The Structure of State Corporate Taxation and its Impact on State Tax Revenues and Economic Activity*

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PRELIMINARY AND INCOMPLETE

Abstract

This paper describes the state corporate tax structure – tax rates and tax base rules – and documents how it has changed over time. It then analyzes the consequences of changes in the corporate tax structure to study their impact on state tax revenues and economic activity. We present five main findings. First, changes in state corporate tax rates tend not to be accompanied by tax base changes. Second, tax base rules (such as loss carry forward provisions and investment tax credits) explain more of the variation in state corporate tax revenue to GDP than state corporate tax rates. Third, the impact of a one percentage point cut in the state corporate tax rate on state corporate tax revenue and state GDP is -2.7% and 1.4%, respectively, without base controls and -3.5% and 1.5% with base controls. Fourth, these effects vary across states and time depending on tax base rules. Fifth, changes in the state corporate tax structure have made economic activity more responsive to changes in tax rates, implying lower revenue-maximizing tax rates.

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How states tax businesses has received renewed interest in both academic and policy circles. Recent work on state corporate tax rates has investigated their impacts on income growth, employment, and business location.[1] However, state policymakers compete to attract businesses not only by changing tax rates, but also by changing the tax base to enhance several investment incentives, loss provisions, enforcement mechanisms.[2] There is a lack of basic facts about the state corporate tax structure overall, its evolution over recent years, and how it impacts tax revenue and economic activity.

This paper aims to establish facts about the state corporate tax structure and describe its consequences for tax revenue and economic activity. We proceed in four steps.

We first describe recent trends in tax rates and twelve determinants of the corporate income tax base. We show states are actively changing the state tax base and often do so in ways that narrow the tax base. This increased generosity is consistent with the observation that while average state corporate tax rates have remained relatively stable, state corporate tax revenues as a share of economic activity has declined substantially. Contrary to the veiw that state tax rate changes are often accompanied by offsetting changes in the tax base, we find that the vast majority of tax base changes are not associated with tax rate changes.

Second, these tax base changes have substantial impacts on state corporate tax collections. We quantify the importance of these tax base changes between 1980 and 2010. We perform analysis of variance decompositions every 5-years and document the growing importance of tax base rules, relative to tax rates, in explaining the variation in corporate tax revenue across states. In 1980, tax rates and tax base controls each accounted for half of the explained variance in tax revenues. By 2005, the fraction of the explained variance corresponding to tax base controls increased to 75%. At the same time, the importance of different tax base controls in explaining tax revenues has evolved over our sample. In particular, loss carryforward provisions have waned in importance, while R&D tax credits, payroll apportionment weights, and different depreciation rules have increased their share of explained variance.

Third, we explore the degree to which controlling for these tax base provisions affect the relationship between tax rates and revenue and state GDP. We find that, while tax base controls

[1] Recent papers include Heider and Ljungqvist (2014), Giroud and Rauh (2015), Suárez Serrato and Zidar (2016), Fajgelbaum et al. (2015), Ohrn (2016), and Ljungqvist and Smolyansky (2014).

[2] These tax base rules are important determinants of measures of state business climate indexes. For instance, Tax Foundation (2016). ALEC (2014) reports that 14 states changed taxes in 2014 with many of the changes affecting both tax rates as well as tax base determinants.

explain a large portion of the variation in revenues, the relationships between tax rates and our outcomes of interest are not fundamentally affected by controlling for these tax base measures.

Fourth, we allow for interactions of the elasticity of corporate tax revenue and the tax base vector and find significant heterogeneity across states and across time. We characterize this heterogeneity across time and show that, on average, tax base changes have made state GDP more responsive to changes in the corporate tax rate. In consequence, this results in a lower revenue-maximizing tax rate (i.e., "Laffer rate"). We find that changes in the allowance of loss carry-forwards and the adoption of federal bonus depreciation are the primary drivers of this change across time.

This paper contributes to three literatures. First, relative to recent work on the effects of changes in state business tax rates on economic activity (Heider and Ljungqvist (2014), Giroud and Rauh (2015), Suárez Serrato and Zidar (2016), Fajgelbaum et al. (2015), Ohrn (2016), and Ljungqvist and Smolyansky (2014)), we explore how the relationships between tax rates and revenues and economics activity depends on the structure of the corporate tax system. A contribution of this paper is the collection and description of comprehensive set of variables that describe the structure of the corporate tax system across U.S. states, which we hope will aid future researchers in this literature. Second, this paper is also related to a set of papers that explore whether tax base changes affect the relationship between corporate tax rates and corporate income tax revenues. In particular, Clausing (2007), Devereux (2007), and Kawano and Slemrod (2015) study this relationship across 29 OECD member countries, and Dahlby and Ferede (2012) perform a similar analysis across Canadian provinces. We follow Kawano and Slemrod (2015) by collecting a comprehensive set of variables that describe the breadth of the tax base and by controlling for this tax base vector in our estimations. Finally, we make the point that the relationship between tax rates and economic activity depends on the structure of the tax base. This point is related to work by Kopczuk (2005), who finds that the elasticity of reported taxable income depends on the availability of deductions.

The paper is organized as follows. Section 1 describes the dataset of tax base determinants. Section 2 performs the variance decomposition analysis and Section 3 explores the effects of controlling for tax base determinants on various outcomes of economic interest. Section 4 explores effect heterogeneity across states and over time and Section 5 discusses policy implications for the revenue-maximizing tax rate, incidence, and tradeoffs between having a broad

corporate tax base and low corporate tax rates.

1 Data and Descriptive Statistics on State Corporate Tax Structure

1.1 Data Sources

Most of the data used in this paper were digitized from a variety of sources including CCH (1980-2010) and CSG (1976-2011) but we also rely on data collected and generously provided by Chirinko and Wilson (2008), Wilson (2009), and Bernthal et al. (2012). Details of each of the variables, sources, and coverage are available in Appendix A. The following variables comprise our state-year panel dataset of tax base measures: an indicator of having throwback rules, an indicator of having combined reporting rules, investment tax credit rates, research and development tax credit rates, number of years for loss carry backs, number of years for loss cary forwards, an indicator for franchise taxes, an indicator for federal income tax deductibility, an indicator for federal income tax base as the state tax base, an indicator for follows federal accelerated depreciation, an indicator for follows accelerated cost recovery system (ACRS) depreciation, and an indicator for federal bonus depreciation.

Most of the variables are indicators of whether a state allows a particular policy. Rules describing loss carriage describe the number of years prior to the loss that a corporation may carry back net operating loss as well as the number of years a corporation may carry forward any excess loss following the loss year. Throwback and combined reporting rules come from Bernthal et al. (2012) and describe whether a state requires a unitary business to submit combined reporting and, in the case of throwback rules, whether a state eliminates "nowhere income" that would be untaxed by either the state with the corporation's nexus or the state in which the relevant sales were being made. Finally, data on state investment tax credits and R&D tax credits come from Chirinko and Wilson (2008) and Wilson (2009) and provide the rate of each of these credits. In the case of the R&D credit, the rate we use is the statutory credit rate adjusted for recapture and type of credit.

In addition to our data on tax base measures, we rely on the statutory corporate income tax rate and apportionment weights for payroll, property and sales that were digitized from

CSG (1976-2011). Finally, we use data from Census Bureau (2011) on reported revenues for each state.

We have data on all twelve of these indicators from 1980, but end dates vary. For seven of the twelve indicators, data end in 2014. Data on investment tax credits end in 2013; data on sales apportionment weights end in 2012; data on R&D credit rates end in 2011; and data on both throwback and combined reporting rules end in 2010.

1.2 Descriptive Statistics

The structure of state corporate taxes varies widely across states and over time. Figure 1 shows that the statutory corporate income tax rate has varied between 0 and 12%. Five states (Nevada, South Dakota, Texas, Washington, and Wyoming) currently have no taxes on corporate income. As of 2012, another five states (Alaska, Illinois, Iowa, Minnesota, and Pennsylvania) had tax rates above 9%. Figure 1 shows that over the past few decades, very modest increases in the state corporate tax rate distribution across states have been accompanied by substantial declines in the share of total state revenue from state corporate tax revenue. Panel A of Figure 2 shows this pattern directly – average state corporate tax rates are quite stable, but the average state corporate tax revenue of GDP has declined from nearly 0.5% to 0.3%. While part of this decline arises from the shift away from traditional corporate form (Cooper et al. (2015)), losses and other factors (Auerbach and Poterba (1987)), part of this decline is due to changes in the state corporate tax base.

Panel B of Figure 2 shows for each year the number of states that change their corporate tax rates and base provisions. Most points fall below the red 45 degree line, illustrating that in almost all years in which states are change their tax base, most of them do not change their tax rates.

Figure 3 shows that the state corporate tax base has tended to become more generous over the past four decades. For instance, in 1980, research and development credits were very rare. Beginning in 1990, some states introduced credits, but the vast majority of these were very small – below 5%. R&D tax credits have become more common in the new millennium. Many states have increased the size of the credit; as of 2010, a large share of states offer credits even more generous than the most generous provisions in 1990. The data reveal similar patterns for

the investment tax credit and loss carry forward provisions.

In contrast, other dimensions of the tax base have expanded over the past three decades. Panel A of Figure 4 shows that while many base provisions were becoming more expansive, an increasing number of states enacted broader provisions, such as throwback and combined reporting rules or adoption of the federal definition of the state tax base for state tax purposes.

Finally, our data show that states have continued to increase the apportionment weight on sales and decrease the weights on property and payroll. Panel B of Figure 4 shows that, in 1980, the majority of states placed less than half of the apportionment weight on sales. This share declined steadily until 2010, leaving only 12 states with sales apportionment shares below 50%.[3]

2 Decomposing Variation in Corporate Tax Revenue

To explore the relationship between state corporate tax revenues as a share state GDP, we decompose R_{st}, state corporate tax revenue as a share of state GDP, into components related to state corporate tax rates, the state corporate tax base, and a residual component.

$$R_{st} = \alpha + \gamma \tau_{st}^{c} + \mathbf{X}_{st}' \mathbf{\Psi}_{st}^{BASE} + u_{st}, \tag{1}$$

where $\mathbf{X}_{st}$ is a vector of tax base controls including the number of years of losses can be carried forward and backward, research and development credits, the payroll apportionment weight, an indicator for federal income deductibility, the investment tax credit, conformity with MACRS depreciation guidelines, federal bonus depreciation rules, federal income as the state tax base, and other tax base rules, as described in Section 1. We can then study the variation in state corporate tax revenue shares by decomposing the variation in these components.

$$Var(R_{st}) = Var(\alpha + \gamma \tau_{st}^{c} + \mathbf{X}_{st}' \mathbf{\Psi}_{st}^{BASE} + u_{st}) \tag{2}$$

[3]Figure A17 shows the average sales and payroll apportionment by year and as well as the evolution of the sales- and payroll-apportioned corporate tax rates over the same period. Given the secular decline in payroll and property weights, it is not surprising that the range of this distribution is more compressed than the distribution of sales-apportioned corporate rate. However, it is striking that the distribution of the sales-apportioned corporate rate is skewed to the right and has, if anything, become more dispersed in recent years by increasing the density of states with higher sales-apportioned corporate rates.

where R_{st} is corporate tax revenue as a share of state GDP, and $\mathbf{X}_{st}$ includes state tax rates and several aspects of the state tax base. We begin by estimating the share of the variance in R_{st} which can be explained by these independent variables. We then break this share down into the proportions which can be attributed to each of these variables, to discover whether variation R_{st} is better explained by variation in the tax base or in the tax rate. Finally, we investigate which components of the tax base hold the greatest explanatory power over variation in R_{st}.

Figure 5 presents the results. The upper left panel shows that the share of variance explained by state tax policy parameters ranges between roughly 25 to 40%. The upper right panel shows that a larger share of the explained variance is accounted for by state corporate tax base rules. Loss carry forward provisions explain the largest share of the variance, though this share has declined in recent years, due to a combination of the rising influence of the research and development credit, as well as changes in apportionment rules.

3 Impacts on State Tax Revenue and Economic Activity

3.1 Event Study Estimates

We begin with an analysis of the typical path of state outcomes preceding and following a change in the state corporate tax structure. We use an event study specification of the form:

$$Y_{st} = \alpha_s + \gamma_t + \sum_{k \in \{-4,-3,-2,0,1,2,3,4,5\}} \beta_k D_{st}^k + \underline{\beta} \sum_{k<-4} D_{st}^k + \overline{\beta} \sum_{k>5} D_{st}^k + \varepsilon_{st} \tag{3}$$

where D_{st}^k is an indicator for state s having changed the state tax structure k periods in the past, α_s is a state fixed effect, and γ_t is a time fixed effect. The coefficients β_k provide the impact on the time path of mean outcomes relative to the period before the tax change (which has been normalized to zero). Additionally, we address imbalance issues by "binning" periods greater than 5 or less than -4, which is reflected in the $\bar{\beta}$ and $\underline{\beta}$ coefficients that are assumed to be stable within end point bins. To address serial correlation in ε_{it}, all standard errors are clustered by state. We consider two main outcomes: log corporate tax revenue and log state GDP.

We fit specifications of this type on our state panel data using data from 1980 to 2010.

We also consider specifications that also control for the leads and lags of key components of the tax base. Specifically, we control for leads and lags of the six most important tax base controls in terms of variance shares of corporate tax revenue: loss carry forward and carry back provisions, federal income tax deductibility, research and development credits, investment tax credits and payroll apportionment weights.

Figure 6 shows the results for corporate tax cuts and corporate tax increases that exceed a 0.5 percentage point change in the rate in absolute value on log corporate tax revenue and log state GDP. Panel A shows that corporate tax decreases that exceed 0.5 percentage point cuts in the rate tend to increase state GDP by roughly 2% cumulatively over a 5 year period. Panel B shows that despite higher economic activity, corporate tax cuts decrease state tax revenue by roughly 7%. Panel C and D show that tax increases have symmetric impacts. Specifically, Panel C shows that corporate tax increases reduce state GDP by roughly 2% over a five year period despite being preceded by higher levels of economic activity. Panel D shows that despite reduced economic activity, tax revenues tend to be roughly 6% higher. However, the event study shows that tax revenues were also higher preceding the tax increase events by roughly a similar magnitude, so it is not clear that corporate tax revenues actually increase following tax increases.

To exploit variation in the size of tax changes, we also estimate models of using net-of-tax rates with a similar form:

$$Y_{st} = \alpha_s + \gamma_t + \sum_{k \in \{-4,-3,-2,0,1,2,3,4,5\}} \beta_k (1 - \tau_{st}^k) + \underline{\beta} \sum_{k<-4} (1 - \tau_{st}^k) + \overline{\beta} \sum_{k>5} (1 - \tau_{st}^k) + \varepsilon_{st} \quad (4)$$

Panel A of Figure 7 shows that a one percentage point increase in the state corporate tax keep rate reduces state corporate tax revenue by roughly 4.5% in the year after the tax change and that this decline appears to last for a few years, although the negative impact of the tax change becomes less pronounced four and five years after the event. Accounting for leads and lags of tax base changes reveals that corporate tax rate cuts tend to decrease revenue, even in the fourth and fifth years following the change. The recovery in state corporate tax revenues is absent when accounting for tax base changes. It should be mentioned that these point estimates are somewhat noisy.

Panel B of Figure 7 shows that this increase in keep rates tends to expand economic activity.

These impacts add roughly 2 percentage points to state GDP after 5 years and are similar with and without corporate tax base changes.

4 Heterogeneous Effects of Tax Rate Changes

The previous section shows that controlling for determinants of the corporate income tax base does not affect the estimated relationship between state taxes and state GDP and corporate tax revenue. One reason why omitting these controls does not affect the estimated effects of the state corporate taxes is that, contrary to common belief, states do not seem to adjust the determinants of the state tax base in years when they change tax rates, as discussed in Section 1.2. However, even if controlling for the tax base does not affect this relationship, economic intuition suggests that changes in corporate tax rates may have differential effects on tax revenue and economic activity depending on the breadth of the tax base.

As a hypothetical example, suppose that California and New York both increase their state corporate tax rates, but suppose further that California has a much more lenient treatment of loss carry-forwards. Firms in California with past losses will face a smaller increase in their effective tax liability as firms in New York, since the tax base in California is narrower. Any behavioral response by firms, such as investment, employment, or relocation, will therefore be more muted in California than in New York. While this example only mentions loss carry forwards, the treatment of other aspects of the tax base, such as depreciation allowances or investment tax credits, have a similar effect in that they modulate the degree to which tax changes affect firm-level decisions. This section explores the extent to which tax base determinants lead to heterogeneous effects of tax rate changes.

For a given outcome Y_{st}, we estimate models of the form:

$$\ln Y_{st} = \alpha_s + \gamma_t + \beta_0 \ln(1 - \tau^c_{st}) + \sum_{k=1}^{12} \beta_k \ln(1 - \tau^c_{st}) \times X^k_{st} + \mathbf{X}'_{st} \mathbf{\Psi}^{BASE}_{st} + u_{st}, \tag{5}$$

where we control for state and year fixed effects, determinants of the tax base, and where we interact the log-corporate tax keep-rate with the determinants of the tax base. We first de-mean the tax base determinants across the estimation sample to facilitate the interpretation of β_0 as the mean elasticity of Y with respect to $(1 - \tau^c)$. However, a state with a tax base

described by $\mathbf{X}_{st}$ will have have an elasticity given by:

$$\varepsilon_{Y,1-\tau} = \beta_0 + \sum_{k=1}^{12} \beta_k X_{st}^k. \tag{6}$$

Table 3 reports the coefficients of regressions following Equation 5 for the case of corporate tax revenues. The first column includes only the corporate tax rate and year fixed effects. Column (2) adds state fixed effect, and column (3) includes controls for the tax base. Column (4) is our main specification that includes interactions of the state tax rate with tax base determinants. The average elasticity β_0 is now larger in absolute value and statistically significant at the 5% level. While columns (1)-(4) cluster standard error at the state level, column (5) presents the same estimates as column (4) but reports robust standard errors. This last column shows that the weight on sales apportionment, whether a state has a franchise tax, complies with ACRS depreciation, or whether it allows for federal accelerated depreciation have large interactions with the corporate tax rate.

