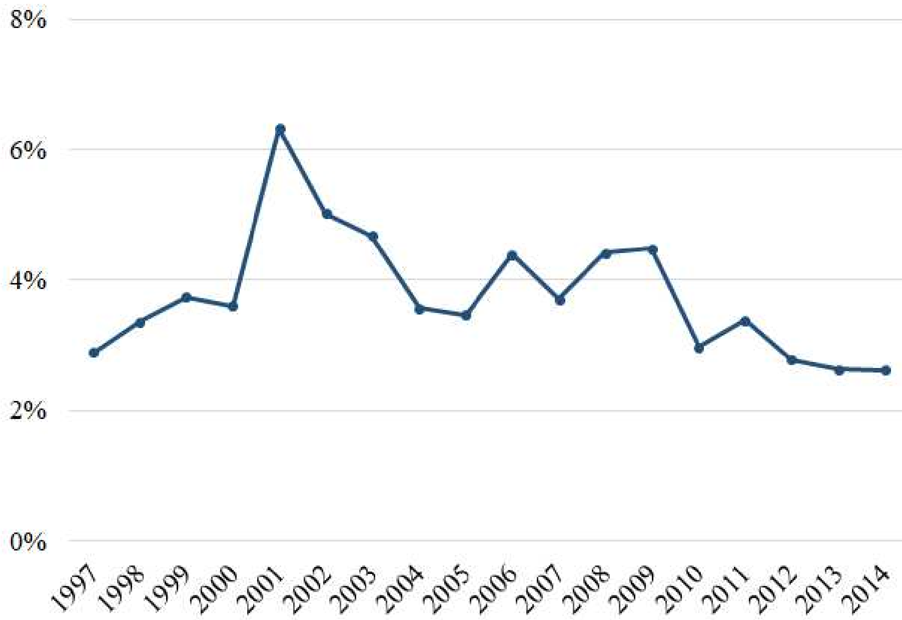


Figure A.9: Z-scores of 3-digit NAICS Industry Job Losses



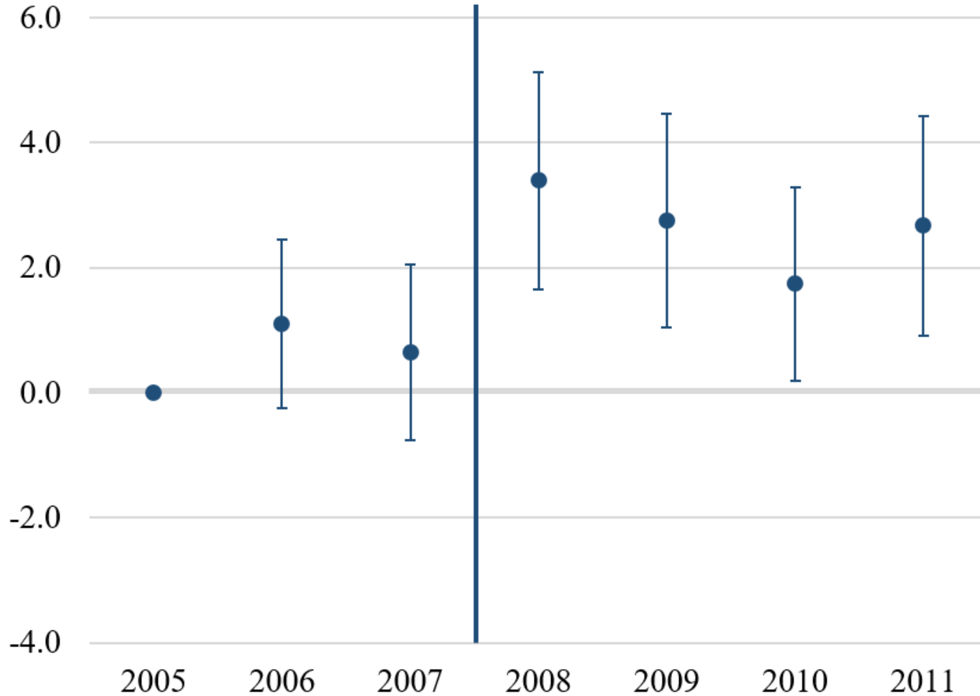
Source: Business Employment Dynamics. Z-scores calculated for the distribution of maximum quarterly job loss rates each year from 1998–2015.

