



Center for  
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**Wisconsin**  
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## **The Evolution and Impacts of the State Corporate Tax Structure: 2011-2020**

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**September 8, 2021**

### **Abstract**

We study how the state corporate tax rate and 15 measures of the state corporate tax base have been evolving since 1980, with a particular focus on changes in the last decade. We find the average corporate tax rate across the 50 states declined from 6.7 percent in 2010 to 6.1 percent in 2020, the lowest value observed in our data covering 1980-2020. The last decade also saw a significant number of changes in the tax base, including a drop in the number of states with a franchise tax from 28 to 13, and an increase in the average R&D tax credit rate from 5.7 to 7.5 percent. Overall, the state corporate tax base has become narrower over time, reducing the state corporate tax revenue as a share of state GDP (the revenue-to-GDP ratio). Together, the changes have increased the explanatory power of the state corporate tax structure, especially the tax rate, in accounting for the variation of the revenue-to-GDP ratio across states and over time. However, the narrower tax base also reduced the marginal effect of the state corporate tax rate on the revenue-to-GDP ratio.

# 1 Introduction

Forty-four states in the U.S. levy a corporate income tax, which is both an important source of revenue for many states and a key determinant of a state's attractiveness/competitiveness for businesses. For example, the structure of a state's corporate income tax, including both the tax rate and measures of the tax base, accounts for 20.8 percent of its total score in the Tax Foundation's State Business Tax Climate Index in 2021.<sup>1</sup>

This paper documents the changes and estimates the impacts of the state corporate income tax structure, with a particular focus on the last decade from 2011 to 2020. Following the recent work by Serrato and Zidar (2018),<sup>2</sup> a state's corporate tax structure is measured by both the tax rate and a vector of 15 variables related to the tax base. Serrato and Zidar (1980) constructed a state-year panel of these measures from 1980 to 2010. We extend their data to 2020, and use the data to study the changes in the state corporate tax structure and their impacts on the state corporate tax revenue, state GDP and the state corporate tax revenue as a share of state GDP (the revenue-to-GDP ratio).

The average corporate tax rate across the 50 states declined from 6.7 percent in 2010 to 6.1 percent in 2020, the lowest value observed in our data covering 1980-2020. From 2011 to 2020, the average revenue-to-GDP ratio fluctuated around 0.27 percent, a value lower than that of most years since 1980. The discrepancy between the decline in the average corporate tax rate and the relative flatness of the average revenue-to-GDP ratio is partly due to changes in the state corporate tax base. In particular, the number of states with a franchise tax dropped by 15, from 28 in 2010 to 13 in 2020, and the average R&D tax credit rate increased from 5.7 percent in 2010 to 7.5 percent in 2020.

Among the 500 state-year observations between 2011 and 2020, we observe 43 instances where the state narrowed the corporate tax base, 20 instances where the state broadened the base, 48 instances where the state decreased the corporate tax rate, and 53 instances where

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<sup>1</sup><https://taxfoundation.org/2021-state-business-tax-climate-index/#Corporate>

<sup>2</sup>Juan Carlos Suárez Serrato and Owen Zidar. The structure of state corporate taxation and its impact on state tax revenues and economic activity. *Journal of Public Economics*, 167 (2018): 158-176.

the state raised the tax rate. The larger number of changes in the rate than the base is different from what happened between 1980 and 2010, when there were more changes in the base than the rate. On the other hand, the larger number of changes leading to a narrowing than a broadening of the state corporate tax base is consistent with what happened during the whole sample period from 1980 to 2020, when there were 314 instances of base narrowing and 158 instances of base broadening. The overall narrowing of the state corporate tax base contributes to the significant decline of the average revenue-to-GDP ratio from over 0.35 percent in 1980s to about 0.27 percent in 2011-2020.

Using all data from 1980 to 2020, we find indicators for rate changes are not significantly correlated with either a simultaneous base narrowing or a simultaneous base broadening, and indicators for base changes are significantly correlated with a simultaneous rate decrease but not increase. In other words, there is only very weak evidence that states tend to change the corporate tax rate and base simultaneously.

After estimating a linear equation relating the revenue-to-GDP ratio to the tax rate and measures of the tax base, we find the observed tax rate and base account for over half of the variation in the revenue-to-GDP ratio across states and over time from 1980 to 2020, and the tax rate accounts for about 60 percent of the explained variation. However, the results of this variance decomposition vary significantly over time. In particular, the explanatory power of the state tax policy parameters has risen from about 50% in 1980 to about 75% in 2020. Moreover, up until 2010, a larger share of the explained variance was accounted for by the base rules. A reversal of this pattern occurred in 2011-2020 when the tax rates accounted for as high as three quarters of the explained variance. The explanatory power of each of the 15 measured base rules has also changed over time.

Finally, we estimate the impacts of the state corporate tax structure by allowing the effects of the tax rate and base to be heterogeneous and dependent on each other. This is done by including interactions between the tax rate and each of the 15 measured base rules into regressions of outcomes such as the revenue-to-GDP ratio on the tax rate and

measures of the tax base. Empirically, we find evidence of significant heterogeneous effects. For example, the estimated effect of the corporate tax rate on the revenue-to-GDP ratio is higher when a state has throwback and combined reporting rules and lower when the R&D tax credit and the number of years for loss carryback are higher. Because of these interactions, the effect of the tax rate varies over time as measures of the tax base changes. In particular, as the state corporate tax base has narrowed over time, the effect of the tax rate on the revenue-to-GDP ratio in 2020 was less than half of what it had been in early 1980s.

The next section introduces the data and measures of the state corporate tax structure. Section 3 studies how these measures have been evolving over time, with a particular focus on changes from 2011 to 2020. Section 4 quantifies the contribution of each measure of the state corporate tax structure to the variation in the revenue-to-GDP ratio. Section 5 estimates the (heterogeneous) impacts of the state corporate tax rate and base. Section 6 concludes.

## **2 Measuring the state corporate tax structure**

Following Serrato and Zidar (2018), we use the corporate tax rate and 15 variables related to the corporate tax base to measure each state's corporate tax structure in each year. The 15 variables for the tax base include an indicator of having throwback rules, an indicator of having combined reporting rules, investment tax credit rates, the research and development (R&D) tax credit rate, an indicator for whether the R&D tax credit applies to an incremental base that is a moving average of past expenditures, an indicator for whether the R&D tax credit applies to an incremental base that is fixed on a level of past expenditures, the number of years for loss carryback, the number of years for loss carryforward, 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 following federal accelerated depreciation, an

indicator for following accelerated cost recovery system (MACRS) depreciation, an indicator for federal bonus depreciation, and the sales apportionment weight which determines the share of national profits of multi-state firms that is taxable in a given state.