Table 4 reports the same set of regressions where the outcome is now state GDP. In this case, we find that controlling for interactions between the tax rate and the tax base does not affect the mean marginal elasticity of state GDP with respect to the sate corporate tax rate. However, the interaction between the different tax bases may drive considerable heterogeneity in this elasticity across states and across time periods. For instance, while a 1% tax decrease increases state GDP by 2%, this increase is considerably larger whenever the state allows for the deductibility of federal income taxes.

While each of these interaction coefficients may be interesting in their own right, our object of interest is $\varepsilon_{Y,1-\tau}$. It is also worth noting that the estimated variance of this object is a function of the covariance matrix of the parameter vector $(\beta_0, \cdots, \beta_{12})$. We now explore how changes in tax base determinants affect $\varepsilon_{Y,1-\tau}$. Consider first, how changes in the structure of the tax base affects these elasticities over time. Figure 8 plots the elasticities of corporate tax revenue and GDP with respect to the state corporate tax rate that correspond to the average tax base for every year between 1980 and 2010. Panel (a) shows that the elasticity of corporate tax revenues decreased in absolute value between 1980 and 2000, and reversed this trend slightly in the latter decade of our sample. Panel (b) shows a similar graph for state GDP and shows that the average elasticity across states increased between 1980 and 2000,

followed by a slight decrease in the 2000's. The variation in this graph is driven only by policy changes across states and implies that, relative to 1980, state GDP is more than twice more responsive to changes in the state corporate tax rate.

In order to decompose the variation in $\varepsilon_{Y,1-\tau}$ across our sample, we perform a variance decomposition that captures both the importance of each interaction β_k, as well as the number of changes in each of these tax base determinants. Panel (a) in Figure 9 shows that changes in the treatment of loss carry-forwards and whether a state allows for federal bonus depreciation are the primary drivers of changes in the elasticity of corporate tax revenues. In contrast, panel (b) shows that the treatment of loss carry forwards is the primary driver of the elasticity of state GDP with respect to the state corporate tax rate.

We further explore the tax-base-driven heterogeneity in this elasticity by plotting the estimated elasticity for ever state for years 1985 and 2005. Figure 11 shows that the revenue elasticity has mostly decreased in absolute value during this period and that this change is driven mostly by changes in the tax base structure of western states. Conversely, the state GDP elasticity has increased over this period, but this change has been driven by states in the midwest and in the south.

5 Policy Implications and Discussion

We now discuss policy implications from our analysis. First, it is worth pointing out that, while changes in tax rates receive public and media attention, changes in state tax bases may have larger effects on revenue and may also modulate the effects of state corporate tax rates on revenue and economic activity. For this reason, the public debate should place relatively more attention to policy changes that affect the structure of state corporate taxation, and not only the statutory tax rate.

Second, given the large effects of the structural of the tax base on corporate tax revenue, states policymakers should use these policies to accomplish particular goals. States that are able to attract businesses for non-tax reasons may prefer to have a lower tax rate and a broader base by, for instance, allowing for the deductibility of federal taxes and adopting the federal income tax base as their own. States wishing to increase investment may depart from this strategy by using tax credits or generous depreciation allowances to encourage investment,

but they may see substantial declines in revenue. Finally, states wishing to attract businesses at any cost may craft a treatment of loss carry forwards that is very favorable to existing businesses.

Third, as states structure the taxation of corporate income for their particular needs and objectives, state policymakers should bear in mind that changes to the structure of state corporate taxation will influence the distortionary costs of increasing the state corporate tax rate. One way to characterize this is to compute the revenue-maximizing tax rate as a function of the state tax base. Following standard calculations, we find that the so-called Laffer rate may be approximated by the quantity:

$$\tau^* = \frac{1}{1 + \varepsilon_{GDP,1-\tau}}. \tag{7}$$

Figure 12 plots this value for the average tax base in every year from 1980-2010 and shows that the revenue-maximizing tax rate has decreased substantially from 1980-2010. While estimates for recent years place it in the high 20%'s, it is worth noting that the maximum tax rate in our sample is 12%, well below these maximum rates.

In future work, we will also explore the degree to which tax base determinants affect the incidence of the state corporate income tax by extending the framework in Suárez Serrato and Zidar (2016) to allow for deductions that may affect the response of firms to tax rate changes. Intuitively, a narrower tax base lower the benefits of a tax cut to business owners as they only pay taxes on a smaller fraction of profits. As there is a smaller benefit from the tax cut, firms are less likely to enter a particular location, which will also mute the effect of the tax cut on employment, wages, and costs of living. Whether the decrease in firm entry is larger than the decrease in the real wage and employment will determine whether the incidence of a state income tax cut is borne by workers of by firm owners.

6 Conclusion

[To be completed.]

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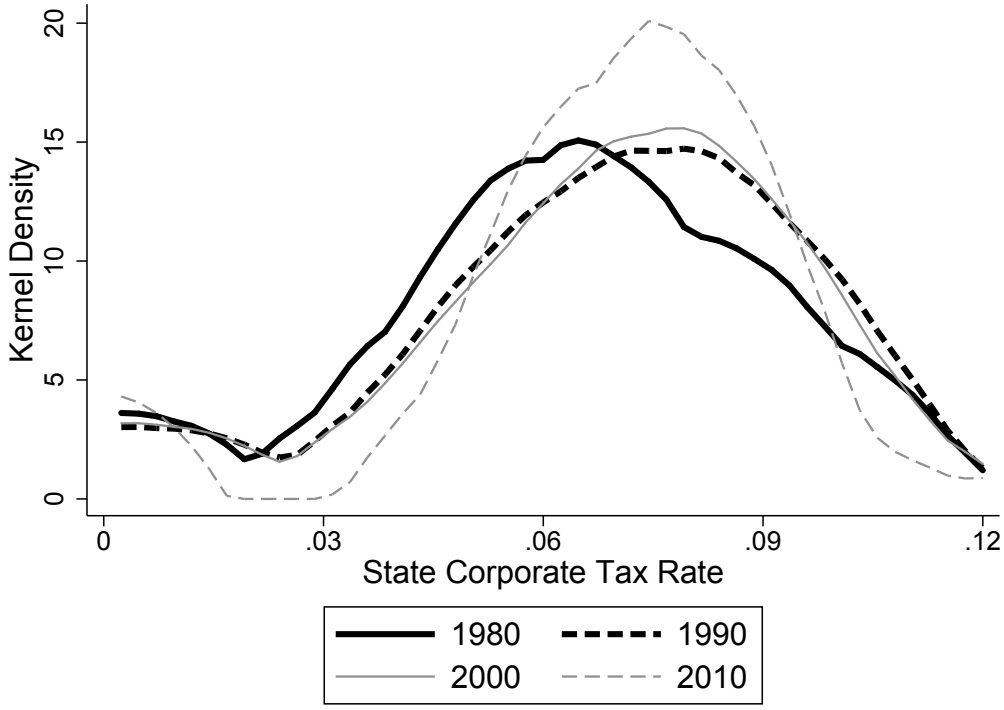
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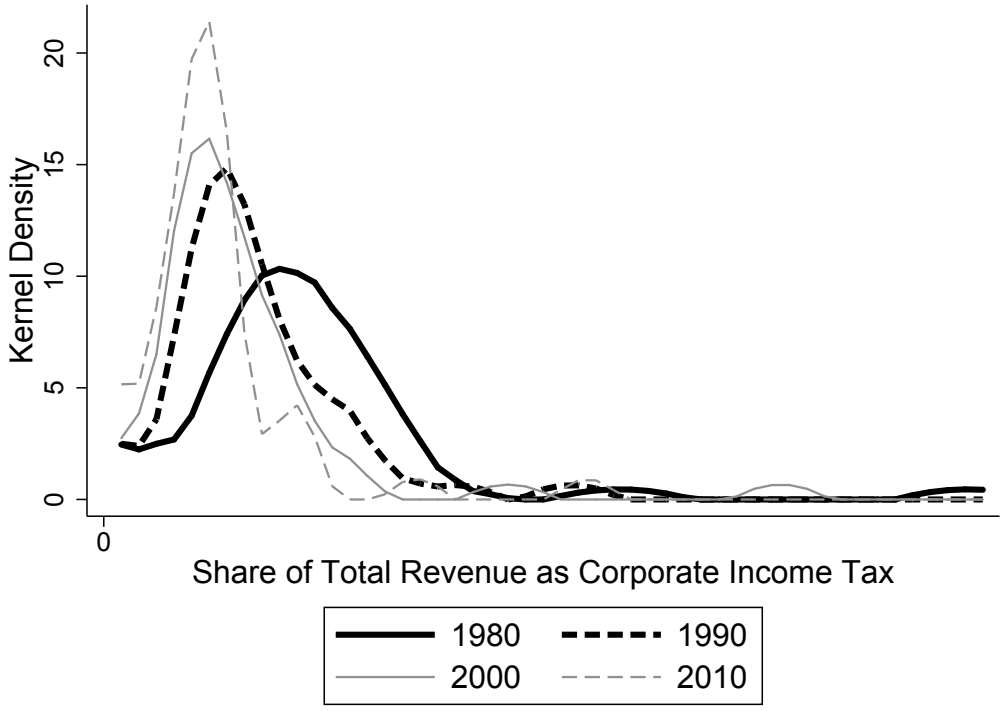
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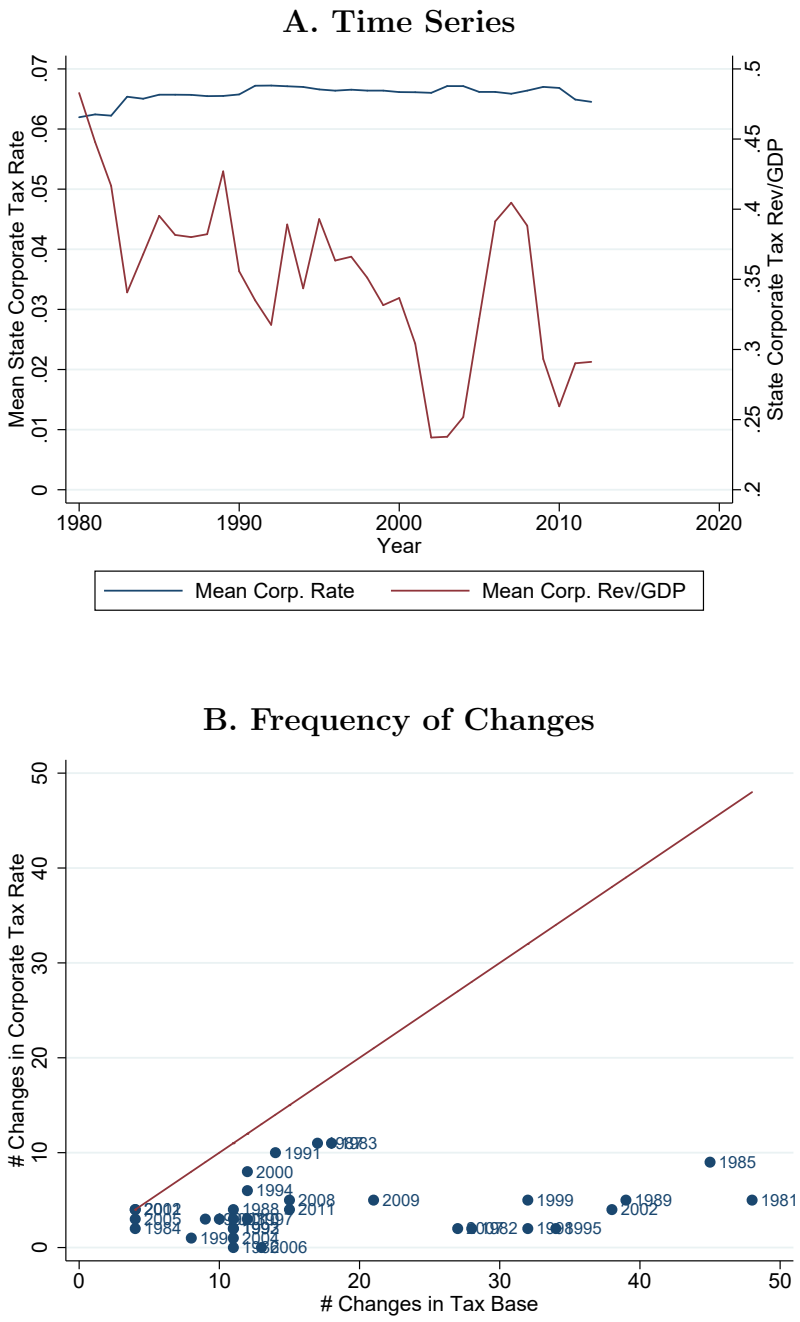
Figure 1: State Corporate Tax Densities By Decade





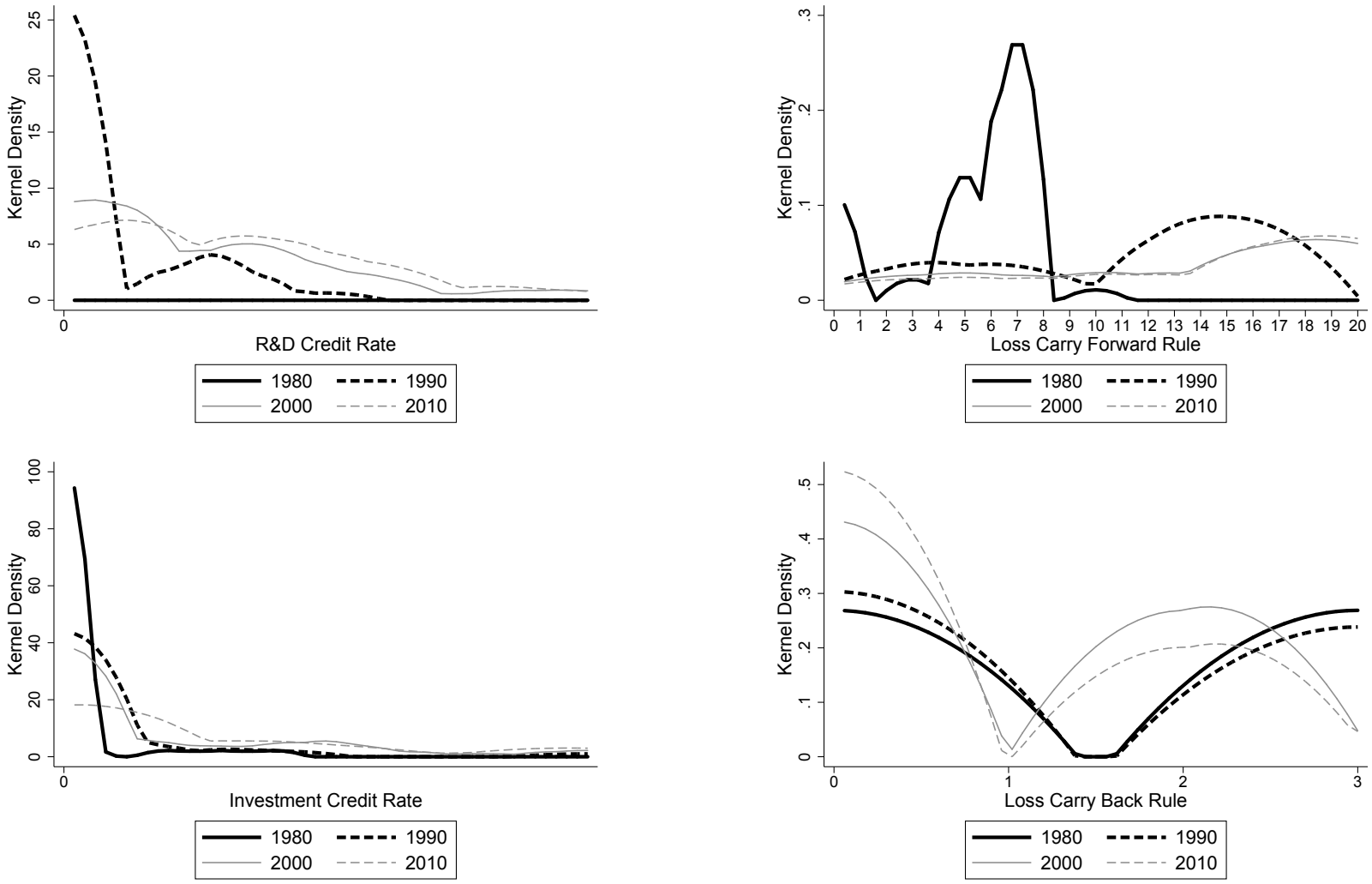
NOTES: These figures present kernel density functions for the state corporate tax rate and the share of total state tax revenue as corporate income tax by decade. The District of Columbia is excluded from the density calculation.