Figure A.10: Annual Establishment Exit Rates (1997–2014)



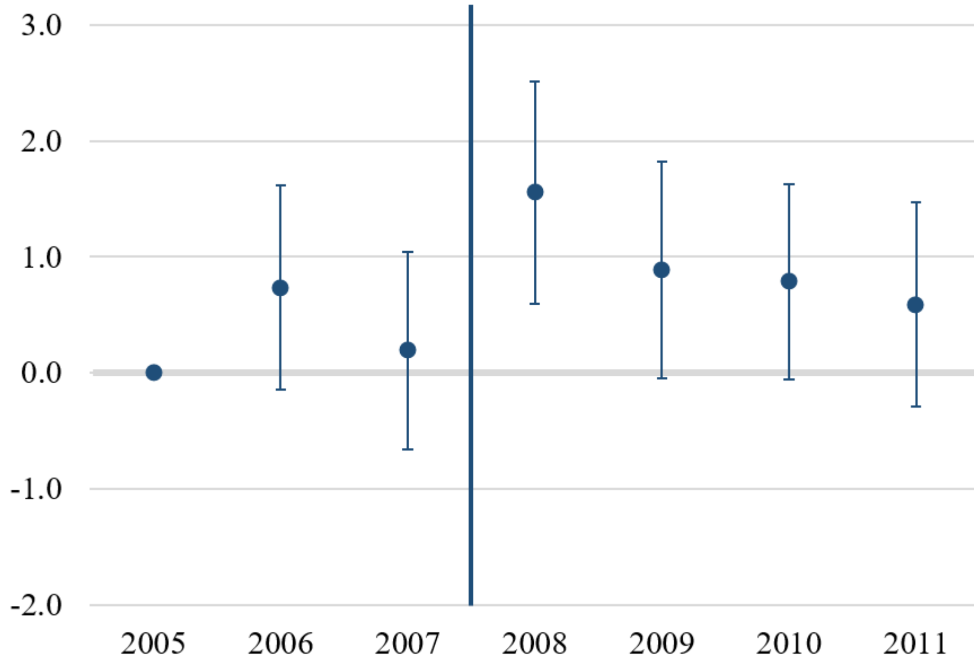
Exit defined as establishment disappearing or reporting zero employment in t+1. The unusually large spike in 2001 is driven by administrative changes in Firm ID due to 2000 Census updating.

Figure A.11: Within-State Comparison: Coefficients on Treatment Plants



Sample consists of approx 26000 plants from 16 Flex states. Treatment defined as plants that have highest maxtax in firm. Yearly coefficients are relative to the baseline difference in 2005. Error bars denote 95% confidence intervals.

Figure A.12: Within-Firm Comparison: Coefficients on Flex States



Sample consists of approx 84000 plants (2800 firms) operating in both Flex and non-Flex states in 2005. Yearly coefficients from regression with state, year, and firm FE's (relative to baseline difference in 2005). Error bars denote 95% confidence intervals.

Table A.1: Breakdown of US Manufacturing by Locations Across States (2002)

Number of States Firm is Located In	Share of Firms (%)	Share of Employment (%)
One	96.7	43.3
Two	1.7	6.8
3–4	0.8	7.0
5–9	0.5	10.9
10 or More	0.3	32.1

Includes all 2002 LBD establishments operating in NAICS 31–33, aggregated by Firm ID.

Table A.2: Correlation with Other State Business Costs

	State Maximum UI Tax		
	(1)	(2)	(3)
	2000	2004	2008
Minimum Wage	340.6**	229.5**	-7.043
	(126.2)	(96.84)	(220.7)
Manufacturing Weekly Wage	-732.1***	-500.3*	-393.9
	(245.6)	(273.0)	(440.6)
Right-to-Work	164.3	278.4	64.61
	(133.0)	(204.4)	(245.4)
Unionization Rate	37.50***	52.22**	46.67
	(12.21)	(21.29)	(28.29)
Workers' Comp	-62.76	-189.9***	-207.8
	(61.99)	(66.06)	(154.7)
Corporate Income Rate	0.574	-0.597	14.73
	(17.50)	(28.46)	(38.88)
R&D Tax Credit	330.8	-1008.2	-1716.7
	(984.5)	(1571.5)	(2321.7)
Personal Income Rate	19.41	20.24	14.47
	(16.21)	(24.30)	(28.98)
Republican Legislature	225.3**	-7.884	245.2
	(101.3)	(145.2)	(228.4)
Constant	-1060.8	-159.4	1186.7
	(643.2)	(605.8)	(1416.4)
R^2	0.400	0.305	0.141
N	51	51	51