To measure the impact of the state corporate tax structure, we use the state corporate tax revenue, the state GDP and the state corporate tax revenue as a share of the state GDP (the revenue-to-GDP ratio). We obtain the state GDP from the U.S. Bureau of Economic Analysis, and the state corporate tax revenue from the U.S. Department of Commerce.

Serrato and Zidar (2018) collected data for these variables from 1980 to 2010. We extend their data to 2020. Most of the data are collected from the same sources as Serrato and Zidar (2018). In particular, the corporate tax rate and most of the tax base variables are obtained from CCH smart charts<sup>3</sup> and by double-checking the relevant provisions in each state. In a few cases, the raw data are edited for consistency. For example, the corporate tax rate in Ohio has been zero since 2011 but the measure for the corporate tax revenue is positive in all years but 2014. The positive revenue comes from the gross receipts tax which is imposed in Ohio instead of the corporate income tax. Since it does not make much sense to use the revenue data when the tax rate is zero, we set the revenue to zero for all state-year observations with a zero tax rate. One state affected by this is South Dakota, which has a zero corporate tax rate but a positive corporate tax revenue in all years from 1980 to 2020. Since Serrato and Zidar (2018) made no such edit, our data are slightly different from theirs even for 1980-2010.

Table 1 presents summary statistics of the corporate tax revenue as a share of GDP and the 15 variables for the corporate tax base. For each variable, panel A reports the average across states and over time for 1980-2010 and 2011-2020, and panel B reports the average across states in 2010 and 2020.

From 2011 to 2020, the revenue-to-GDP ratio is 0.268 percent on average. This is about 24 percent lower than the average of 0.351 percent from 1980 to 2010. However, much of

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<sup>3</sup><https://answerconnect.cch.com/smartcharts?multistate=state>

the decline occurred before 2011. In fact, as shown in panel B, the average revenue-to-GDP ratio increased slightly from 0.258 percent in 2010 to 0.268 percent in 2020.

Table 1: Summary Statistics

<i>Panel A. 1980-2020 Pooled Sample</i>					
		1980-2010		2011-2020	
	Observations	Mean	Std. Dev.	Mean	Std. Dev.
Corp Tax Revenue as Share of GDP (%)	2050	0.351	0.287	0.268	0.175
Throwback Rules	2050	0.492	0.500	0.580	0.494
Combined Reporting	2050	0.281	0.450	0.620	0.486
Investment Tax Credit	2050	1.062	2.323	3.838	6.522
R&D Tax Credit	2050	2.629	4.369	7.496	6.956
Loss Carryback Rules	2050	1.183	1.381	0.538	1.005
Loss Carryforward Rules	2050	11.379	6.707	15.564	6.708
Franchise Tax	2050	0.534	0.499	0.260	0.439
Fed Income Tax Deductible	2050	0.105	0.306	0.060	0.238
Fed Income as State Tax Base	2050	0.814	0.389	0.820	0.385
Fed Accelerated Depreciation	2050	0.851	0.356	0.820	0.385
ACRS Depreciation	2050	0.802	0.399	0.860	0.347
Federal Bonus Depreciation	2050	0.692	0.462	0.380	0.486
Sales Apportionment Weight	2050	51.043	23.856	70.410	28.907
Incremental R&D Credit, Base is Fixed	2050	0.203	0.402	0.460	0.499
Incremental R&D Credit, Base is Moving Average	2050	0.097	0.296	0.180	0.385
<i>Panel B. 2010 and 2020 Cross Section</i>					
		2010		2020	
	Observations	Mean	Std. Dev.	Mean	Std. Dev.
Corp Tax Revenue as Share of GDP (%)	50	0.258	0.216	0.268	0.182
Throwback Rules	50	0.480	0.505	0.580	0.499
Combined Reporting	50	0.500	0.505	0.620	0.490
Investment Tax Credit	50	2.120	3.280	3.900	6.360
R&D Tax Credit	50	5.695	5.608	7.492	7.023
Loss Carryback Rules	50	0.700	1.055	0.500	0.974
Loss Carryforward Rules	50	14.220	7.081	15.800	6.664
Franchise Tax	50	0.560	0.501	0.260	0.443
Fed Income Tax Deductible	50	0.080	0.274	0.060	0.240
Fed Income as State Tax Base	50	0.860	0.351	0.820	0.388
Fed Accelerated Depreciation	50	0.820	0.388	0.820	0.388
ACRS Depreciation	50	0.860	0.351	0.860	0.351
Federal Bonus Depreciation	50	0.380	0.490	0.380	0.490
Sales Apportionment Weight	50	66.142	27.984	76.622	28.618
Incremental R&D Credit, Base is Fixed	50	0.400	0.495	0.460	0.503
Incremental R&D Credit, Base is Moving Average	50	0.160	0.370	0.180	0.388

Regarding the tax base, some of the most significant differences between the last 10 years and the 30 years before that are: an increase in the number of states using combined reporting rules, an increase in both the investment tax credit and the R&D tax credit, a decrease in the number of states using the franchise tax and an increase in the sales apportionment weight used to determine the share of national profits of multi-state firms taxable in a given state.

### 3 Changes in the state corporate tax structure

This section discusses more of the changes in the state corporate tax structure. We will focus on the ten years from 2011 to 2020. However, as a background, we also present the relevant statistics for 1980-2010 as having been done by Serrato and Zidar (2018).

Figure 1 provides an overview. The blue line in Panel A shows a decline in the average corporate tax rate from about 6.7 percent in 2010 to about 6.1 percent in 2020, the lowest value observed in the data. Overall, the average corporate tax rate has been relatively flat at around 6-7 percent over the past 40 years. This is in stark contrast to the average revenue-to-GDP ratio, which, as shown by the red line, has declined from over 0.35 percent to less than 0.3 percent in 2020. The relatively flat corporate tax rate and the significant decline in the revenue-to-GDP ratio suggests a narrowing of the corporate tax base on average over time.