Figure 2: Changes in State Tax Corporate Tax Structure



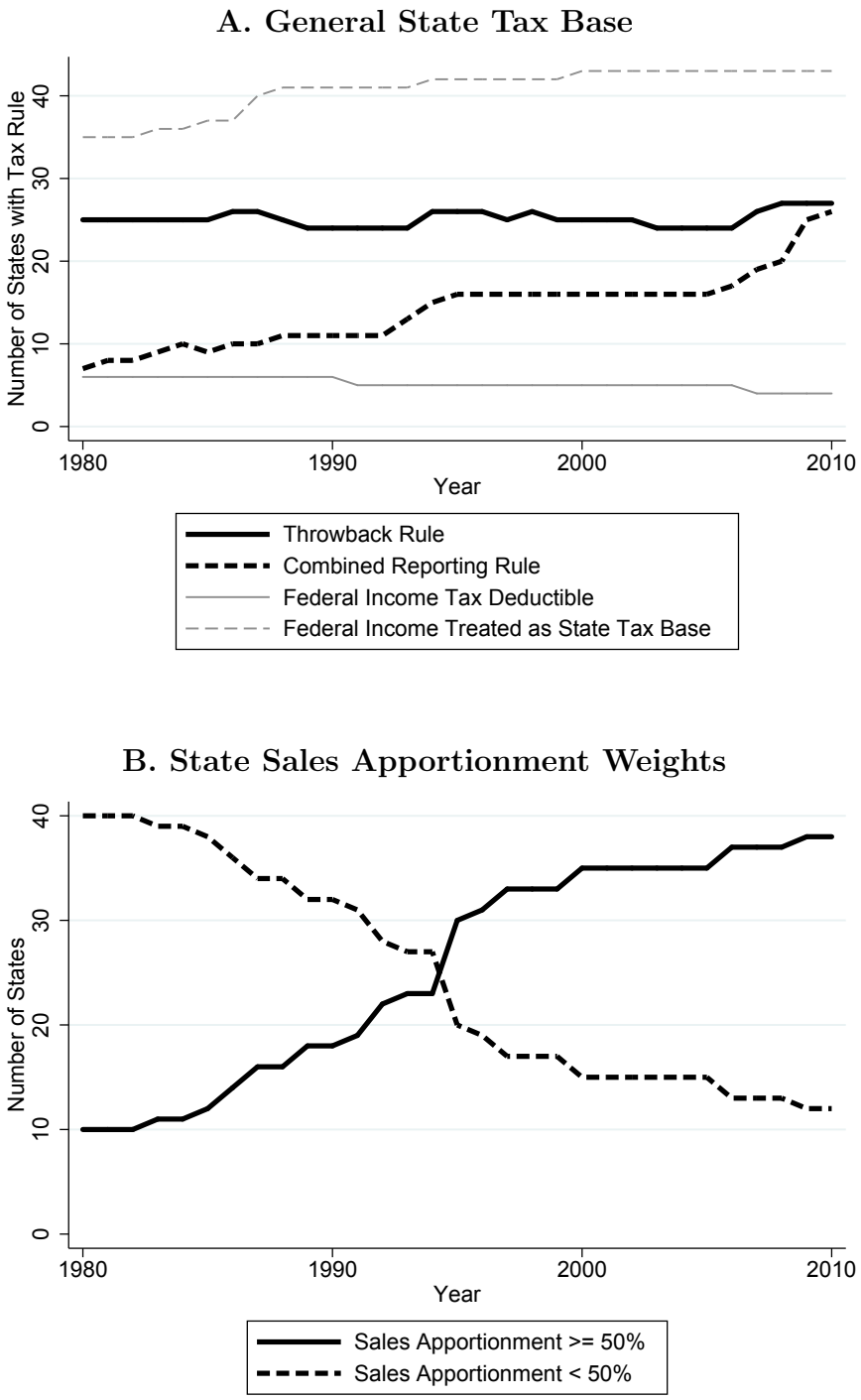
NOTES: These figures show annual trends in both the mean corporate tax rate across states and corporate tax revenue as a share of GDP in panel A. Panel B shows by year the number of states that changed rates and tax base provisions. It illustrates that these pairs are not on a 45 degree line, so most years in which many states change base provisions are not years in which many states also change rates.

Figure 3: Corporate Tax Base Densities By Decade



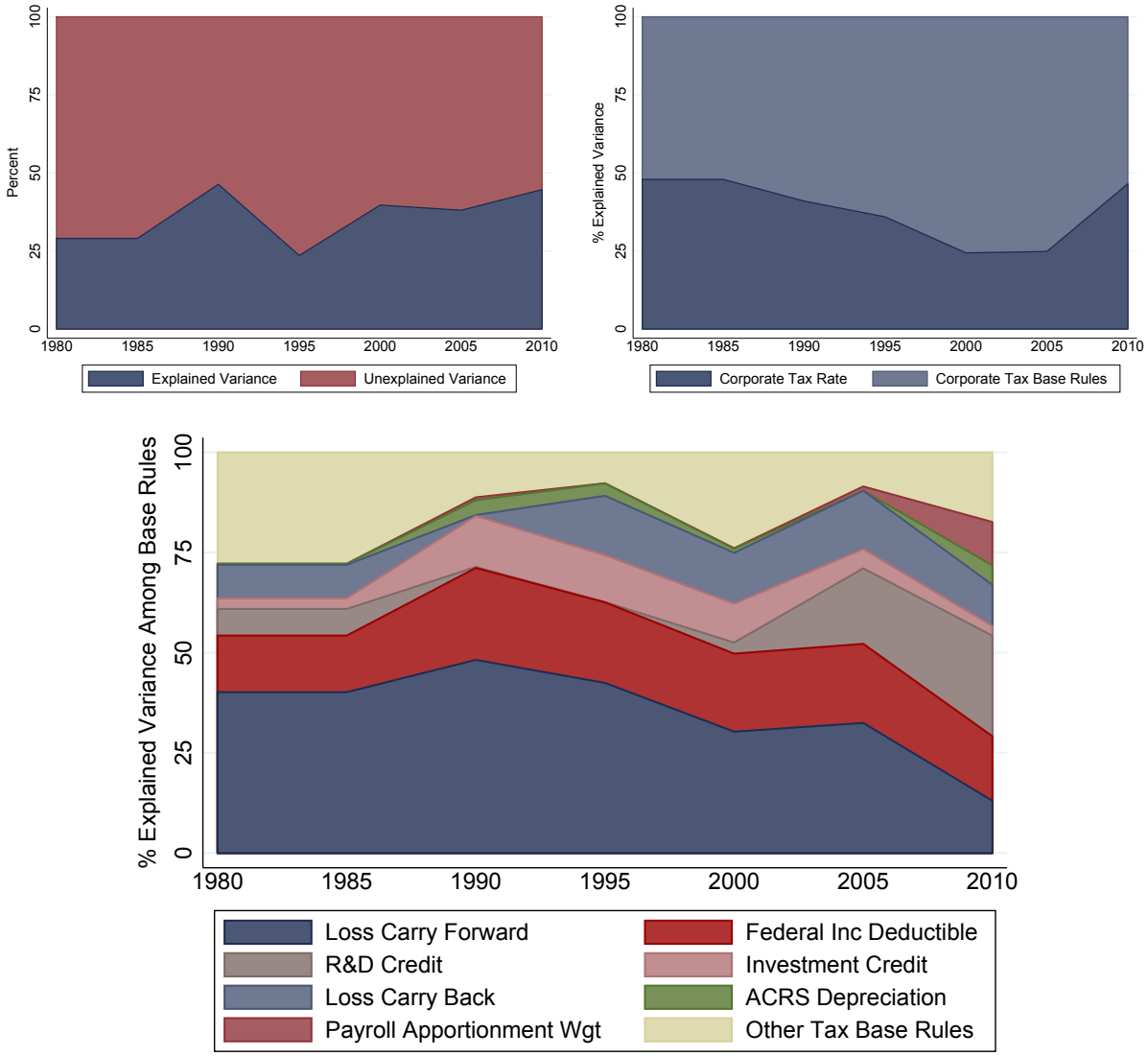
NOTES: These figures present kernel density functions for various tax base rules by decade. Loss carry forward and loss carry back are measured in years allotted by the respective rule. The District of Columbia is excluded from the density calculation. See Appendix A.1 for details on each tax base rule and data sources.

Figure 4: State Tax Base and Sales Apportionment Weight



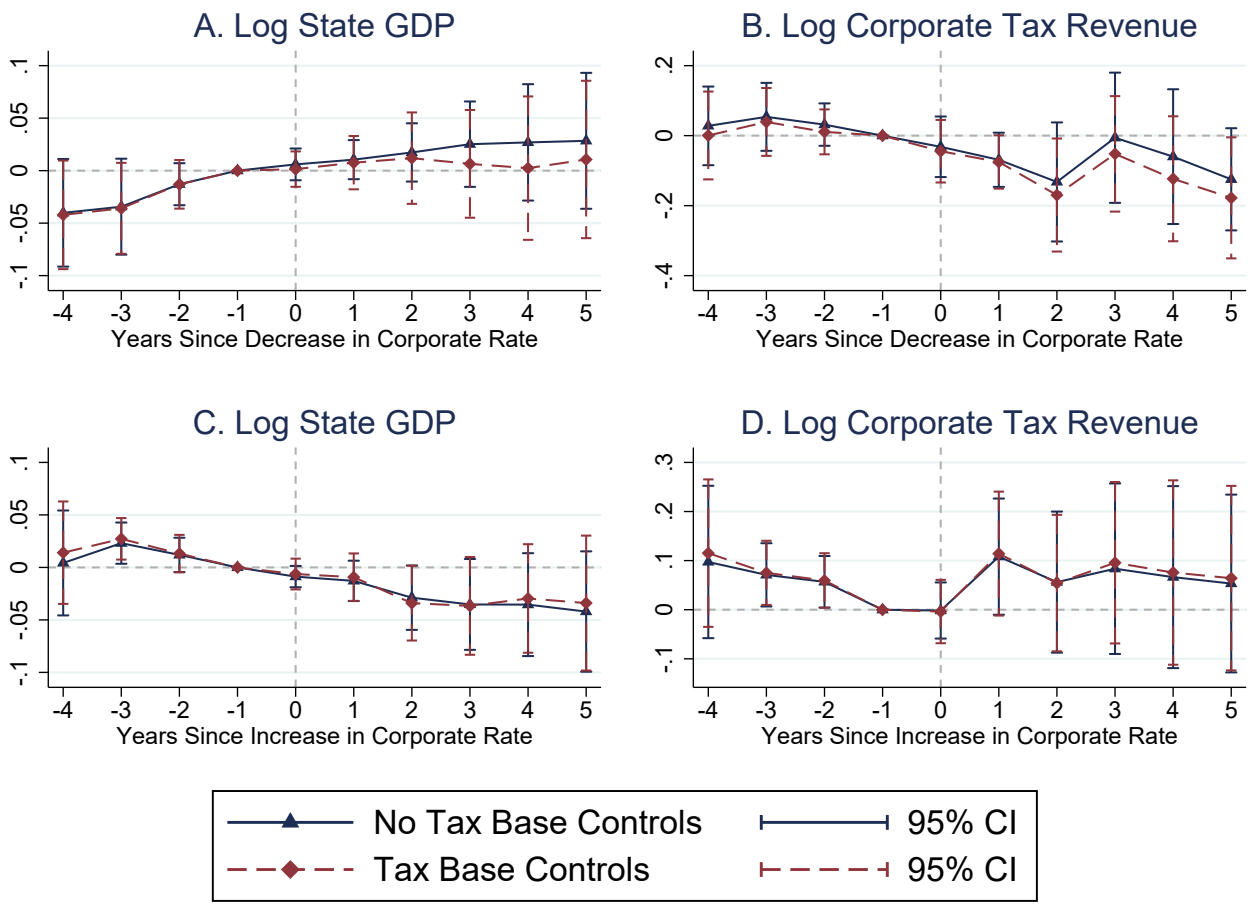
NOTES: These figures show annual trends in both base rules and the sales apportionment weight between 1980 and 2010.

Figure 5: Corporate Tax Revenue Share of GDP - Variance Decomposition - 5-Year Breaks



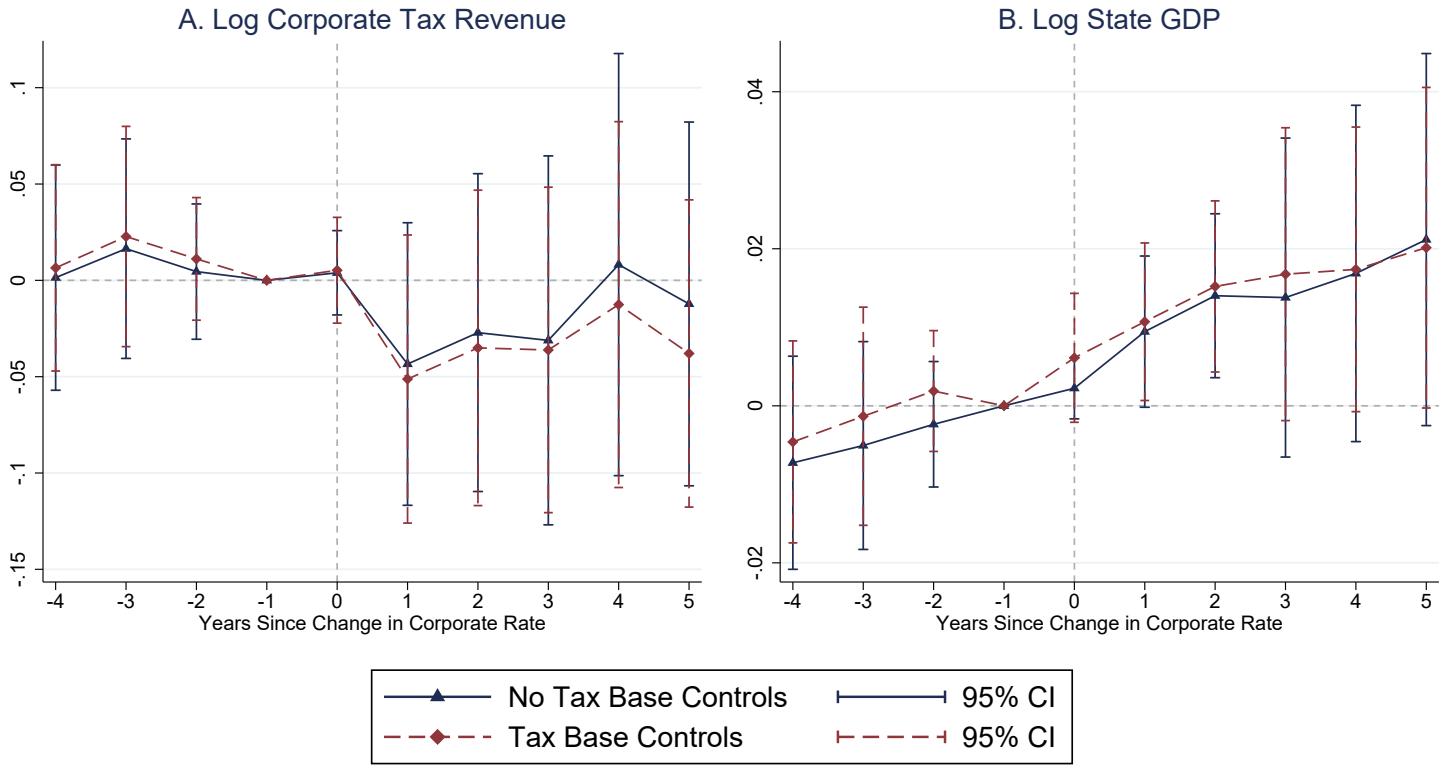
NOTES: These figures show the general explanatory power for the corporate tax rate and base rules. The first figure shows the explained vs. unexplained variance in the specified model. The second figure shows the ratio of explained variance for the corporate tax rate vs. the corporate tax base rules. The third shows the ratio of explained variance only among the corporate tax base rules. Equation 1 presents the expression for state corporate tax revenue as a share of state GDP. Each figure has 6 point estimates that correspond to 5-year spans between 1980 and 2010. The following tax base rules encompass those included in the model: loss carry forward, loss carry back, R&D credit, investment credit, throwback rule, combined reporting rule, federal income tax deductibility, federal bonus depreciation, federal income as state tax base, federal accelerated depreciation, ACRS depreciation, and the payroll apportionment weight.

Figure 6: Event Analysis: Impact of Corporate Tax Rate Changes on Log State GDP and Corporate Tax Revenue



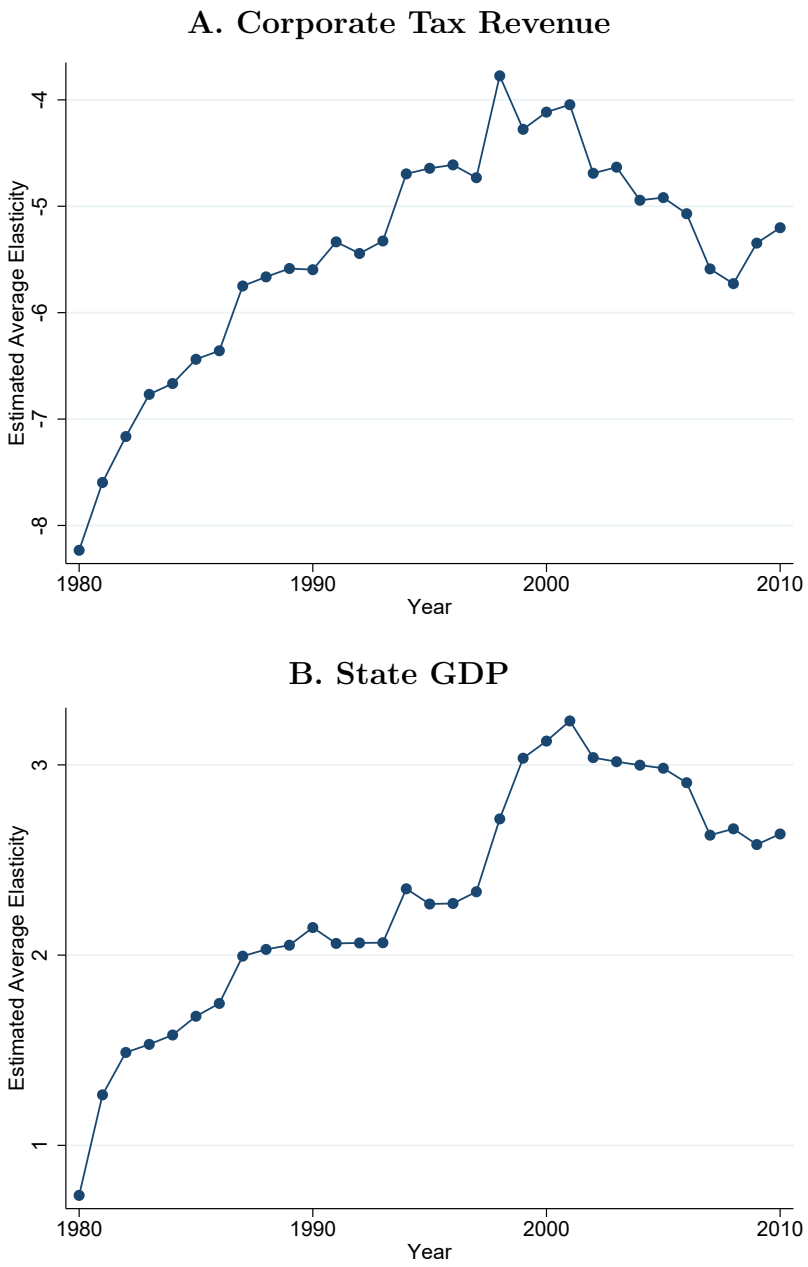
NOTES: This figure shows the effect of increases and decreases in the state corporate rate of at least .5pp on log state GDP and corporate tax revenue, respectively. Year and state fixed effects are utilized. Where specified, we additionally control for the following tax base rules: loss carry forward, loss carry back, R&D credit, investment credit, payroll apportionment weight, and federal income tax deductibility. Standard errors are clustered by state.