Minimum wage data from Dept of Labor. Manufacturing wage data from QCEW. Unionization rates from Bureau of Labor Statistics. Workers' Compensation data from Oregon DCBS. Income tax and R&D tax credit data from Suárez Serrato and Zidar (2016). State partisanship data from National Conference of State Legislatures. Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.3: Placebo Tax Deviation from Firm Mean (1997–2014)

	(1) Exit	(2) Exit	(3) Exit	(4) Empl Growth
Placebo Dev_{fst} ($100′$s$)	0.00379	0.00342	0.0125	0.0193
	(0.0140)	(0.0140)	(0.0156)	(0.0366)
Placebo $\text{Dev}_{fst} * \Delta_{jt}$ ($100′$s$)	-0.00338	-0.00282	0.00272	0.0234
	(0.0102)	(0.0102)	(0.0131)	(0.0255)
Distance_{fst}		-0.00233	-0.00540	-0.00157
		(0.00377)	(0.00461)	(0.00978)
Employment Share_{fst}	-10.03***	-10.05***	-9.016***	8.706***
	(0.165)	(0.194)	(0.211)	(0.475)
R^2	0.020	0.021	0.021	0.025
Mean of Dep Var	3.935	3.935	4.461	-10.58
SD of Placebo Dev	4.444	4.444	3.817	4.444
Multi FE	Yes	Yes	Yes	Yes
State-by-Year FE	Yes	Yes	Yes	Yes
Industry-by-Year FE	Yes	Yes	Yes	Yes
Multi-by-Year FE		Yes	Yes	Yes
Age Bins		Yes	Yes	Yes
Weighting			Yes	
# of Unique Firms	14500	14500	14500	14500
N	475000	475000	475000	475000

Dependent variables are multiplied by 100. Multi is a categorical variable for # of states firm is located in. Exit=100 if establishment disappears or reports zero employment in t+1. Placebo Dev is calculated replacing each state's maxtax with the maxtax of the alphabetically preceding state. Distance defined as straight line distance from the state with firm's largest employment share, and is equal to zero if no plant has employment share greater than 20%. All columns are unweighted except for Column 3, which weights by 1/(# of plants in the firm). Standard errors clustered at firm level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.4: Controlling for Lagged Employment (1997–2014)

	(1) Exit	(2) Exit	(3) Exit	(4) Empl Growth
Dev_{fst} ($\$100's$)	0.0433***	0.0444***	0.0546***	-0.112***
	(0.0150)	(0.0150)	(0.0175)	(0.0378)
$\text{Dev}_{fst} * \Delta_{jt}$ ($\$100's$)		0.0290***	0.0346**	-0.0539*
		(0.0112)	(0.0147)	(0.0281)
$\text{LogEmp}_{fs,t-2}$	-0.816***	-0.815***	-0.995***	1.004***
	(0.0379)	(0.0378)	(0.0448)	(0.0963)
$\text{Employment Share}_{fst}$	-7.047***	-7.047***	-5.919***	7.796***
	(0.204)	(0.204)	(0.222)	(0.501)
R^2	0.025	0.025	0.026	0.027
Mean of Dep Var	3.804	3.804	4.341	-10.76
State-by-Year FE	Yes	Yes	Yes	Yes
Industry-by-Year FE	Yes	Yes	Yes	Yes
Multi-by-Year FE	Yes	Yes	Yes	Yes
Age Bins	Yes	Yes	Yes	Yes
Weighting			Yes	
# of Unique Firms	13500	13500	13500	13500
N	460000	460000	460000	460000

Dependent variables are multiplied by 100. Multi is a categorical variable for # of states firm is located in. Exit=100 if establishment disappears or reports zero employment in t+1. Distance defined as straight line distance from the state with firm's largest employment share, and is equal to zero if no plant has employment share greater than 20%. All columns are unweighted except for Column 3, which weights by 1/(# of plants in the firm). Standard errors clustered at firm level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.5: Restricting to Firms Operating in Only One NAICS Industry (1997–2014)