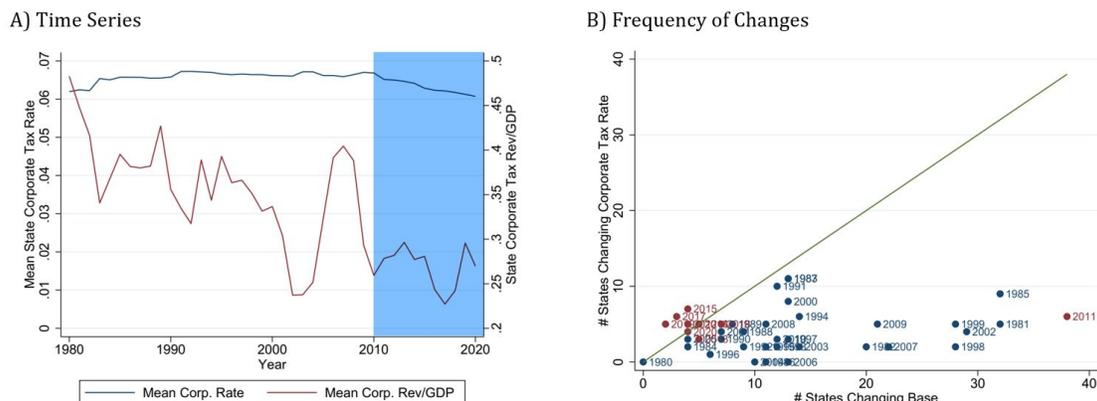


Figure 1: Changes in the State Corporate Tax

Before a detailed look at how the corporate tax base and rate have changed over time, panel B of figure 1 reports the number of changes for each of the two measures in each year. The blue and red dots are for 1980-2010 and 2011-2020, respectively. All blue dots lie below the 45 degree line in green, indicating there were more states changing the base (the horizontal axis) than the rate (the vertical axis) in each year from 1980 to 2010, where a base change is defined as a change in any of the 15 variables mentioned above. The same

pattern is observed for 2011 when a historical high of 37 states changed their corporate tax bases, including 15 states eliminating the franchise tax, 17 states changing the throwback rules, and 10 states changing the combined reporting rules. From 2012 to 2020, the number of base changes has been relatively small and comparable to the number of rate changes.

Figure 2 plots cross-state distributions (kernel density functions) of the corporate tax rate and the revenue-to-GDP ratio in every ten years from 1980 to 2020. Panel A shows that the range of the state corporate tax rate has remained between 0 and 12 percent in the past 40 years. Consistent with the slight increase in the average tax rate in 1980s shown in figure 1, there was a rightward shift in the distribution between 1980 and 1990. This was followed by a reduction in the dispersion of the distribution in the next two decades. Finally, consistent with the slight decrease in the average tax rate in the last ten years shown in figure 1, the distribution shifted slightly to the left between 2010 and 2020. In particular, the number of states with no corporate tax increased from 5 (Nevada, South Dakota, Texas, Washington, and Wyoming) in 2010 to 6 in 2020, with Ohio being the latest state to eliminate the corporate tax. On the other end, the number of states having a tax rate above 9% decreased from 5 (Alaska, Illinois, Iowa, Minnesota, and Pennsylvania) in 2010 to 4 in 2020, with Illinois exiting the group.

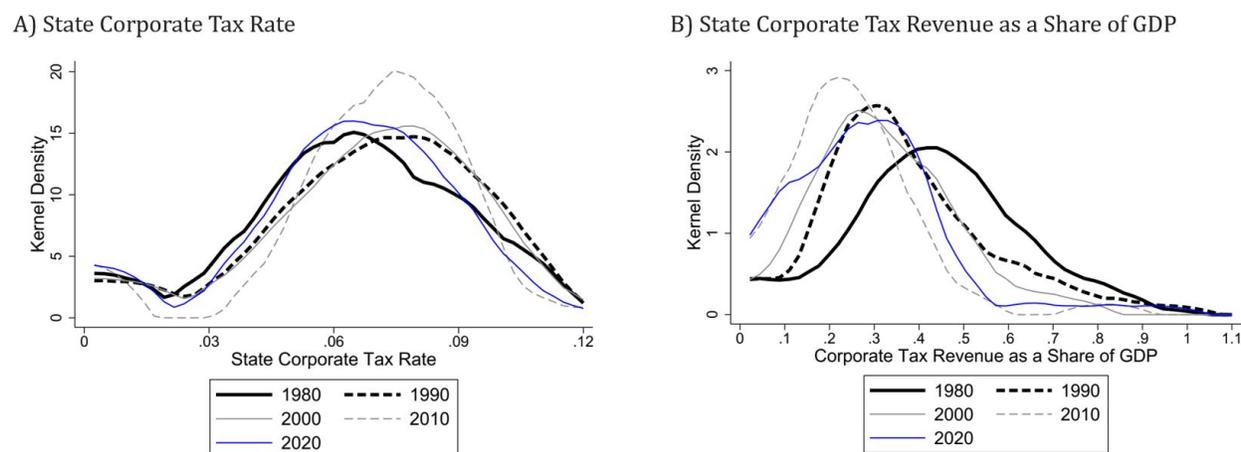


Figure 2: Cross-State Distributions of the Corporate Tax Rate and the Revenue-to-GDP Ratio in Every Ten Years From 1980 to 2020

Panel B shows that, consistent with the decline in the average revenue-to-GDP ratio seen in figure 1, the distribution of the corporate tax revenue as a share of GDP had been shifting to the left from 1980 to 2010. The reverse happened between 2010 and 2020: the distribution of the revenue-to-GDP ratio shifted slightly to the right, consistent with the increase in the average from 0.258 percent in 2010 to 0.268 percent in 2020 reported in table 1.