Figure 7: Event Analysis: Impact of Net-of-Corporate Tax Rate on Log State GDP and Corporate Tax Revenue



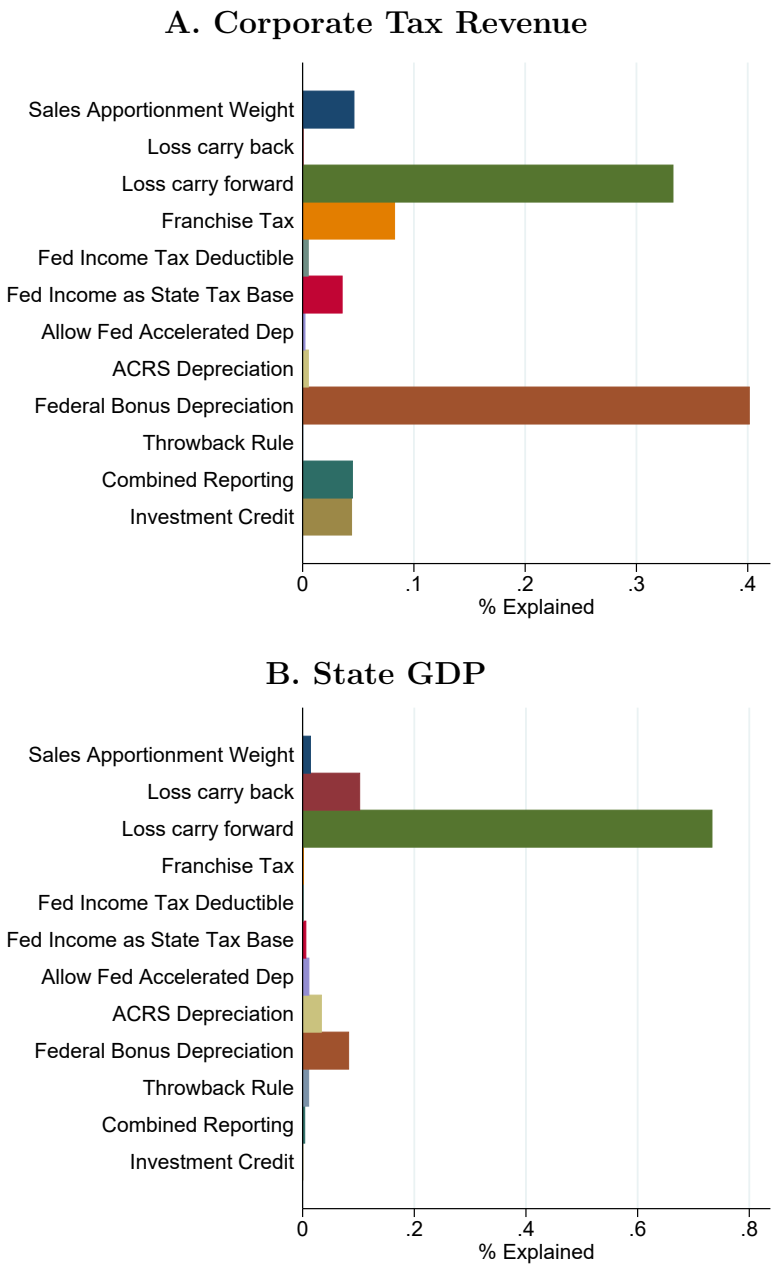
NOTES: This figure shows the effect of the change in the net-of-corporate tax rate on log state GDP and corporate tax revenue, respectively. Year and state fixed effects are utilized. Where specified, we additionally control for the following tax base rules: loss carry forward, loss carry back, R&D credit, investment credit, payroll apportionment weight, and federal income tax deductibility. Standard errors are clustered by state.

Figure 8: Elasticity of Corporate Tax Revenue and GDP w.r.t Net-of-Corporate Tax Rate by Year



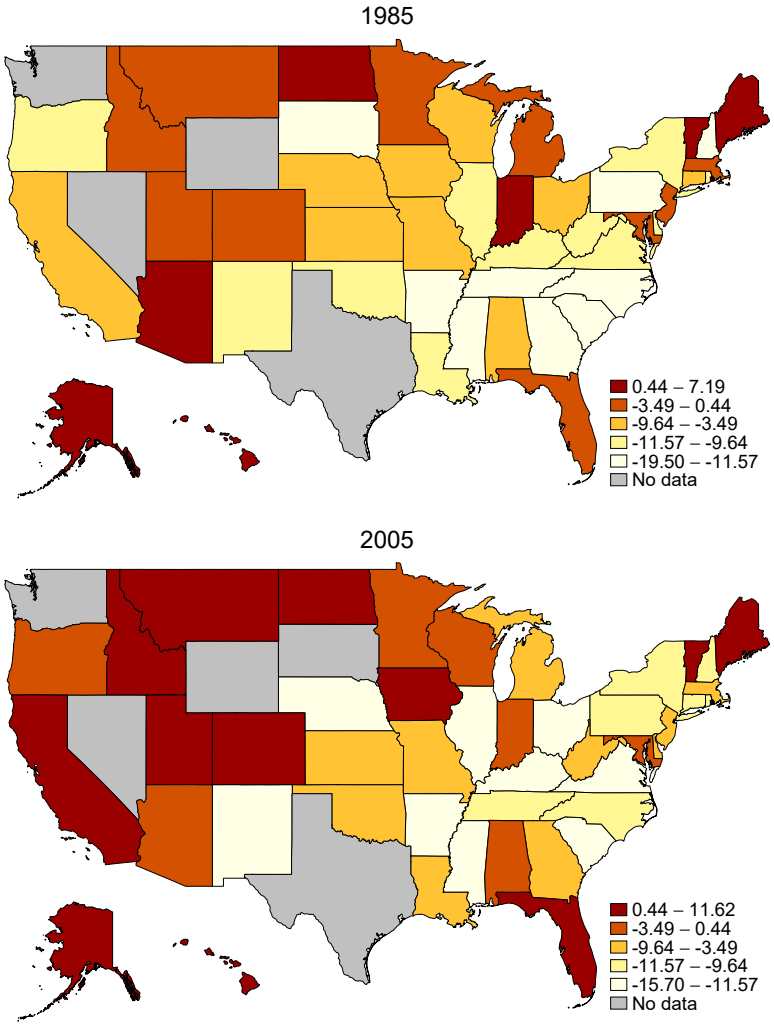
NOTES: These figures plot the average elasticity across states in a given year. The definition of the elasticity is given in Equation 6 in Section 4. We compute this average using the distribution of tax base parameters in a given year and the estimates reported in Tables 3 and 4.

Figure 9: Decomposing Elasticity of Corporate Tax Revenue w.r.t Net-of-Corporate Tax Rate



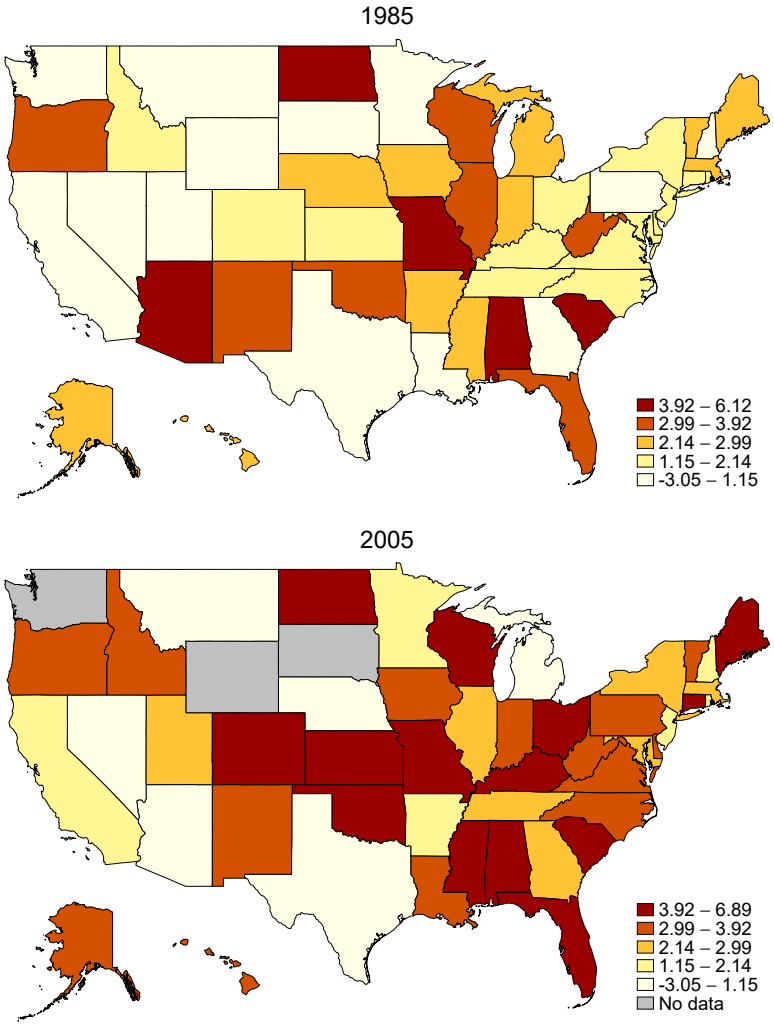
NOTES: These figures decompose the variance in the estimated elasticities for revenue and state GDP. The definition of the elasticity is given in Equation 6 in Section 4. We compute the elasticities for ever state-year observation using the estimates reported in Tables 3 and 4. By construction, the variance in the model is equal to the total variance. The bars report the fraction of the total variance that is due to changes in each of the tax base parameters.

Figure 10: Elasticity Maps - Revenue



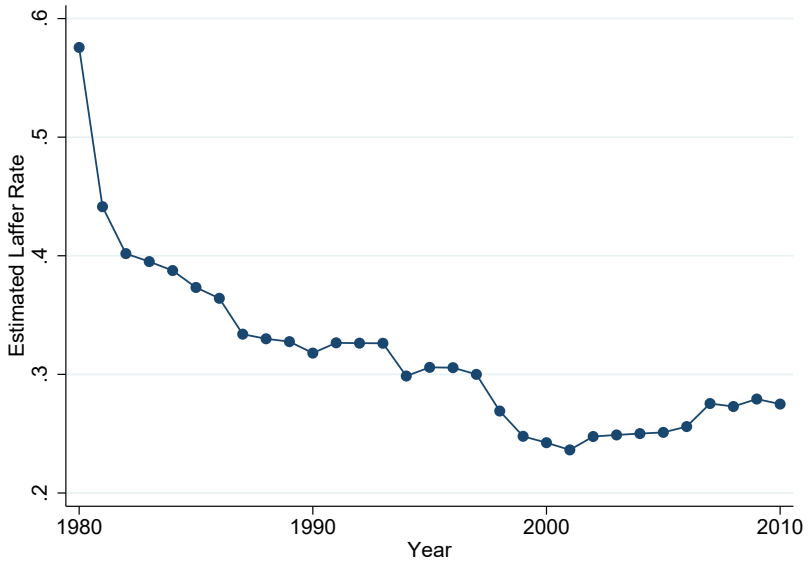
NOTES: These maps plot the estimated elasticities of revenue for every state in 1985 and 2005. The category (color) ranges are held constant across time except for the maximum and minimum values. The definition of the elasticity is given in Equation 6 in Section 4. We compute the elasticities for ever state-year observation using the estimates reported in Tables 3 and 4.

Figure 11: Elasticity Maps - GDP



NOTES: These maps plot the estimated elasticities of state GDP for every state in 1985 and 2005. The category (color) ranges are held constant across time except for the maximum and minimum values. The definition of the elasticity is given in Equation 6 in Section 4. We compute the elasticities for ever state-year observation using the estimates reported in Tables 3 and 4.

Figure 12: Estimated Laffer Tax Rate by Year



NOTES: This figure plots the implied average revenue-maximizing rate for every year. We first compute the average tax-elasticity of state GDP across states for a given year using the formula in Equation 6 in Section 4. We compute this average using the distribution of tax base parameters in a given year and the estimates reported in Tables 4. The Laffer rate is then given by Equation 7 in Section 5.

Table 1: Summary of Base Changes

Base narrowing/broadening:	-1	+1	Total Changes	No Change
Sales Apportionment Weight	100	33	133	1467
Loss Carry Back	26	45	71	1663
Loss Carry Forward	91	15	106	1628
Francise Tax	4	3	7	1727
Federal Income Tax Deductible	2	4	6	1728
Federal Income Tax as State Tax Base	9	1	10	1724
Federal Accelerated Depreciation	2	5	7	1727
ACRS Depreciation	58	15	73	1661
Federal Bonus Depreciation	19	49	68	1666
Throwback	23	24	47	1441
Combined Reporting	21	2	23	1476
Investment Credit	35	10	45	1638

NOTES: This table reports the number of tax-year observations was a change in tax base and tax rate. A change that represents a narrowing of the base is counted in the -1 column, while a year that represents a broadening of the base is counted as $+1$.

Table 2: Frequency of State Tax Rate and Base Changes

Base Change	Rate Decrease	No Change	Rate Increase	Total
Narrowing	22.37	17.63	8.29	16.74
	(17)	(259)	(17)	(293)
No Change	64.47	73.11	88.29	74.51
	(49)	(1074)	(181)	(1304)
Broadening	13.16	9.26	3.41	8.74
	(10)	(136)	(7)	(153)
Total	100.00	100.00	100.00	100.00
	(76)	(1469)	(205)	(1750)

NOTES: This table reports the fraction of state-year observations that saw a simultaneous change in tax base and in tax rate. Numbers in parenthesis report the number of state-year observations that correspond to a given cell. Overall, this table shows that the majority of times when there is a change in the tax base (either a narrowing or a broadening) there is no accompanying change in the tax rate.

Table 3: Heterogenous Effects of Corporate Tax Rates on Corporate Revenue

	(1)	(2)	(3)	(4)	(5)
$ln(1-\tau^c)$	-6.226	-2.534	-3.569	-5.432**	-5.432***
	(8.579)	(3.028)	(2.377)	(2.260)	(1.203)
$ln(1-\tau^c)$ × Sales Apportionment Weight				-0.147**	-0.147***
				(0.068)	(0.038)
$ln(1-\tau^c)$ × Loss carry-back				0.989	0.989*
				(0.990)	(0.545)
$ln(1-\tau^c)$ × Loss carry-forward				0.096	0.096
				(0.218)	(0.129)
$ln(1-\tau^c)$ × Franchise Tax				-12.218	-12.218***
				(8.051)	(3.737)
$ln(1-\tau^c)$ × Fed Income Tax Deductible				10.292	10.292**
				(6.843)	(5.006)
$ln(1-\tau^c)$ × Federal Income as State Tax Base				-0.222	-0.222
				(6.918)	(2.079)
$ln(1-\tau^c)$ × Allow Fed Acc Dep				7.520	7.520**
				(6.464)	(3.206)
$ln(1-\tau^c)$ × ACRS Depreciation				-7.329	-7.329***
				(4.545)	(2.822)
$ln(1-\tau^c)$ × Federal Bonus Depreciation				0.192	0.192
				(2.103)	(1.687)
$ln(1-\tau^c)$ × Apportionment throwback rules				-0.131	-0.131
				(1.718)	(1.016)
$ln(1-\tau^c)$ × Apportionment combined reporting rules				0.493	0.493
				(3.271)	(2.086)
$ln(1-\tau^c)$ × Investment tax credit				3.839	3.839
				(34.125)	(21.457)
Year FE	Yes	Yes	Yes	Yes	Yes
State FE	No	Yes	Yes	Yes	Yes
Base Controls	No	No	Yes	Yes	Yes
Observations	1413	1413	1413	1413	1413
Marginal Effect	-6.226	-2.534	-3.569	-5.419	-5.419

NOTES: This table reports the coefficients of regressions of log-corporate tax revenue on the log-corporate keep rate. The specifications are described in detail in Equation 5 of Section 4. Columns (1)-(4) cluster standard errors at the state level and column (5) reports robust standard errors. The interacted regressions in columns (4) and (5) first de-mean the tax base parameters so that the coefficient on $\ln(1-\tau^c)$ can be interpreted as the mean marginal elasticity. We confirm this by reporting the mean marginal effect in the table.

Table 4: Heterogenous Effects of Corporate Tax Rates on GDP

	(1)	(2)	(3)	(4)	(5)
$ln(1-\tau^c)$	1.557	2.581**	2.107**	2.117**	2.117***
	(6.660)	(1.044)	(0.853)	(0.942)	(0.389)
$ln(1-\tau^c)$ × Sales Apportionment Weight				-0.032	-0.032***
				(0.029)	(0.011)
$ln(1-\tau^c)$ × Loss carry-back				0.249	0.249
				(0.504)	(0.189)
$ln(1-\tau^c)$ × Loss carry-forward				0.156*	0.156***
				(0.087)	(0.035)
$ln(1-\tau^c)$ × Franchise Tax				-3.984**	-3.984***
				(1.542)	(0.825)
$ln(1-\tau^c)$ × Fed Income Tax Deductible				8.061**	8.061***
				(3.067)	(2.397)
$ln(1-\tau^c)$ × Federal Income as State Tax Base				2.046	2.046***
				(2.567)	(0.750)
$ln(1-\tau^c)$ × Allow Fed Acc Dep				0.847	0.847
				(1.042)	(0.772)
$ln(1-\tau^c)$ × ACRS Depreciation				0.269	0.269
				(1.060)	(0.742)
$ln(1-\tau^c)$ × Federal Bonus Depreciation				1.046	1.046**
				(1.036)	(0.473)
$ln(1-\tau^c)$ × Apportionment throwback rules				0.249	0.249
				(0.885)	(0.402)
$ln(1-\tau^c)$× Apportionment combined reporting rules				2.015	2.015***
				(1.324)	(0.590)
$ln(1-\tau^c)$ × Investment tax credit				-16.483	-16.483***
				(18.058)	(5.856)
Year FE	Yes	Yes	Yes	Yes	Yes
State FE	No	Yes	Yes	Yes	Yes
Base Controls	No	No	Yes	Yes	Yes
Observations	1413	1413	1413	1413	1413
Marginal Effect	1.557	2.581	2.107	2.121	2.121

NOTES: This table reports the coefficients of regressions of log-state GDP on the log-corporate keep rate. The specifications are described in detail in Equation 5 of Section 4. Columns (1)-(4) cluster standard errors at the state level and column (5) reports robust standard errors. The interacted regressions in columns (4) and (5) first de-mean the tax base parameters so that the coefficient on $\ln(1-\tau^c)$ can be interpreted as the mean marginal elasticity. We confirm this by reporting the mean marginal effect in the table.