	(1) Exit	(2) Exit	(3) Exit	(4) Exit
Dev_{fst} (\$100′s)	0.0534**	0.0544**		
	(0.0229)	(0.0230)		
$\text{Dev}_{fst} * \Delta_{jt}$ (\$100′s)		0.0268		
		(0.0181)		
Dev2_{fst} (\$100′s)			0.0275*	0.0280*
			(0.0149)	(0.0150)
$\text{Dev2}_{fst} * \Delta_{ft}$ (\$100′s)				0.0132
				(0.0111)
$\text{Log(Emp)}_{fs,t-2}$	-0.538***	-0.538***	-0.538***	-0.538***
	(0.0591)	(0.0591)	(0.0591)	(0.0591)
Employment Share_{fst}	-7.886***	-7.885***	-7.891***	-7.889***
	(0.277)	(0.277)	(0.277)	(0.277)
R^2	0.033	0.033	0.033	0.033
Mean of Exit	4.099	4.099	4.099	4.099
State-by-Year FE	Yes	Yes	Yes	Yes
Industry-by-Year FE	Yes	Yes	Yes	Yes
Multi-by-Year FE	Yes	Yes	Yes	Yes
Age Bins	Yes	Yes	Yes	Yes
# of Unique Firms	7000	7000	7000	7000
N	200000	200000	200000	200000

Exit=100 if establishment disappears or reports zero employment in t+1. Multi is a categorical variable for # of states firm is located in. Sample restricted to firm-years with more than one plant and operating in single 6-digit NAICS industry. Standard errors clustered at firm level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.6: Firms with No New Entry Since 1992 (1997–2014)

	(1) Exit	(2) Exit	(3) Exit	(4) Empl Growth
Dev_{fst} ($\$100's$)	0.0555**	0.0561**	0.0632**	-0.109*
	(0.0243)	(0.0242)	(0.0264)	(0.0592)
$\text{Dev}_{fst} * \Delta_{jt}$	0.0532***	0.0540***	0.0317	-0.117**
	(0.0204)	(0.0204)	(0.0235)	(0.0494)
Distance_{fst}		-0.00300	-0.00589	0.00531
		(0.00647)	(0.00744)	(0.0159)
Employment Share_{fst}	-9.699***	-9.730***	-9.139***	12.53***
	(0.256)	(0.310)	(0.331)	(0.725)
R^2	0.027	0.028	0.029	0.035
Mean of Dep Var	4.282	4.282	4.579	-11.42
Multi FE	Yes	Yes	Yes	Yes
State-by-Year FE	Yes	Yes	Yes	Yes
Industry-by-Year FE	Yes	Yes	Yes	Yes
Multi-by-Year FE		Yes	Yes	Yes
Age Bins		Yes	Yes	Yes
Weighting			Yes	
# of Unique Firms	9500	9500	9500	9500
N	177000	177000	177000	177000

Dependent variables are multiplied by 100. Multi is a categorical variable for # of states firm is located in. Exit=100 if establishment disappears or reports zero employment in t+1. Distance defined as straight line distance from the state with firm's largest employment share, and is equal to zero if no plant has employment share greater than 20%. All columns are unweighted except for Column 3, which weights by 1/(# of plants in the firm). Standard errors clustered at firm level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.7: Separate Sub-Periods: (1997–2005) and (2006-2014)

	1997–2005				2006–2014			
	(1) Exit	(2) Exit	(3) Exit	(4) Empl Growth	(5) Exit	(6) Exit	(7) Exit	(8) Empl Growth
Dev_{fst} ($\$100's$)	0.0477**	0.0477**	0.0443*	-0.133**	0.0531***	0.0538***	0.0704***	-0.0131***
	(0.0223)	(0.0223)	(0.0257)	(0.0582)	(0.0193)	(0.0193)	(0.0227)	(0.0490)
$\text{Dev}_{fst} * \Delta_{jt}$	0.0459***	0.0456***	0.0226	-0.119***	0.0285*	0.0307*	0.0525**	-0.0169
	(0.0166)	(0.0166)	(0.0215)	(0.0409)	(0.0164)	(0.0165)	(0.0215)	(0.0416)
Distance_{fst}		0.00750	0.00148	-0.0274*		-0.0123***	-0.0127**	0.0255**
		(0.00553)	(0.00647)	(0.0141)		(0.00476)	(0.00608)	(0.0125)
Employment Share_{fst}	-10.81***	-10.60***	-9.591***	9.000***	-9.205***	-9.469***	-8.418***	8.441***
	(0.230)	(0.271)	(0.295)	(0.666)	(0.220)	(0.257)	(0.283)	(0.646)
R^2	0.022	0.023	0.023	0.024	0.018	0.019	0.020	0.027
Mean of Dep Var	4.247	4.247	4.721	-11.28	3.594	3.594	4.170	-9.823
SD of Dev	3.580	3.580	3.580	3.035	3.580	4.144	4.144	3.535
4.144								
Multi FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-by-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-by-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Multi-by-Year FE		Yes	Yes	Yes		Yes	Yes	Yes
Age Bins		Yes	Yes	Yes		Yes	Yes	Yes
Weighting			Yes				Yes	
# of Unique Firms	12000	12000	12000	12000	10500	10500	10500	10500
N	248000	248000	248000	248000	227000	227000	227000	227000