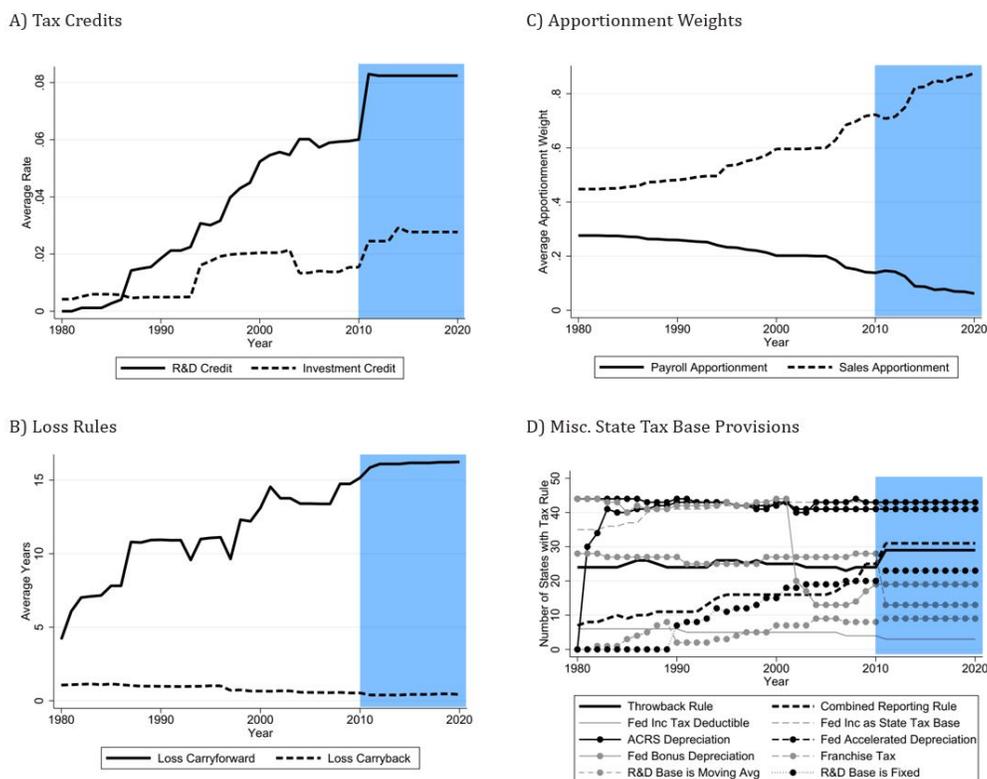


Figure 3: Changes in the Base Rules

Figure 3 plots the evolution of some of the base rules over time. Panel A shows that the average R&D tax credit rate had been increasing in most years from 1980 to 2011, with the increase between 2010 and 2011 being particularly sharp. Since then the average R&D tax credit rate has been flat at around 8 percent. As for the investment credit, there was a significant increase in mid 1990s and a substantial decline in mid 2000s. After another increase in early 2010s, the average investment credit rate is now slightly below 3 percent. Panel B shows an increase in the use of the loss carryforward provisions over time, while the use of the loss carryback provisions is limited and declining. Panel C shows an increase

in the sales apportionment weight and a decrease in the payroll apportionment weight over time. Finally, panel D shows the trends for some other base rules, most of which have been relatively stable since 2010. The most notable change is the significant reduction in the number (from 28 to 13) of states using the franchise tax mentioned above.

To get a better understanding of the changes in the base rules, following Serrato and Zidar (2018), we classify each change into either a narrowing or a broadening of the base, and report the counts in table 2. Column -1 (+1) shows the number of changes in each base rule that lead to a narrowing (broadening) of the corporate tax base. An increase in the rate of investment credits, R&D credits, or sales apportionment weight corresponds to a narrowing of the base, while a decrease corresponds to a broadening. An increase in the number of years allowed for both loss carryforward and loss carryback corresponds to a narrowing of the base, while a decrease corresponds to a broadening. For franchise taxes, federal income tax deductibility, federal accelerated depreciation and ACRS depreciation, the rule being turned off corresponds to a broadening of the base, while it being turned on corresponds to a narrowing. For throwback rules, combined reporting, moving average base for incremental R&D, fixed base for incremental R&D and federal income as state tax base, the rule being turned off corresponds to a narrowing of the base, while it being turned on corresponds to a broadening.

Panel A shows that, from 1980 to 2020, there are more changes categorized as tax base narrowing than broadening. This suggests that an aggregate trend towards narrower bases is partly responsible for the substantial decline in the revenue-to-GDP ratio observed in figure 1. Of these changes, the increase in the number of years allowed for carrying losses forward and the increased reliance on sales as a factor for apportionment are the most frequently reformed measures in data.

Table 2: Summary of base changes

<i>Panel A. 1980-2020 Pooled Sample</i>				
Base narrowing/broadening:	-1	+1	Total changes	No change
Sales Apportionment Weight	103	5	108	1892
Loss Carryback	27	50	77	1923
Loss Carryforward	94	15	109	1891
Franchise Tax	3	18	21	1979
Federal Income Tax Deductible	2	5	7	1993
Federal Income Tax as State Tax Base	2	8	10	1990
Federal Accelerated Depreciation	2	5	7	1993
ACRS Depreciation	57	14	71	1929
Federal Bonus Depreciation	18	43	61	1939
Throwback	29	34	63	1937
Combined Reporting	4	28	32	1968
Investment Credit	39	10	49	1951
R&D Credit	56	10	66	1934
Incremental R&D Credit, Base is Moving Average	10	19	29	1971
Incremental R&D Credit, Base is Fixed	2	25	27	1973

<i>Panel B. 2011-2020 Pooled Sample</i>				
Base narrowing/broadening:	-1	+1	Total changes	No change
Sales Apportionment Weight	32	4	36	464
Loss Carryback	4	8	12	488
Loss Carryforward	9	0	9	491
Franchise Tax	0	15	15	485
Federal Income Tax Deductible	0	1	1	499
Federal Income Tax as State Tax Base	2	0	2	498
Federal Accelerated Depreciation	0	0	0	500
ACRS Depreciation	0	0	0	500
Federal Bonus Depreciation	0	0	0	500
Throwback	6	11	17	483
Combined Reporting	2	8	10	490
Investment Credit	5	1	6	494
R&D Credit	5	2	7	493
Incremental R&D Credit, Base is Moving Average	0	1	1	499
Incremental R&D Credit, Base is Fixed	0	3	3	497

Panel B reports similar statistics for 2011-2020. The sales apportionment weight and the number of years allowed for carrying losses forward are still the most frequently used measures to narrow the corporate tax base. On the other hand, the elimination of the franchise tax and the use of throwback and combined reporting rules are the most used measures to broaden the tax base.

To relate and compare changes in the tax base with changes in the tax rate, table 3 reports the fraction of state-year observations that saw a simultaneous change in the tax base and rate, with the number of state-year observations that correspond to a given cell reported in the parentheses. The last row in panel A shows that, from 1980 to 2020, states have decreased the corporate tax rate 117 times and increased it 105 times, for a total of 222 changes. On the other hand, the last column shows that, during the same period, states have narrowed the corporate tax base 314 times and broadened it 158 times, for a total of 472 changes. As mentioned above, the larger number of base narrowing than broadening suggests an aggregate trend towards narrower bases which contributes to the substantial decline in the revenue-to-GDP ratio observed in panel A of figure 1.

In addition to total numbers of base and rate changes, table 3 also allows us to study the correlation between the two types of changes. For example, the first column of panel A shows that, among the 117 state-year observations with a rate decrease, 21.4 percent are associated with a narrowing of the base, and 12 percent are associated with a base broadening. In comparison, among the 105 observations with a rate increase, 9 (8.6 percent) involve a base narrowing, and another 9 (8.6 percent) involve a base broadening. The larger fraction of changes involving base narrowing among those with a rate decrease suggests a positive correlation between the two types of changes.