Appendices for Online Publication

This appendix contains several sections.

A Data

A.1 Tax Base Rules

1. Throwback Rules
    - Variable: throwback
    - Source: Bernthal et al. (2012)
    - Definition: Indicator for whether state eliminates "nowhere income" that would be untaxed by either the state with the corporation's nexus or the state in which the relevant sales were being made.
2. Combined Reporting Rules
    - Variable: combined
    - Source: Bernthal et al. (2012)
    - Definition: Indicator for whether a state requires a unitary business to submit combined reporting.
3. Investment Tax Credit
    - Variable: investment_credit
    - Source: Chirinko and Wilson (2008)
    - Definition: Rate of investment tax credit for a given state-year.
4. Research and Development Tax Credit
    - Variable: rec_val
    - Source: Dan Wilson (2009)
    - Definition: Statutory credit rate adjusted for recapture and type of credit.
5. Loss Carry Back Rules
    - Variable: Losscarryback
    - Source: CCH (1980 - 2010)
    - Definition: Number of years prior to the loss year that a corporation may carry back net operating loss.
6. Loss Carry Forward Rules
    - Variable: Losscarryforward
    - Source: CCH (1980 - 2010)

- Definition: Number of years a corporation may carry forward any excess loss following the loss year.

7. Franchise Tax (indicator)

   - Variable: FranchiseTax
   - Source: CCH (1980 - 2010)
   - Definition: An indicator for whether or not a Franchise tax is levied on corporations in a given state-year.

8. Federal Income Tax Deductible

   - Variable: FedIncomeTaxDeductible
   - Source: CCH (1980 - 2010)
   - Definition: An indicator for whether or not federal income tax is deductible in a given state-year.

9. Federal Income as State Tax Base

   - Variable: FederalIncomeasStateTaxBase
   - Source: CCH (1980 - 2010)
   - Definition: An indicator for whether or not federal income in used as the state tax base in a given state-year.

10. Federal Accelerated Depreciation

    - Variable: AllowFedAccDep
    - Source: CCH (1980 - 2010)
    - Definition: An indicator for whether or not federal accelerated depreciation is allowed in a given state-year.

11. Accelerated Cost Recovery System (ACRS) Depreciation

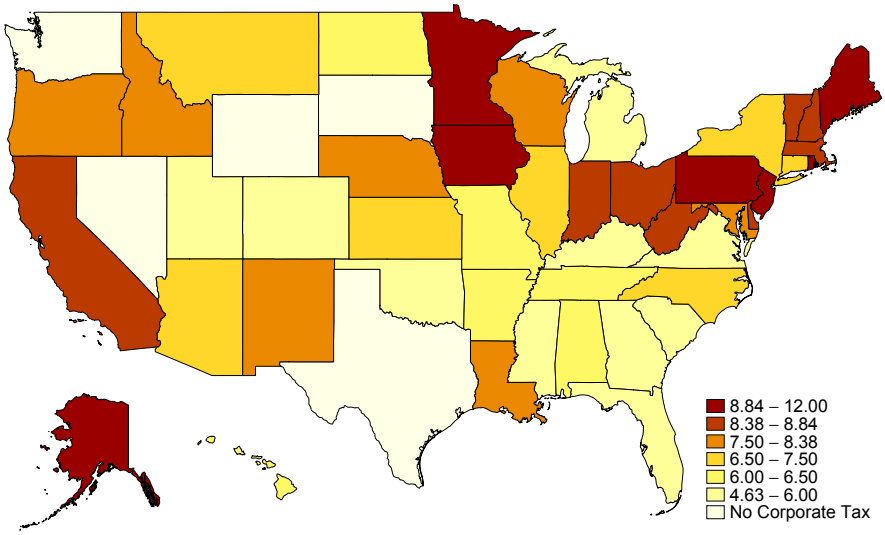
    - Variable: ACRSDepreciation
    - Source: CCH (1980 - 2010)
    - Definition: An indicator for whether or not ACRS is allowed in a given state-year.

12. Federal Bonus Depreciation

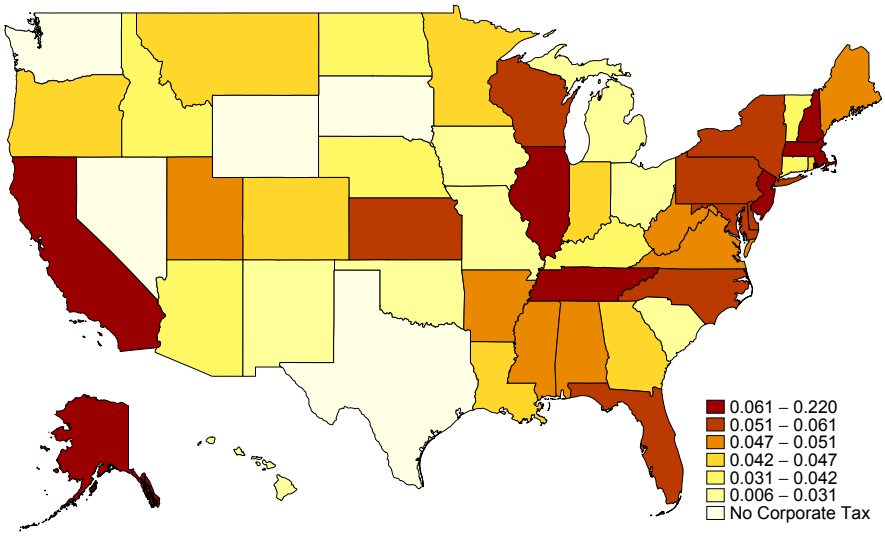
    - Variable: FederalBonusDepreciation
    - Source: CCH (1980 - 2010)
    - Definition: An indicator for whether or not federal bonus depreciation is allowed in a given state-year.

Figure A1: Rates & Revenue

Corporate Tax Rate - 2012



Corporate Revenue Share - 2012



Sales Apportionment Weight - 2012

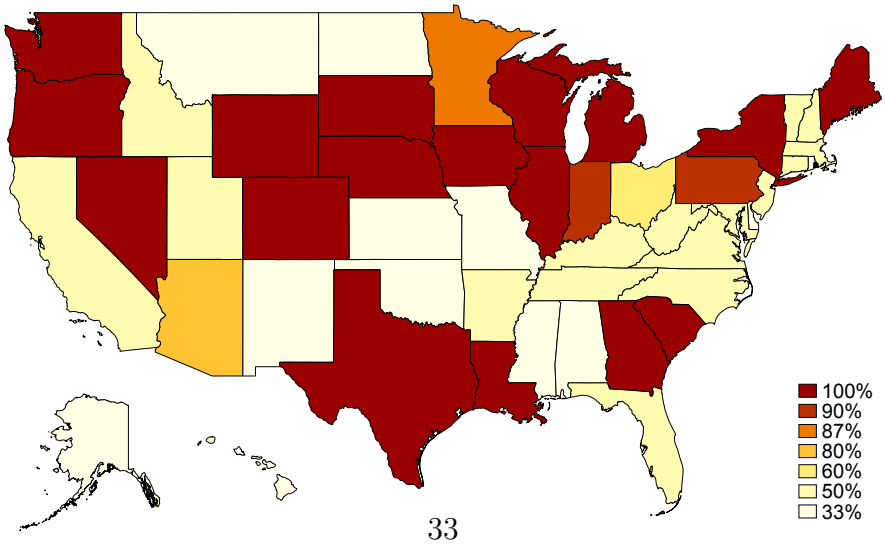


Figure A2: Corporate Tax Base Rules

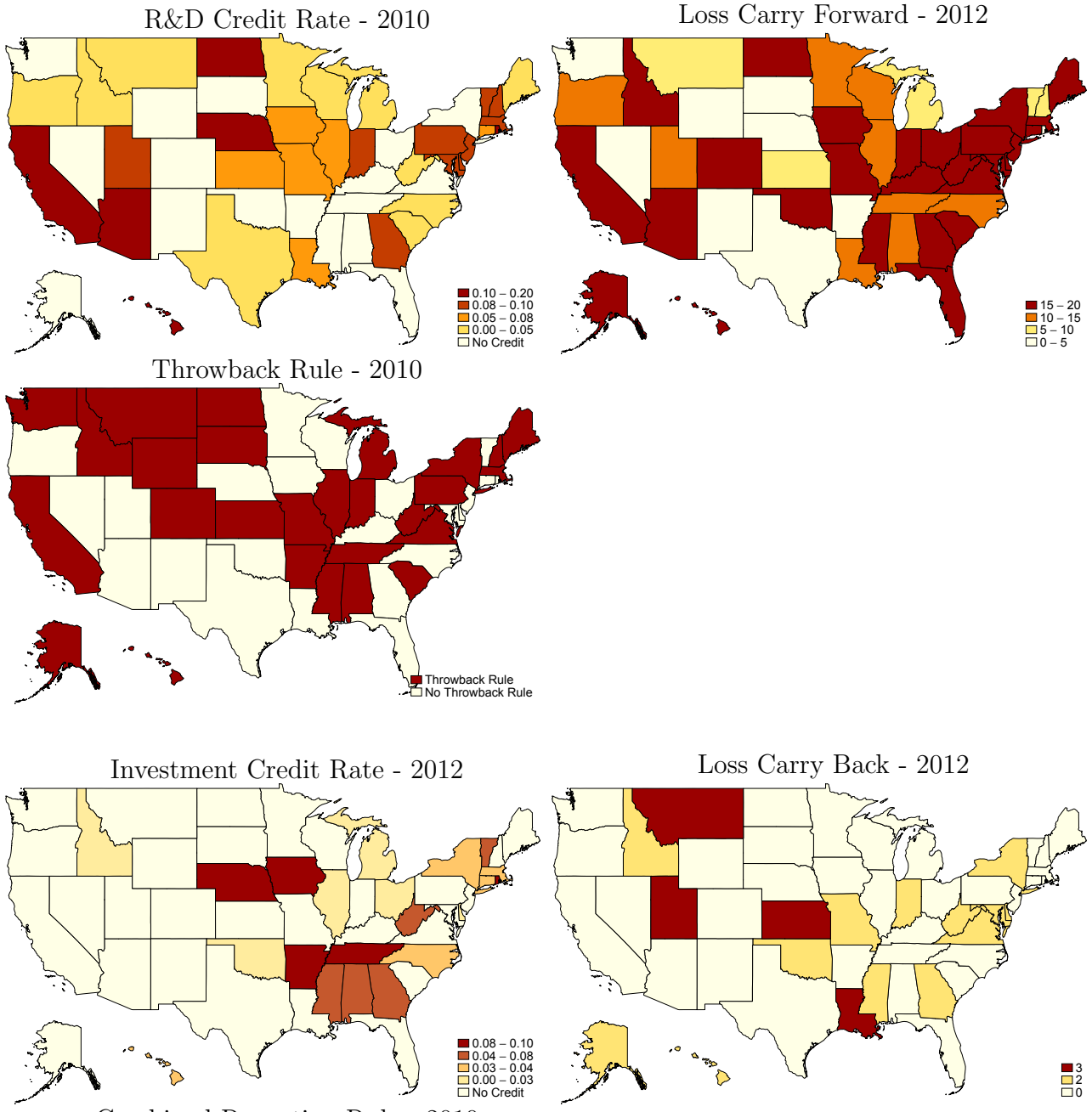
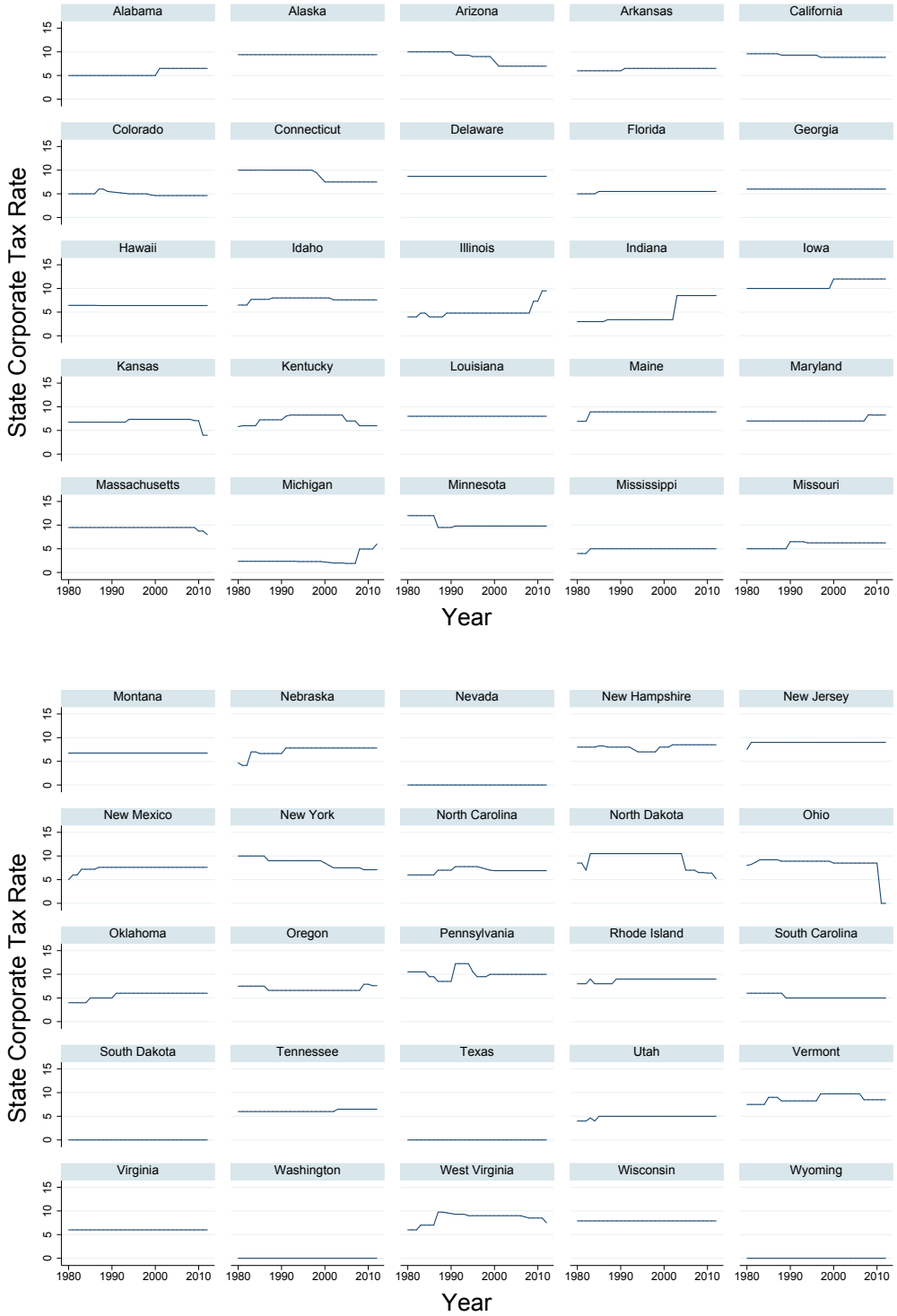
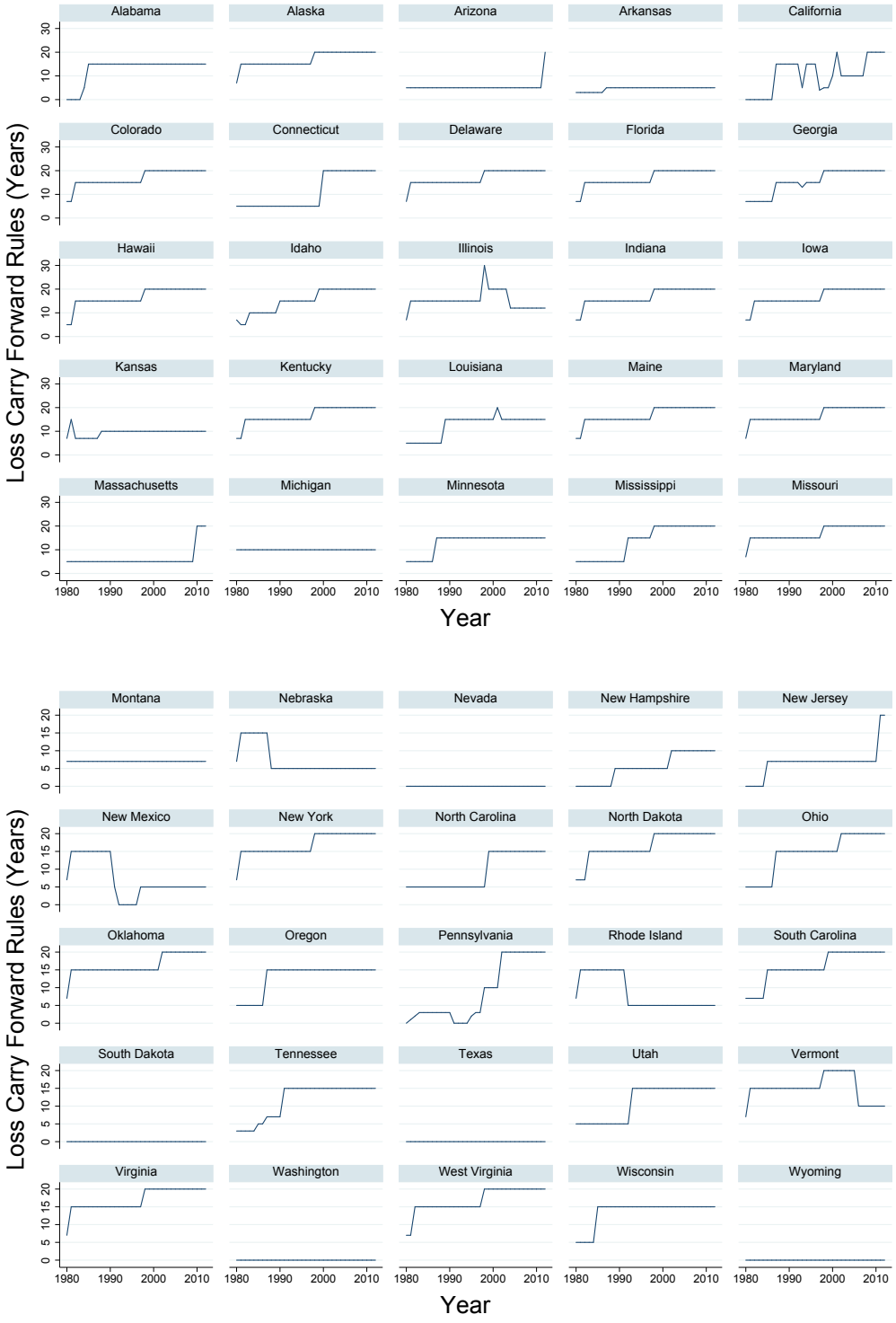