Dependent variables are multiplied by 100. Multi is a categorical variable for # of states firm is located in. Exit=100 if establishment disappears or reports zero employment in t+1. Distance defined as straight line distance from the state with firm's largest employment share, and is equal to zero if no plant has employment share greater than 20%. All columns are unweighted except for Column 4, which weights by 1/(# of plants in the firm). Corporate tax data from Suárez Serrato and Zidar (2016). Standard errors clustered at firm level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.8: Hiring Using Matched LEHD Data (2000–2013)

	(1) Any Hire	(2) Any Hire	(3) Log Hires	(4) Log Hires
Dev_2000	-0.00871	-0.00741	-0.0114	-0.0138**
	(0.0733)	(0.0730)	(0.00705)	(0.00692)
Dev_2001	-0.108	-0.101	-0.0163**	-0.0151**
	(0.0952)	(0.0947)	(0.00731)	(0.00726)
Dev_2002	-0.195**	-0.203**	-0.0128*	-0.0126*
	(0.0947)	(0.0953)	(0.00741)	(0.00737)
Dev_2003	-0.114	-0.113	-0.0133*	-0.0127*
	(0.0962)	(0.0969)	(0.00694)	(0.00694)
Dev_2004	-0.0436	-0.0630	-0.0138**	-0.0147**
	(0.0873)	(0.0881)	(0.00653)	(0.00647)
Dev_2005	-0.0305	-0.0354	-0.00321	-0.00266
	(0.0806)	(0.0804)	(0.00658)	(0.00650)
Dev_2006	-0.126*	-0.128*	-0.0151**	-0.0147**
	(0.0735)	(0.0738)	(0.00664)	(0.00658)
Dev_2007	-0.0161	-0.0163	-0.0127*	-0.0110*
	(0.0758)	(0.0761)	(0.00650)	(0.00647)
Dev_2008	-0.0663	-0.0457	-0.00394	-0.000412
	(0.0880)	(0.0889)	(0.00668)	(0.00666)
Dev_2009	0.109	0.136	-0.000570	0.00427
	(0.145)	(0.145)	(0.00686)	(0.00670)
Dev_2010	-0.0285	-0.0370	-0.00752	-0.00621
	(0.106)	(0.107)	(0.00683)	(0.00687)
Dev_2011	-0.233**	-0.228**	-0.0174**	-0.0194***
	(0.100)	(0.102)	(0.00696)	(0.00694)
Dev_2012	0.0271	0.0118	-0.00233	-0.00504
	(0.103)	(0.103)	(0.00678)	(0.00678)
Dev_2013	0.195*	0.189*	-0.00660	-0.00722
	(0.105)	(0.107)	(0.00691)	(0.00694)
Employment Share$_{fst}$	14.13***	14.15***	2.827***	2.842***
	(0.516)	(0.516)	(0.0484)	(0.0480)
R^2	0.039	0.044	0.235	0.251
Mean of Dep Var	96.16	96.16	3.185	3.185
Multi FE	Yes	Yes	Yes	Yes
State-by-Year FE	Yes	Yes	Yes	Yes
Additional Controls		Yes		Yes
N	115000	115000	115000	115000

Any Hire is indicator equal to 100 if establishment has any new hire in year t. Log Hires=Ln(1+Hires), where Hires is the total number of new hires in year t. Multi is a categorical variable for # of states firm is located in. Standard errors clustered at firm level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$