Table 3: Frequency of Rate and Base Changes

<i>Panel A. 1980-2020 Pooled Sample</i>				
Base change	Rate decrease	No change	Rate increase	Total
Narrowing	21.4 (25.0)	15.3 (280.0)	8.6 (9.0)	15.3 (314.0)
No Change	66.7 (78.0)	77.3 (1413.0)	82.9 (87.0)	77.0 (1578.0)
Broadening	12.0 (14.0)	7.4 (135.0)	8.6 (9.0)	7.7 (158.0)
Total	100.0 (117.0)	100.0 (1828.0)	100.0 (105.0)	100.0 (2050.0)

<i>Panel B. 2011-2020 Pooled Sample</i>				
Base change	Rate decrease	No change	Rate increase	Total
Narrowing	20.8 (10.0)	7.3 (33.0)	0.0 (0.0)	7.8 (43.0)
No Change	75.0 (36.0)	88.9 (399.0)	98.1 (52.0)	88.5 (487.0)
Broadening	4.2 (2.0)	3.8 (17.0)	1.9 (1.0)	3.6 (20.0)
Total	100.0 (48.0)	100.0 (449.0)	100.0 (53.0)	100.0 (550.0)

Panel B reports similar statistics for 2011-2020. The last row shows that, during the ten years, states have decreased the corporate tax rate 48 times and increased it 53 times, for a total of 101 changes. On the other hand, the last column shows that, during the same period, states have narrowed the corporate tax base 43 times and broadened it 20 times, for a total of 63 changes. The larger number of changes in the rate than the base is consistent with panel B of figure 1, which shows that states were more likely to change the rate and less likely to change the base in 2011-2020 than 1980-2010.

Among the 48 state-year observations with a rate decrease, 10 (20.8 percent) are associated with a narrowing of the base, and only 2 (4.2 percent) are associated with a base broadening. In comparison, none of the 53 observations with a rate increase involves a base narrowing, and only 1 involves a base broadening. This suggests that base changes are more likely to occur simultaneously with a rate decrease than increase in the last ten years.

Table 4 presents Probit estimates of the likelihood of a coincidence in base and rate changes. Panel A estimates the probability of a change in the tax base as a function of a rate change. Panel B does the reverse and estimates the probability of a change in the tax rate as a function of a base change. Both panels use all observations from 1980 to 2020.

Table 4: Probit estimates of the coincidence of base and rate changes

<i>Panel A: Base change using 1980-2020 data</i>			
	Any base change	Base broadening	Base narrowing
Rate decrease	0.3360 (0.2450)	0.0069 (0.2891)	0.4862 (0.2694)
No rate change	-0.1471 (0.2132)	-0.4006 (0.2492)	0.1066 (0.2036)
<i>Panel B: Tax rate change using 1980-2020 data</i>			
	Any tax change	Tax increase	Tax decrease
Base narrowed	0.2713* (0.1298)	-0.0669 (0.1803)	0.3755* (0.1528)
Base broadened	0.4023* (0.1565)	0.2655 (0.2372)	0.3929* (0.1652)

Estimates in panel A suggest that rate changes are not significant predictors of base changes. On the other hand, estimates in panel B suggest that rate decreases are more likely to occur when there is a base change, irrespective of whether it is a base narrowing or broadening. While the estimates in panel A are similar to those in Serrato and Zidar (2018), the estimates in panel B are slightly different. In particular, Using data from 1980 to 2010, Serrato and Zidar (2018) find only base broadening is a significant predictor for a rate decrease. Together, the estimates suggest there is at best very weak evidence that states tend to change the corporate tax rate and base simultaneously.

## 4 Decomposing variation in state corporate taxes

Let  $R_{st}$  be the corporate tax revenue as a share of GDP (the revenue-to-GDP ratio) for state  $s$  in year  $t$ , and

$$R_{st} = \alpha + \gamma\tau_{st} + X'_{st}\Psi^{BASE} + \mu_{st} \quad (1)$$

where  $\tau$  is the corporate tax rate,  $X$  is a vector of variables measuring the tax base, and  $\mu$  is the error term. We have

$$Var(R_{st}) = Var(\alpha + \gamma\tau_{st} + X'_{st}\Psi^{BASE} + \mu_{st}) \quad (2)$$

which could be used to decompose the variation in  $R_{st}$  into three components: a component related to the state corporate tax rate, a component related to the state corporate tax base, and a residual component.

Figure 4 presents the decomposition results using all data from 1980 to 2020. The left bar in Panel A shows that more than half of the variation in the revenue-to-GDP ratio across states and over time can be explained by the state corporate tax structure, i.e.,  $\frac{Var(\gamma\tau_{st} + X'_{st}\Psi^{BASE})}{Var(R_{st})} > 0.5$ . The right bar shows that the state corporate tax rate accounts for more than 60 percent of the explained variation, i.e.,  $\frac{Var(\gamma\tau_{st})}{Var(\gamma\tau_{st} + X'_{st}\Psi^{BASE})} > 0.6$ . In comparison, using data from 1980 to 2010, Serrato and Zidar (2018) find the explained variation is slightly less than half, and the state corporate tax base accounts for more of the explained variation than the state corporate tax rate. The differences suggest the relationship between the state corporate tax rate and the revenue-to-GDP ratio was stronger in 2011-2020 than it had been in 1980-2010.

Panel B shows the relative contribution of each base rule  $j$ , i.e.,  $\frac{Var(x'_{st}\Psi^j)}{\sum_j Var(x'_{st}\Psi^j)}$ . The five most important provisions are the deductibility of the federal income tax (27%), throwback rules (15%), using the federal income as state base (14%), sales apportionment weights (14%), and having a franchise tax (12%). They are the same five rules as in Serrato and Zidar (2018), but their relative importance has changed. For example, the contribution of having

a franchise tax diminished from 21% to 12%, while the contribution of the deductibility of the federal income tax increased from 16% to 27%.