Figure A3: Corporate Tax Rate By State-Year



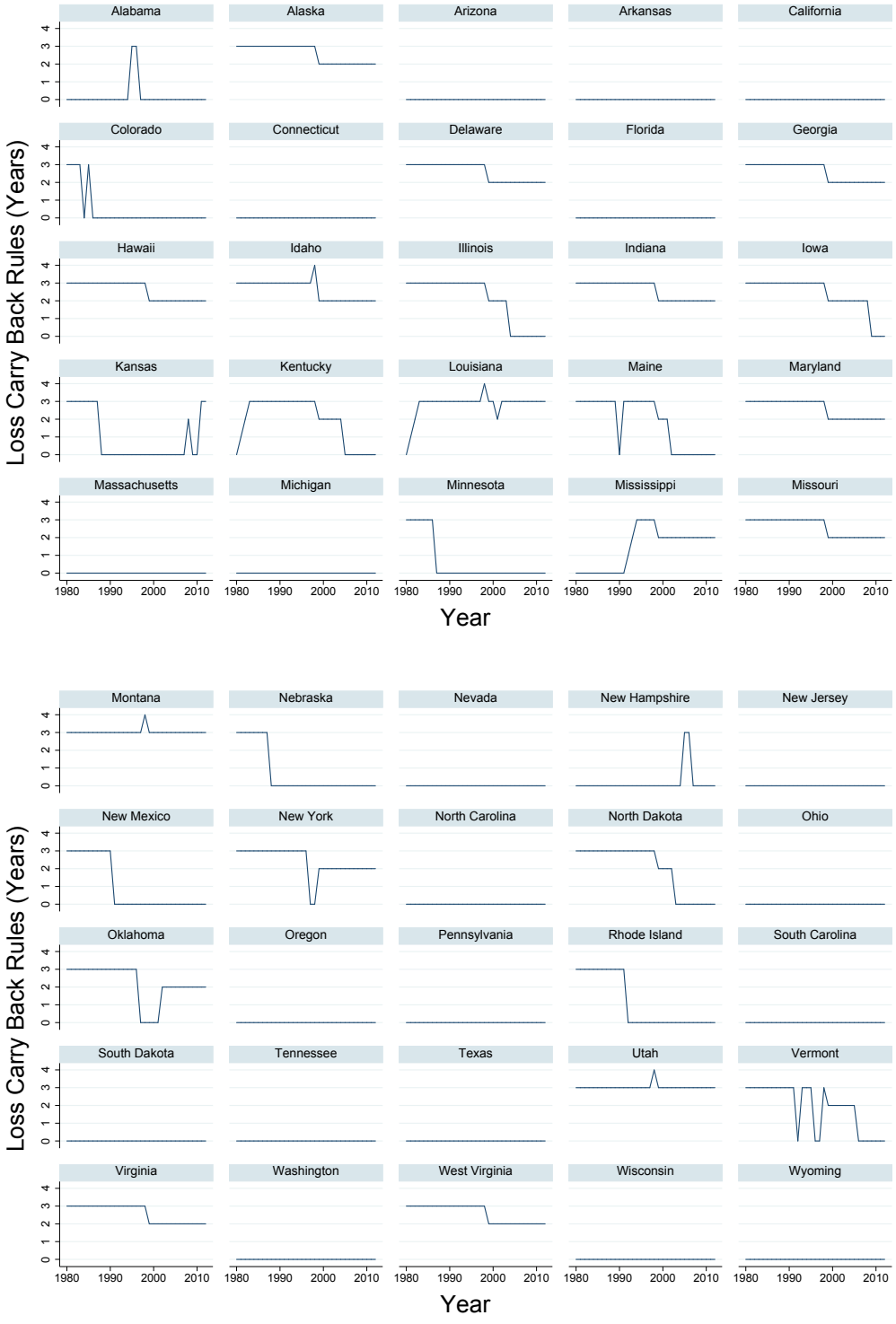
NOTES: Sample spans 1980-2012.

Figure A4: Loss Carry Forward Rule By State-Year



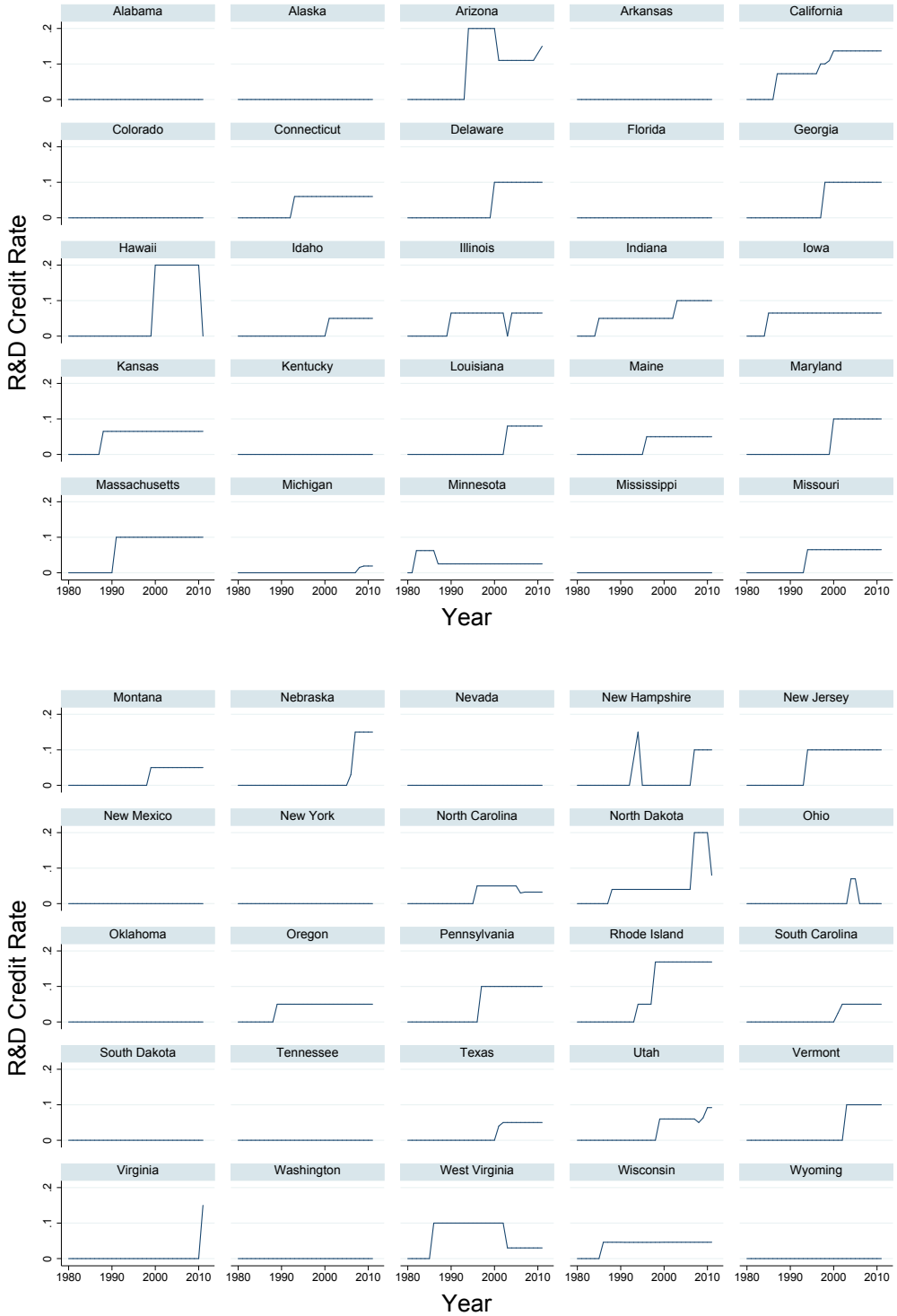
NOTES: Sample spans 1980-2014.

Figure A5: Loss Carry Back Rule By State-Year



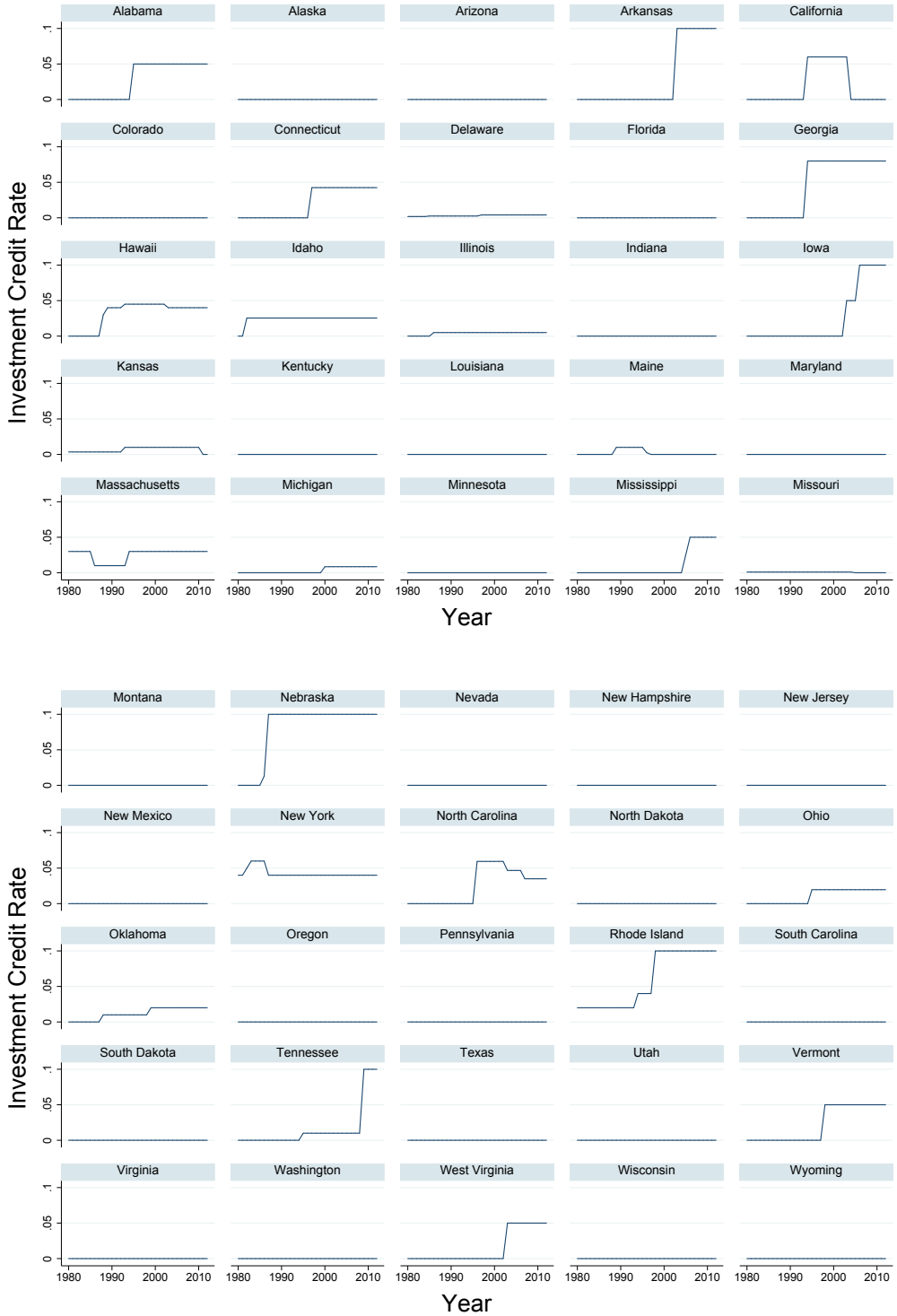
NOTES: Sample spans 1980-2014.

Figure A6: R&D Credit Rate By State-Year



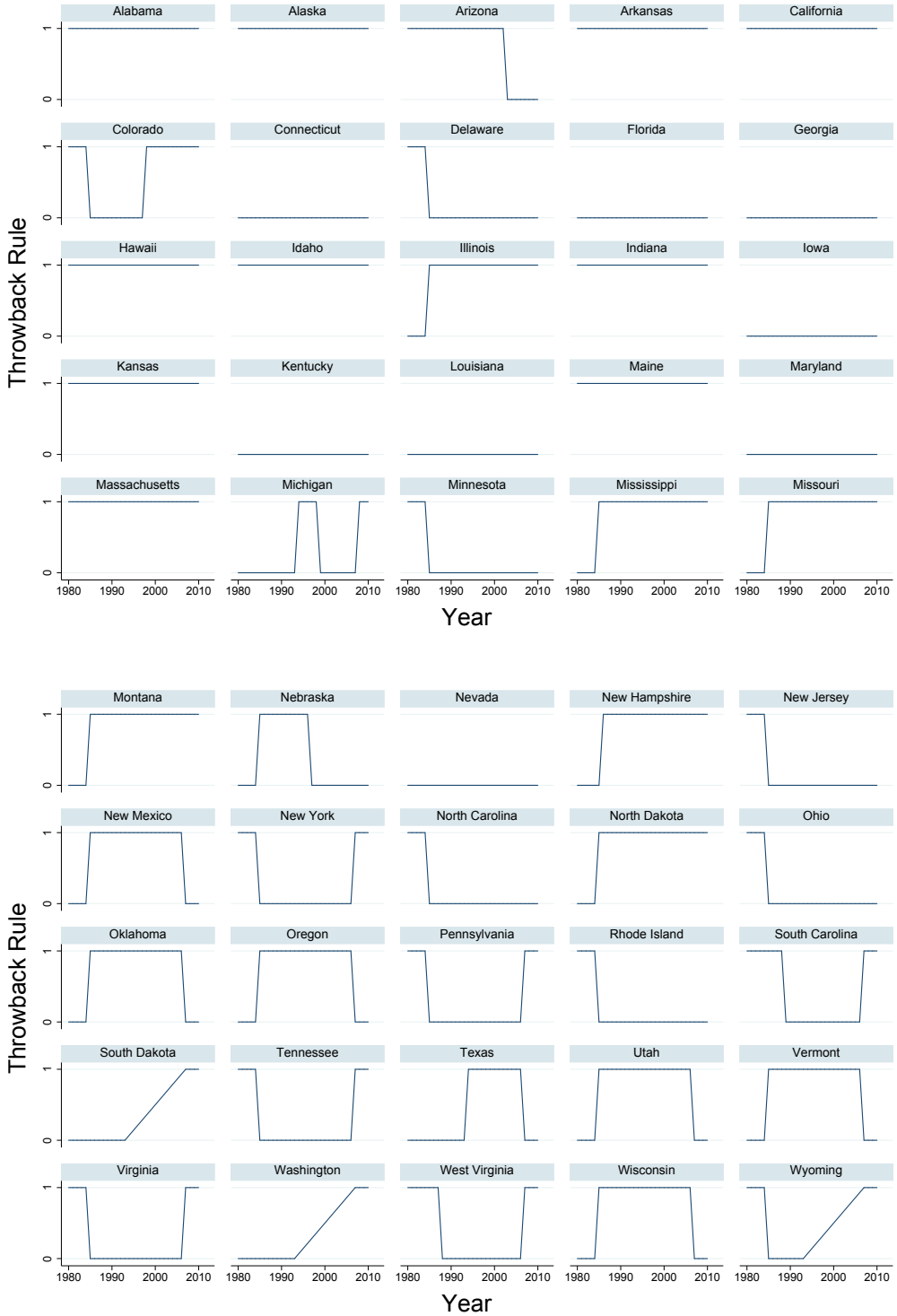
NOTES: Sample spans 1980-2011.

Figure A7: Investment Credit Rate By State-Year



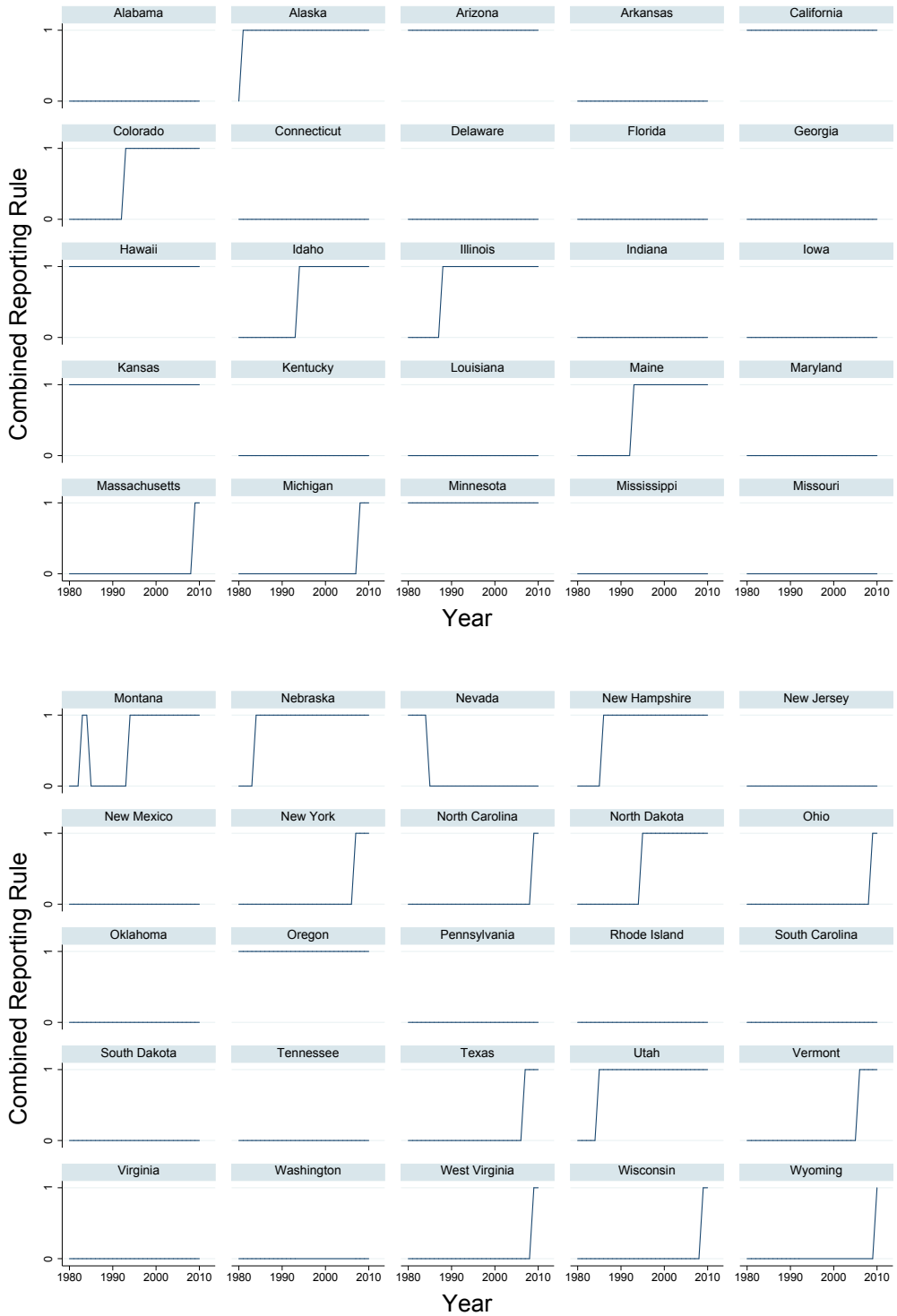
NOTES: Sample spans 1980-2013.

Figure A8: Throwback Rule By State-Year



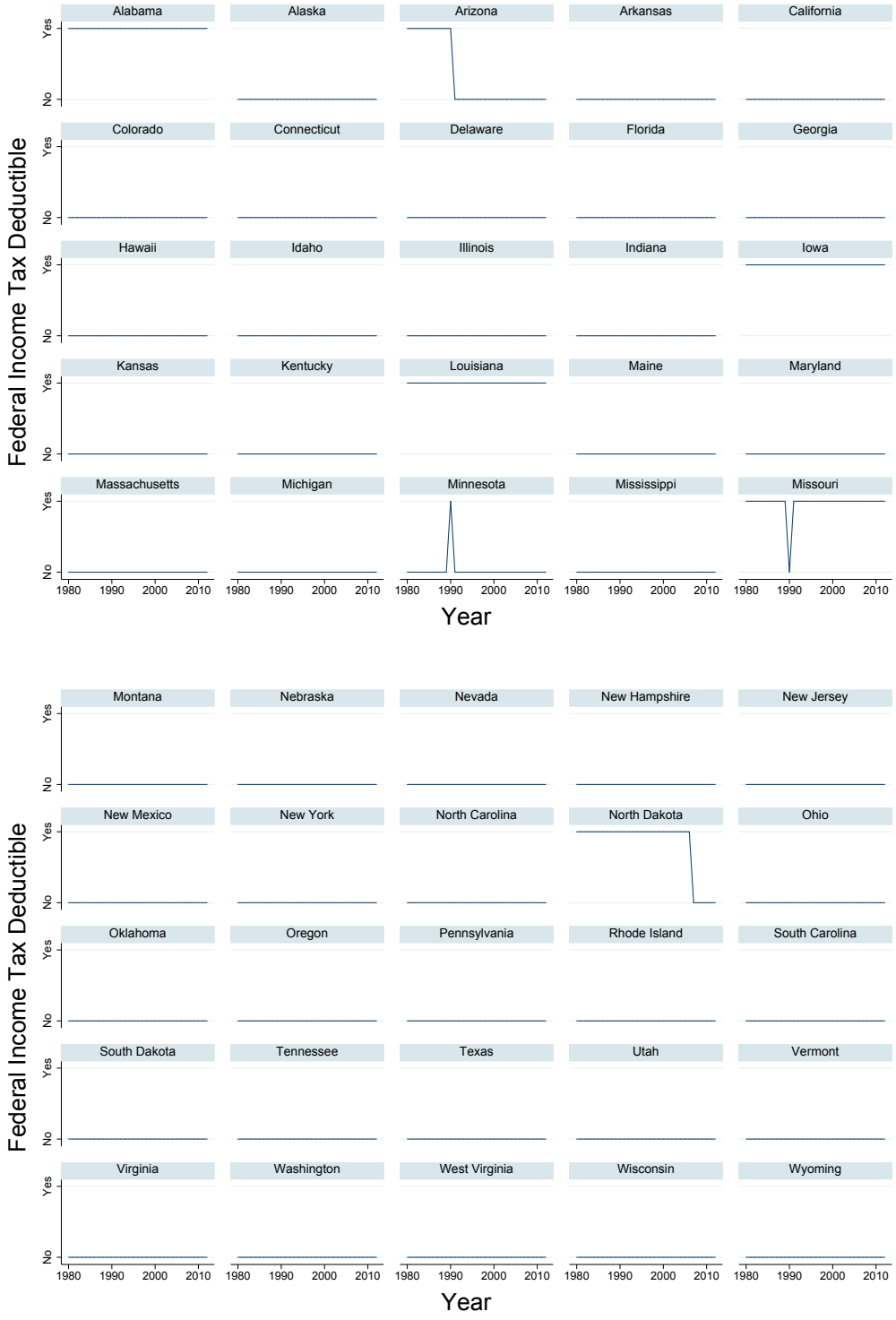
NOTES: Sample spans 1980-2010.

Figure A9: Combined Reporting Rule By State-Year



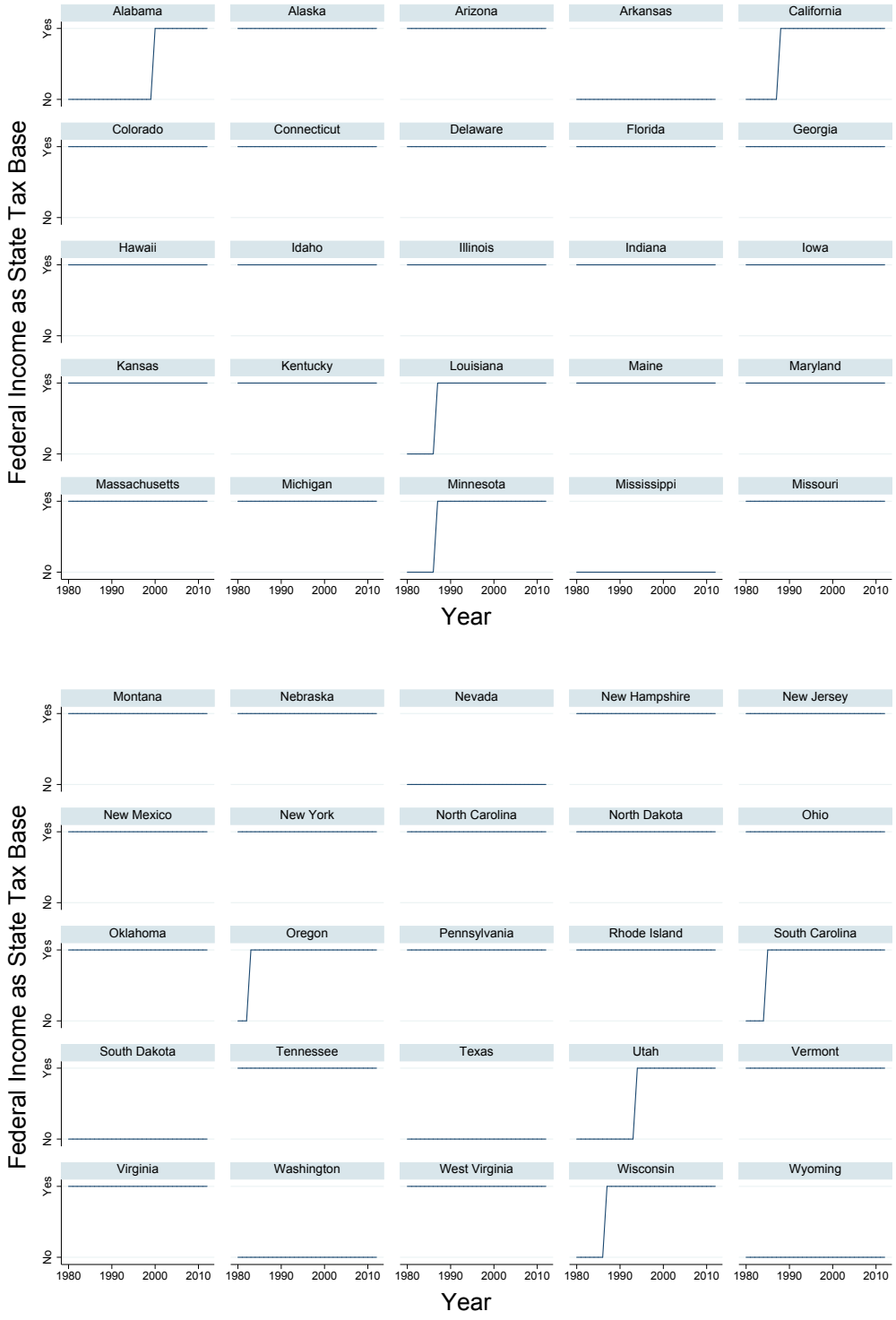
NOTES: Sample spans 1980-2010.

Figure A10: Federal Income Tax Deductible By State-Year



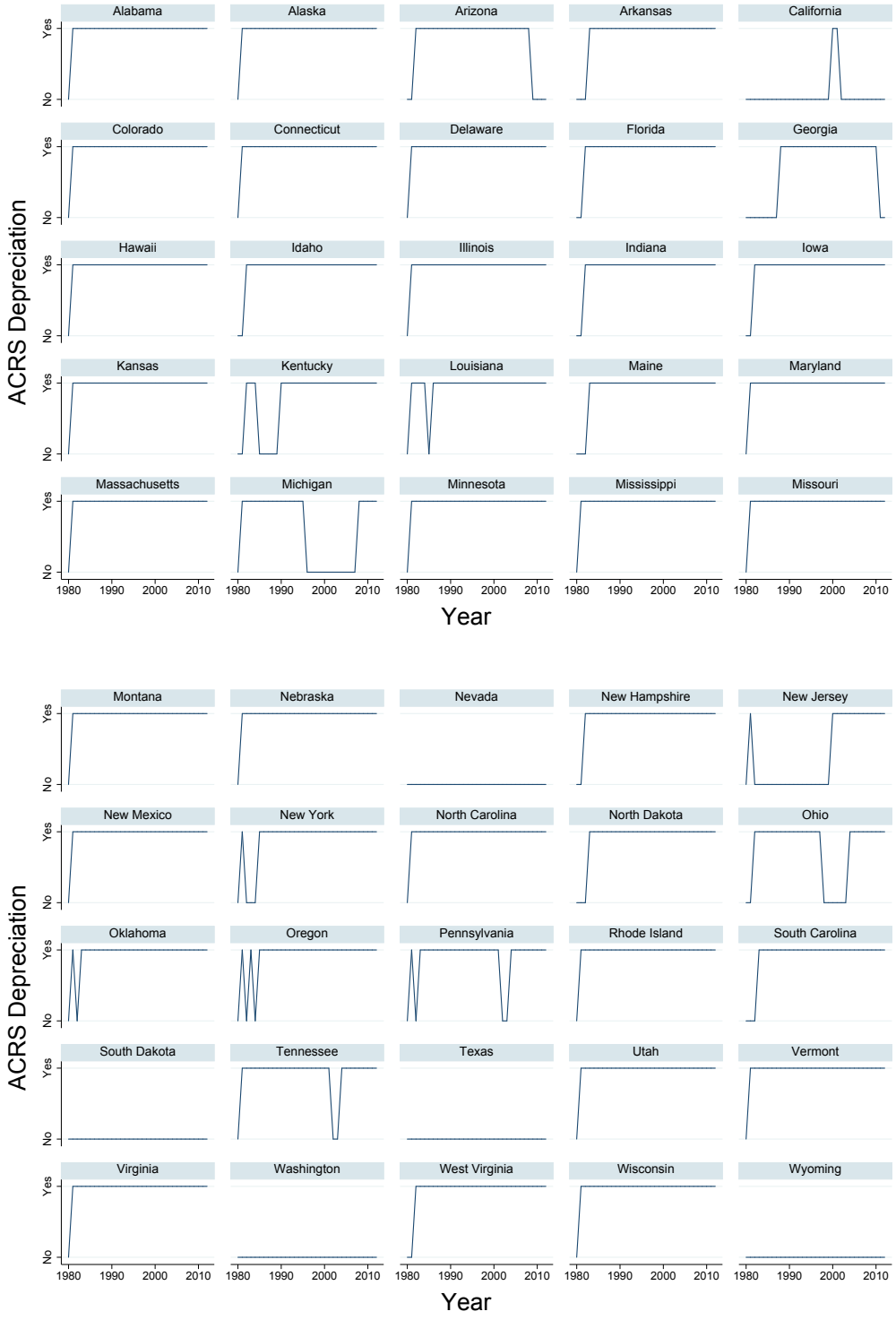
NOTES: Sample spans 1980-2014.

Figure A11: Federal Income as State Tax Base By State-Year



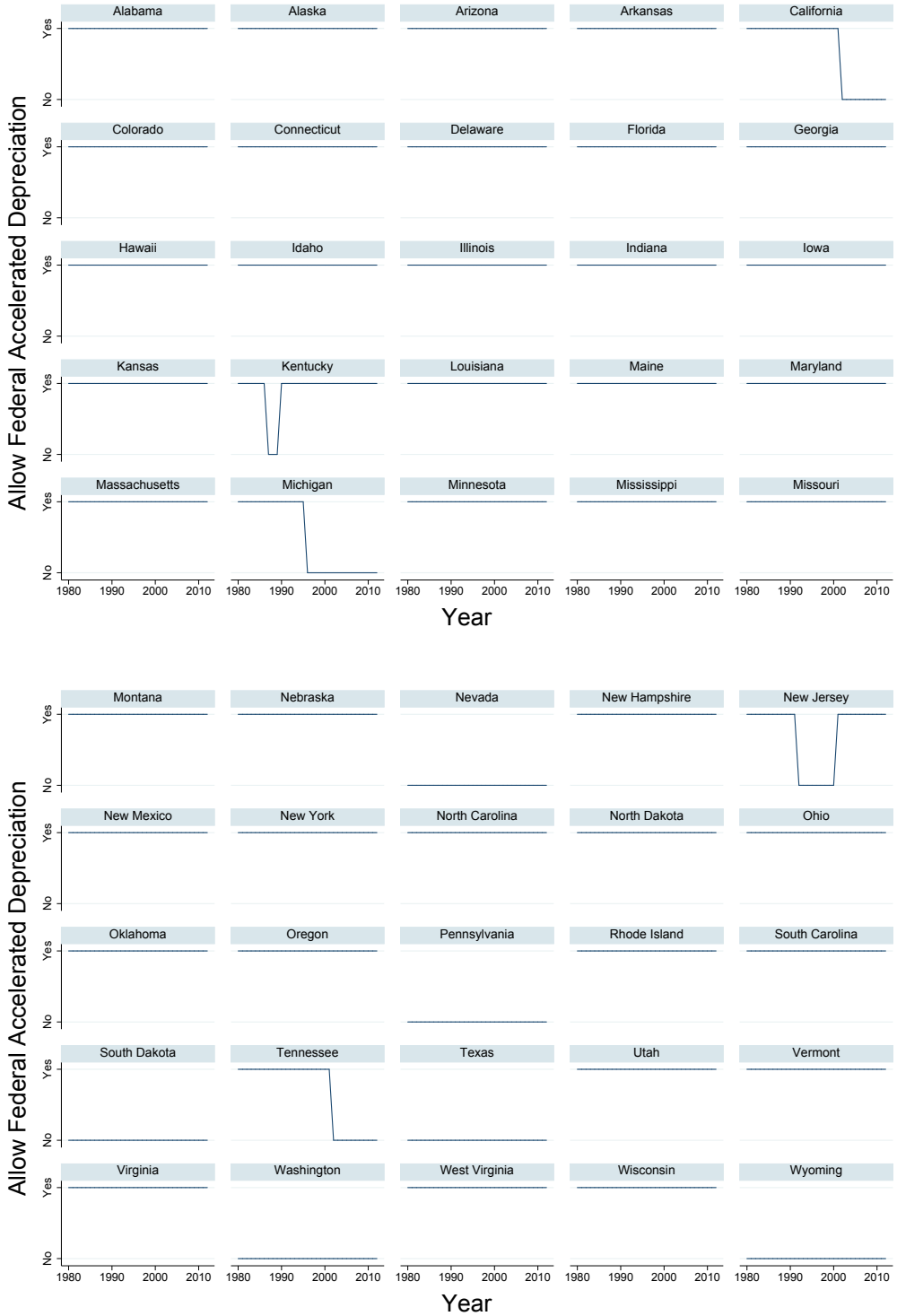
NOTES: Sample spans 1980-2014.