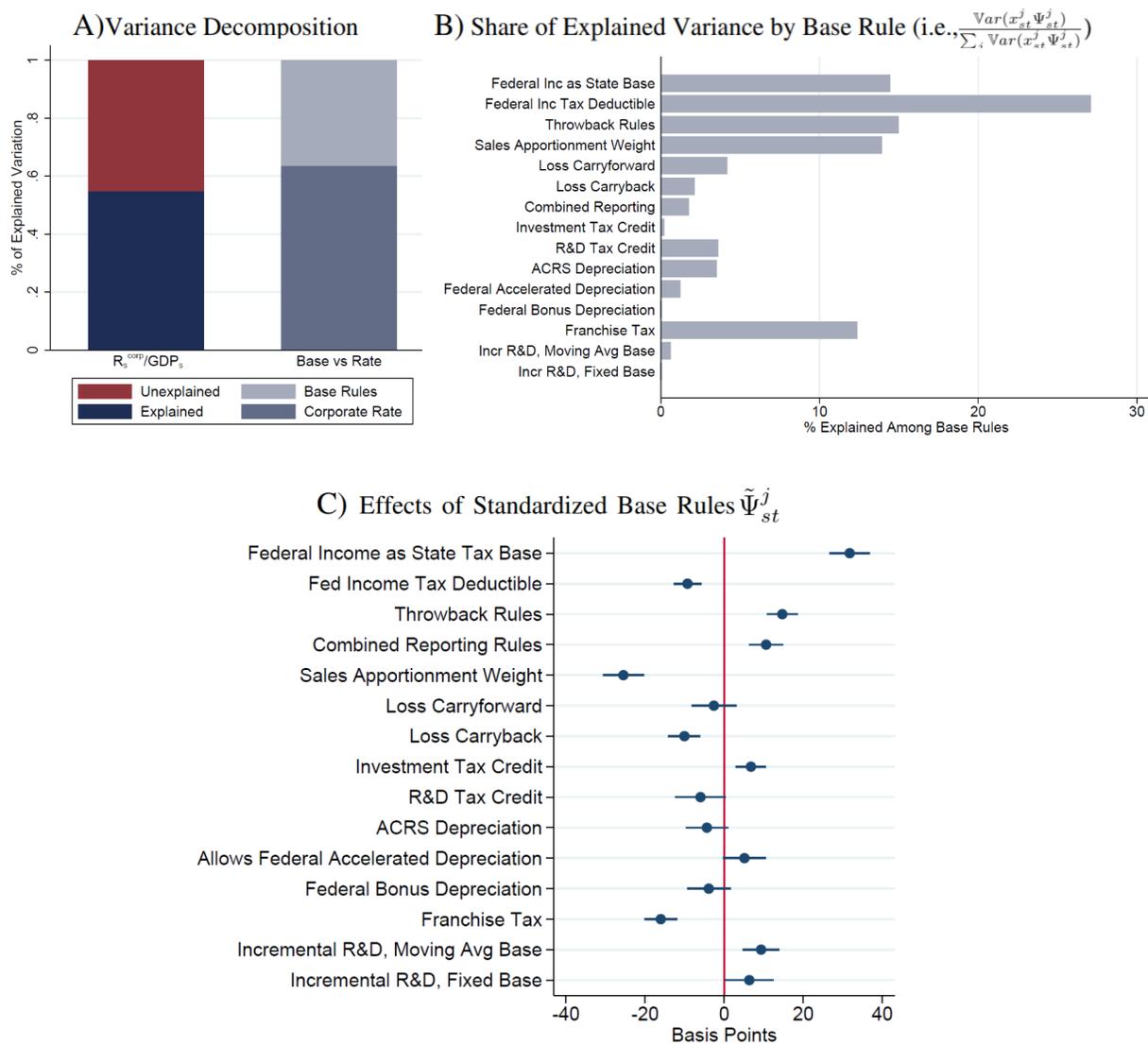


Figure 4: Variance of the state corporate tax revenue as a share of GDP

The contribution of a base rule depends on both the variance of the provision  $x_{st}^j$  and the magnitude of its relationship with the revenue-to-GDP ratio  $\Psi^j$ . To isolate the contribution of the latter, following Serrato and Zidar (2018), we regress the revenue-to-GDP ratio on each standardized rule  $\tilde{x}_{st}^j = \frac{x_{st}^j - \bar{x}^j}{\sigma_{x_j}}$ , where  $\bar{x}^j$  and  $\sigma_{x_j}$  are the mean and standard deviation of  $x_{st}^j$ , respectively. Panel C shows the results. Each row shows the point estimate of  $\Psi^j$ , which

is the effect of a one standard deviation increase in the standardized base measure  $\tilde{x}_{st}^j$ . Seven of the 15 base rules are positively related to the revenue-to-GDP ratio, with federal income as state base having the last impact. Among the 8 base rules whose effects are estimated to be negative, the sales apportionment weight and the indicator for having a franchise tax have the largest impacts. As mentioned above in table 2, increasing the sales apportionment weight and eliminating the franchise tax were two of the most frequently used options to reform the state corporate tax structure in 2011-2020. Since the two options have opposite impacts on the revenue-to-GDP ratio, the net impact depends on their relative importance.

Figure 5 shows how the explanatory power of the state corporate tax structure has evolved over time. For each five-year interval from 1980 to 2020, panel A shows the share of the variation in the revenue-to-GDP ratio that can be explained by the state corporate tax structure, panel B shows the contribution of rates versus base rules to the explained variation, and panel C shows the relative contribution of each base rule.

Panel A shows that the explanatory power of the state tax policy parameters has risen from about 50% in 1980 to about 75% in 2020. Panel B shows that, up until 2010, a larger share of the explained variance was accounted for by the base rules. A reversal of this pattern occurred in 2011-2020 when the tax rates accounted for as high as three quarters of the explained variance. Panel C shows that the base rule with the largest explanatory power between 1980 and 2000, during the 2000s and since 2010 are the sales apportionment weight, the use of federal income as state tax base, and the deductibility of the federal income tax, respectively.

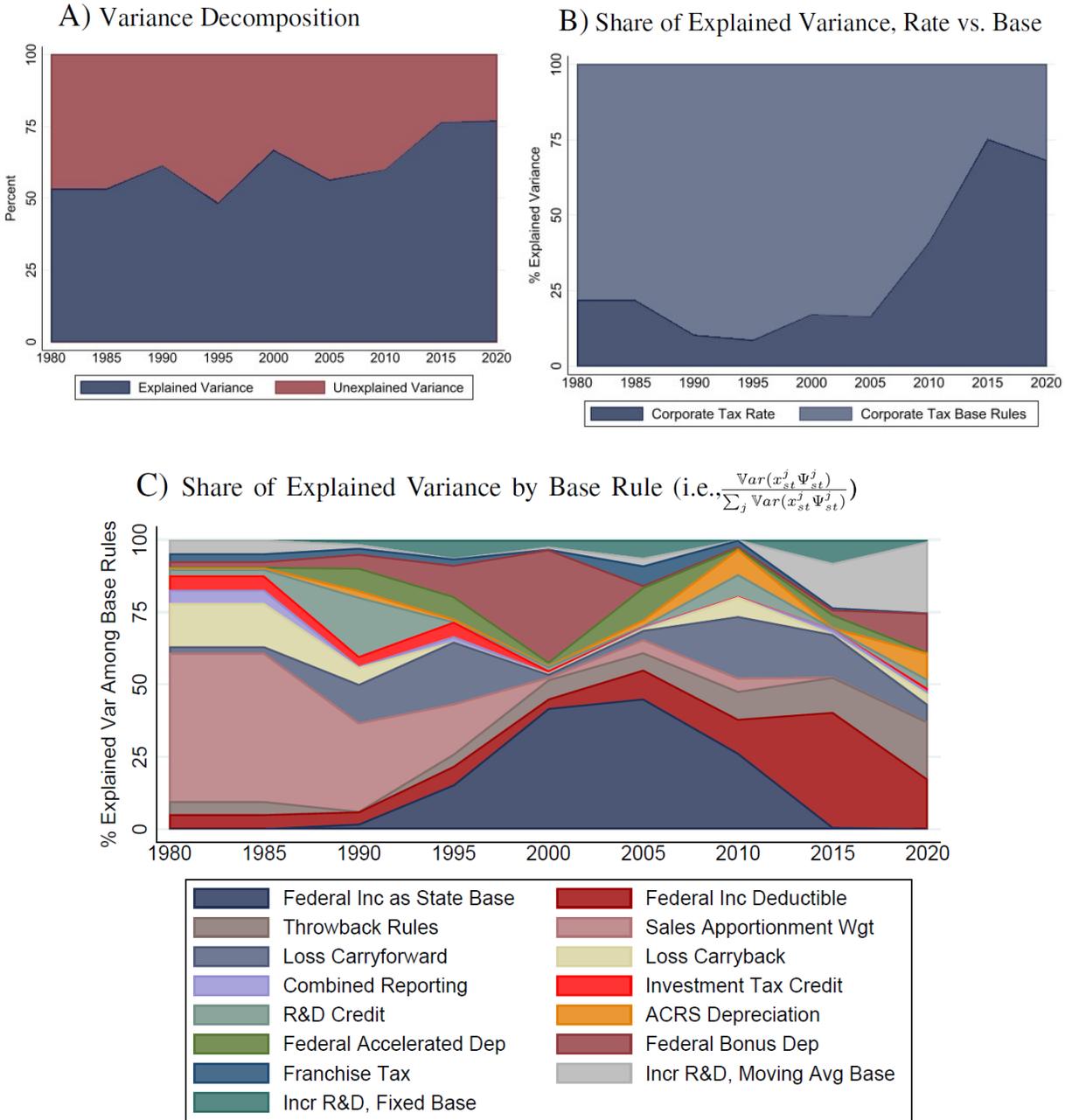


Figure 5: Corporate tax revenue share of GDP - Variance decomposition by five-year period

## 5 Impacts on state tax revenue and economic activity

We now analyze how the state corporate tax structure affects tax revenue and economic activity.

## 5.1 Event study estimates

As in Serrato and Zidar (2018), we begin with an event study analysis of the typical path of state outcomes preceding and following a change in the state corporate tax structure. For each outcome  $Y$ , we estimate a specification of the following form

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

where  $D_{st}^k$  is an indicator for state  $s$  having changed the state tax rate  $k$  periods in the past,  $\alpha_s$  is a state fixed effect, and  $\gamma_t$  is a time fixed effect. The coefficients  $\beta_k$  provide the impact on the time path of mean outcomes relative to the period before the tax rate change (which has been normalized to zero).

Using data from 1980 to 2020, figure 6 shows the results for corporate tax cuts (panels A to C) and corporate tax increases (panels D to F) that exceed a 0.5 percentage point change in the rate in absolute value on three outcomes: the revenue-to-GDP ratio, log state corporate tax revenue, and log state GDP. The full navy line indicates a specification without additional controls. The dashed red line plots the coefficients from a specification that additionally controls for the five base rules with the largest impacts on the revenue-to-GDP ratio shown in panel B of figure 4: federal income tax treated as state base, the sales apportionment weight, throwback rules, federal income tax deductibility, the number of years for loss carryforward, and the franchise tax.

Panel A shows that decreases in the corporate tax rate that exceed 0.5 percentage points tend to reduce the revenue-to-GDP ratio by about 5 percentage points cumulatively over a 5-year period. The estimates are similar to those by Serrato and Zidar (2018), but they are more precise and exhibit a smoother trend after tax decreases.

Panels B and C show the importance of the numerator and denominator separately. We find, cumulatively over 5 years, corporate tax cuts decrease state tax revenue by less than 10%, and have a negligible impact on state GDP. In comparison, Serrato and Zidar (2018)

find the (negative) impact on state tax revenue is more than 10%, and the impact on state GDP is positive, although neither of the differences are statistically significant.