Figure A12: ACRS Depreciation Rule By State-Year



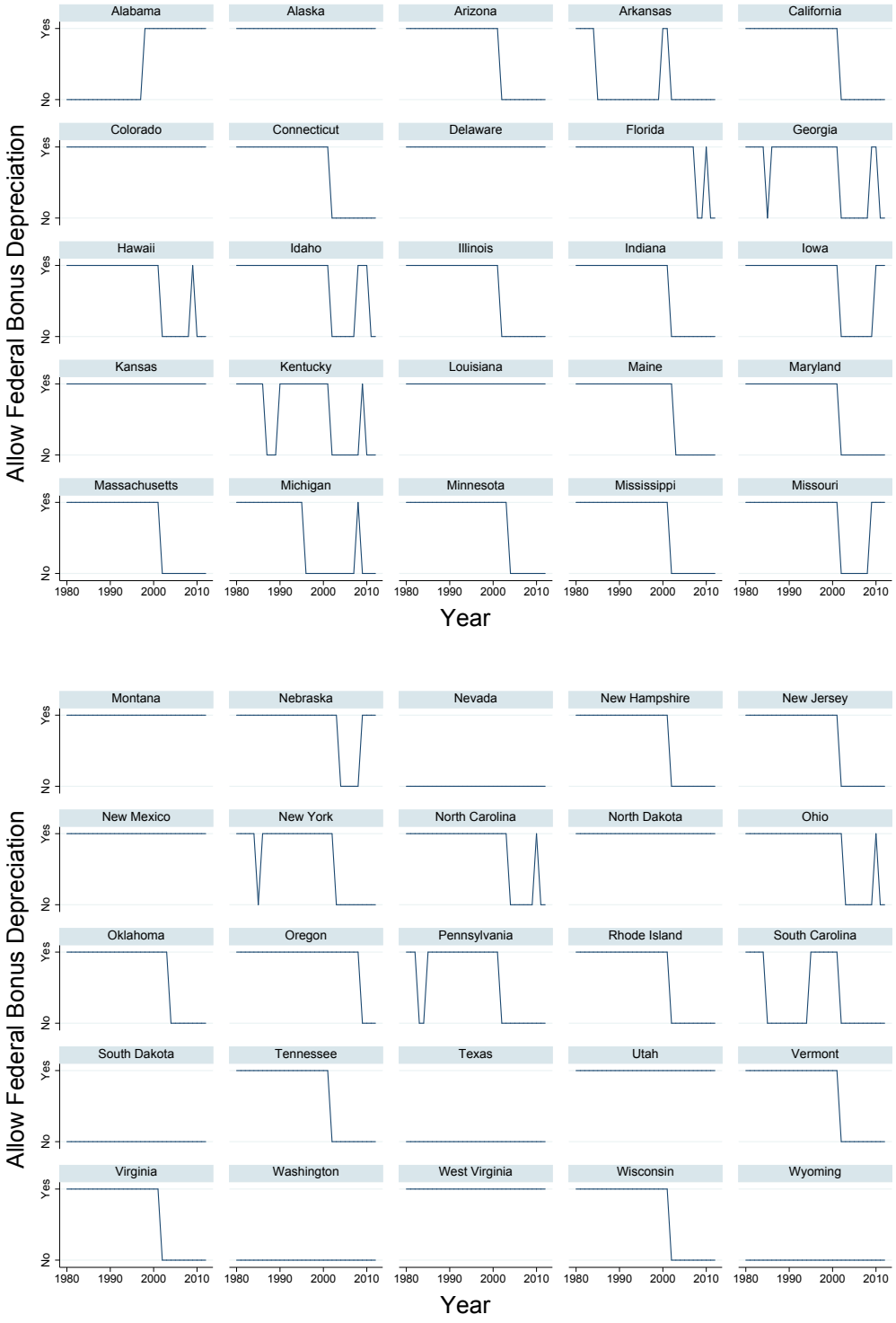
NOTES: Sample spans 1980-2014.

Figure A13: Federal Accelerated Depreciation Rule By State-Year



NOTES: Sample spans 1980-2014.

Figure A14: Federal Bonus Depreciation Rule By State-Year



NOTES: Sample spans 1980-2014.

Figure A15: Corporate Tax Revenue Share by Region

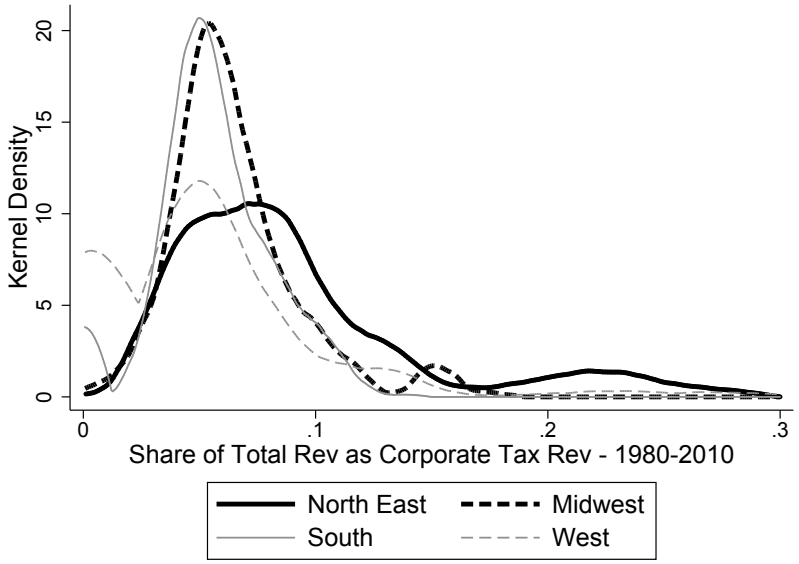
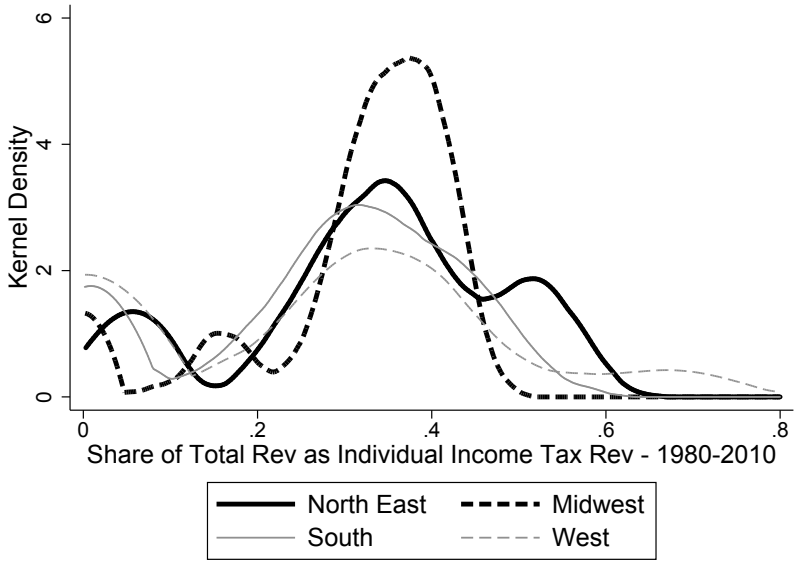
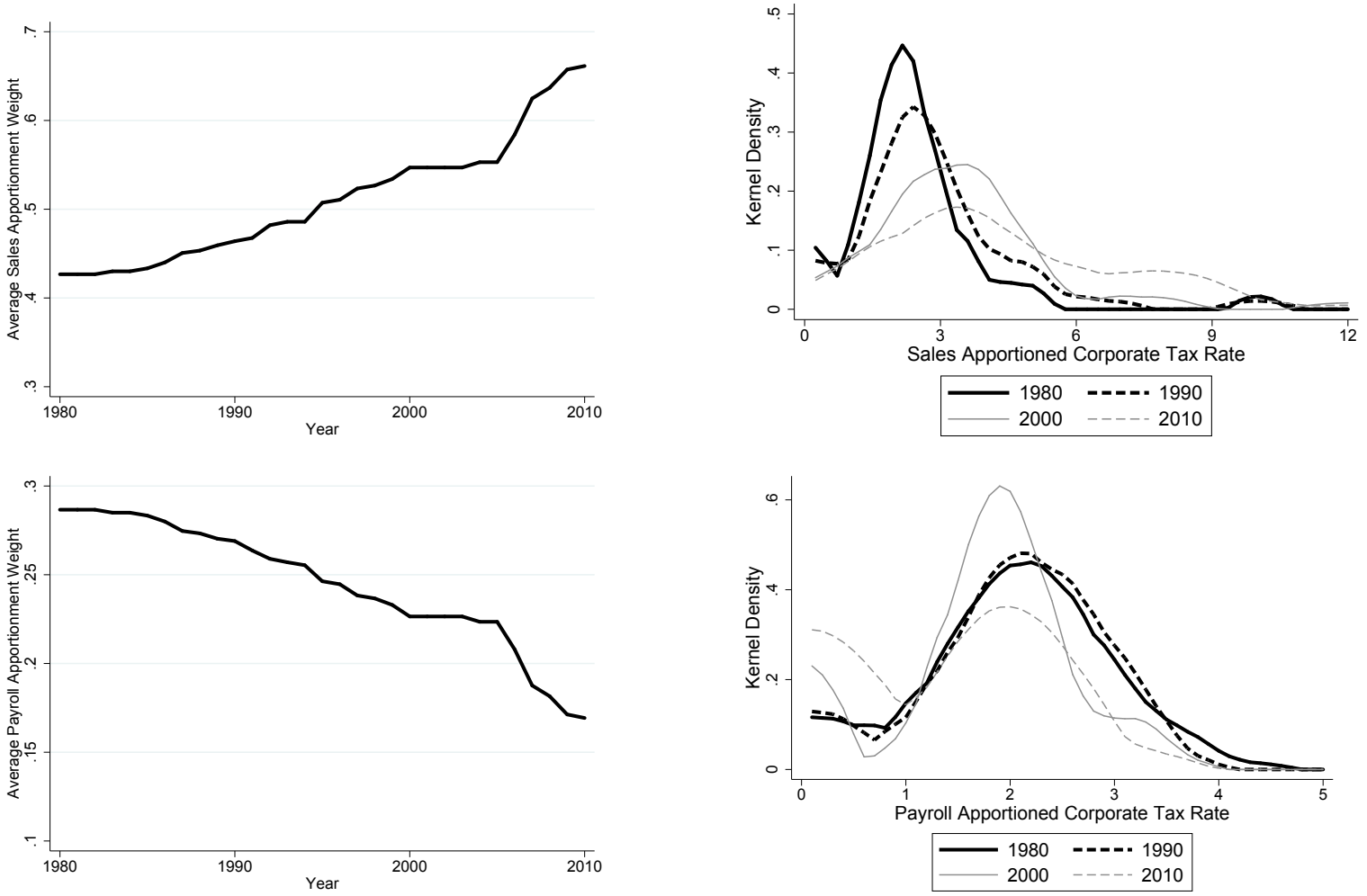


Figure A16: Individual Income Tax Revenue Share by Region



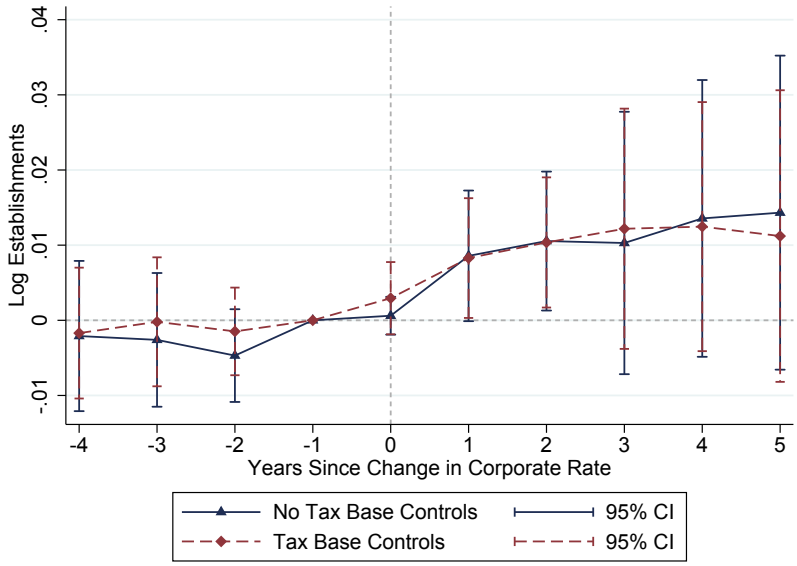
NOTES: Sample spans 1980-2010. Regions are based on standard U.S. Census regions. Note that the kernel density is equally weighted by state-year observation. That is, a single observation is one state-year (within a single region). The alternative would be to take the total single tax revenue for a given state over the sample period (1980-2010) and divide it by the total tax revenue for that state over the sample period. Both produce similar results.

Figure A17: Apportionment Weights & Apportioned Corporate Tax Rates



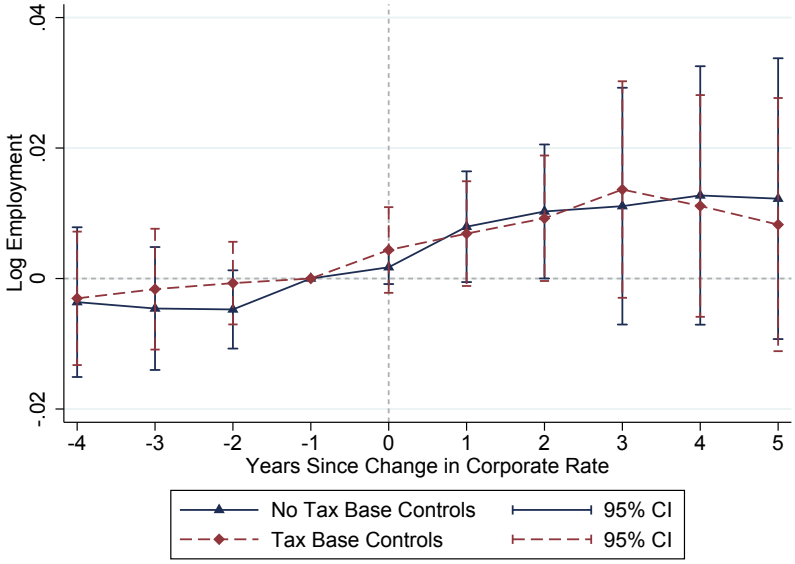
NOTES: The figures on the left present the annual trends in both the average sales and payroll apportionment weights between 1980 and 2010. The figures on the right present kernel density functions over the sales and payroll apportioned corporate tax rates by decade. The sales apportioned corporate tax rate is computed simply by cross-multiplying the state corporate tax rate and the state sales apportionment weight. The payroll apportioned corporate tax rate is computed analogously.

Figure A18: Event Analysis: Impact Net-of-Corporate Tax Rate on Log Number of Establishments (CBP)



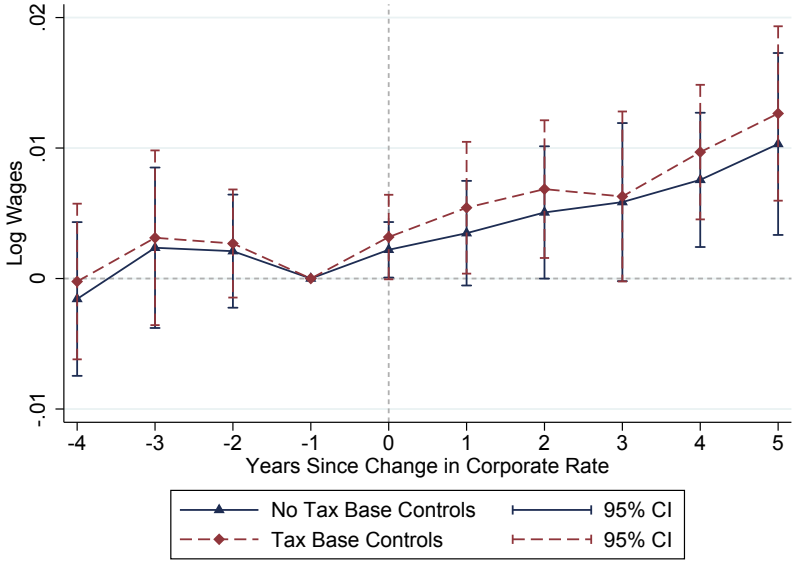
NOTES: This figure shows the effect of the change in the net-of-corporate tax rate on log number of establishments. The source of establishment estimates in these figures is County Business Patterns (CBP). Year and state fixed effects are utilized. Where specified, we additionally control for the following tax base rules: loss carry forward, loss carry back, R&D credit, investment credit, payroll apportionment weight, and federal income tax deductibility. Standard errors are clustered by state.

Figure A19: Event Analysis: Impact Net-of-Corporate Tax Rate on Log Employment (BEA)



NOTES: This figure shows the effect of the change in the net-of-corporate tax rate on log employment. The source of employment estimates in these figures is the U.S. Bureau of Economic Analysis (BEA). Year and state fixed effects are utilized. Where specified, we additionally control for the following tax base rules: loss carry forward, loss carry back, R&D credit, investment credit, payroll apportionment weight, and federal income tax deductibility. Standard errors are clustered by state.

Figure A20: Event Analysis: Impact Net-of-Corporate Tax Rate on Log Wages (BEA)



NOTES: This figure shows the effect of the change in the net-of-corporate tax rate on log wages. The source of wage estimates in these figures is the U.S. Bureau of Economic Analysis (BEA). Year and state fixed effects are utilized. Where specified, we additionally control for the following tax base rules: loss carry forward, loss carry back, R&D credit, investment credit, payroll apportionment weight, and federal income tax deductibility. Standard errors are clustered by state.

Table A1: Probits

	Any Base Change	Any Base Change	Base Broadening	Base Narrowing
Rate decrease	0.8186***	0.2110	0.1196	0.1997
	(0.1574)	(0.2180)	(0.3595)	(0.2308)
No rate change	0.5736***	-0.0774	-0.1616	-0.0244
	(0.0945)	(0.1786)	(0.2941)	(0.1815)
Year FE	No	Yes	Yes	Yes

NOTES: This table report coefficients from a probit model estimating the probability of a change in the tax base using changes in tax rates. Standard errors clustered by state.

Table A2: Frequency of tax base changes accompanying rate changes

Tax Rate Change:	Dec.	Dec.	Inc.	Inc.	None	None	Total	Total
Total Rate Changes:	76		205		1469		281	
Base narrowing/broadening:	-1	+1	-1	+1	-1	+1	-1	+1
Sales Apportionment Weight	4	2	2	1	94	30	100	33
Loss Carry Back	1	3	2	1	22	39	25	43
Loss Carry Forward	8	1	6	1	75	13	89	15
Francise Tax	1	1	1	1	2	1	4	3
Federal Income Tax Deductible	0	1	0	2	2	1	2	4
Federal Income Tax as State Tax Base	2	0	0	0	6	0	8	0
Federal Accelerated Depreciation	0	0	0	0	2	5	2	5
ACRS Depreciation	1	0	6	1	50	14	57	15
Federal Bonus Depreciation	1	2	2	2	16	44	19	48
Throwback	4	3	4	0	15	21	23	24
Combined Reporting	1	0	2	0	18	2	21	2
Investment Credit	1	2	1	0	33	8	35	10

NOTES: This table reports the number of tax-year observations was a change in tax base and tax rate. A change that represents a narrowing of the base is counted in the -1 column, while a year that represents a broadening of the base is counted as $+1$.