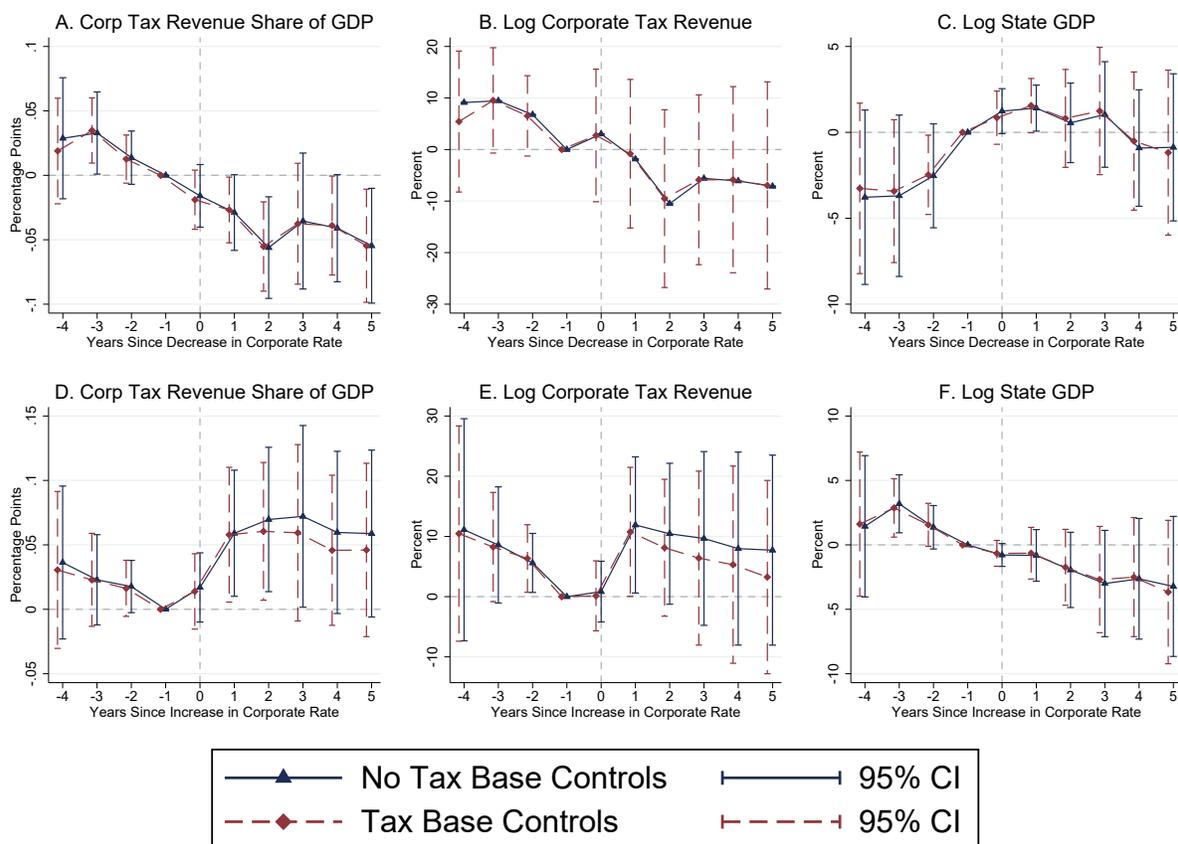


Figure 6: Event analysis: Impacts on state corporate tax revenue and GDP of changes in state corporate tax rates exceeding 0.5 percentage points in absolute value

Panels D, E, and F show that tax rate increases have roughly symmetric impacts, though pre-trends are a bit more noticeable prior to state corporate tax increases. Specifically, panel E shows that tax revenues were also higher by roughly a similar magnitude before the tax rate increases, so it is not clear that corporate tax revenues actually increased following tax rate increases. We view these event studies as describing the typical evolution of outcomes before and after tax rate changes. Since these tax rate changes are potentially endogenous and intended to address current (or expected) economic conditions, these impacts are descriptive and not causal.

## 5.2 Regression estimates

To better understand the impacts of the state corporate tax structure, we estimate the following equation

$$Y_{st} = \alpha_s + \gamma_t + \beta_0 \tau_{st} + \sum_{j=1}^{15} \beta_j \tau_{st} \times \tilde{x}_{st}^j + \tilde{X}_{st}' \tilde{\Psi}^{BASE} + u_{st} \quad (4)$$

where  $Y_{st}$  is outcome  $Y$  in state  $s$  in year  $t$ ,  $\alpha_s$  and  $\gamma_t$  are the state and year fixed effects,  $\tau_{st}$  is the corporate tax rate in state  $s$  in year  $t$ ,  $\tilde{x}_{st}^j$  is the  $j$ th standardized base rule defined in the previous section,  $\tilde{X}_{st}$  is the vector of standardized base rules, and  $u_{st}$  is the error term.

By incorporating the interactions  $\tau_{st} \times \tilde{x}_{st}^j$ , the specification allows the impacts of the tax rate and base to be heterogeneous and dependent on each other. Intuitively, other things equal, an increase in the tax rate should raise less revenue when the tax base is relatively narrow. Similarly, an expansion of the tax base should have a smaller impact when the tax rate is relatively low.

Table 5 reports the estimates. Column (1) shows the results for the revenue-to-GDP ratio from a model that controls for the tax base variables but omits their interactions with the state corporate tax rate, i.e.,  $\beta_j = 0$  for all  $j$ . The coefficient for the corporate tax rate is estimated to be about 1.2, suggesting that a one percentage point increase in the corporate tax rate would increase the revenue-to-GDP ratio by about 1.2 percentage points. Because of the relatively large standard error, the estimate is not statistically different from zero. In comparison, the estimate in Serrato and Zidar (2018) is larger at 1.6 and statistically significant.

Column (2) reports the estimates with the interactions between the base rules and the tax rate. The main effect of the tax rate is estimated to be about 0.9 and statistically insignificant. In comparison, the estimate in Serrato and Zidar (2018) is larger at 2.4 and statistically significant.

	(1)	(2)	(3)	(4)	(5)	(6)
	Revenue to GDP Ratio		Log(Revenue)		Log(GDP)	
$\tau$	1.233 (0.969)	0.876 (0.796)				
$\log(1 - \tau)$			-2.222 (3.192)	-3.333* (1.816)	0.337 (0.932)	0.629 (0.541)
Joint Interaction		1.575*** (0.398)		5.223*** (1.231)		1.782*** (0.183)
<b>Individual Interactions</b>						
R&D Credit		-0.579* (0.301)		0.290 (0.826)		0.590** (0.243)
Sales Apportionment Wgt		0.235** (0.100)		-0.561* (0.305)		-0.592*** (0.081)
Loss Carryback		-0.457*** (0.114)		1.150*** (0.301)		0.120 (0.091)
Loss Carryforward		-0.361*** (0.110)		1.071*** (0.348)		0.474*** (0.088)
Franchise Tax		0.066 (0.080)		-1.146*** (0.355)		-0.077 (0.065)
Federal Inc Deductible		-0.388*** (0.114)		1.697*** (0.288)		0.949*** (0.090)
Federal Inc as State Base		-0.237** (0.099)		0.652*** (0.248)		-0.275*** (0.079)
Federal Accelerated Dep		-1.094*** (0.134)		2.684*** (0.382)		0.714*** (0.108)
ACRS Depreciation		0.636*** (0.086)		-2.008*** (0.281)		-0.112 (0.069)
Federal Bonus Dep		0.006 (0.112)		0.497 (0.343)		-0.007 (0.091)
Throwback Rules		0.144** (0.072)		0.425 (0.293)		-0.334*** (0.059)
Combined Reporting		0.150* (0.084)		-0.933** (0.384)		-0.387*** (0.068)
Investment Tax Credit		-0.183 (0.143)		1.821*** (0.381)		-0.295** (0.115)
R&D Incremental Mov Avg		0.190 (0.182)		0.592 (0.512)		0.314** (0.146)
R&D Incremental Fixed		-0.435** (0.207)		2.384*** (0.760)		0.549*** (0.168)
N	2,050	2,050	1,835	1,835	2,050	2,050
Base Controls	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y
State Fixed Effects	Y	Y	Y	Y	Y	Y

Table 5: Effects of corporate tax rate changes on tax revenues and economic activity

For a given state with a tax base  $\tilde{X}_{st}$ , the total effect of the tax rate  $\tau$  on the revenue-

to-GDP ratio  $R_{st}$  is given by

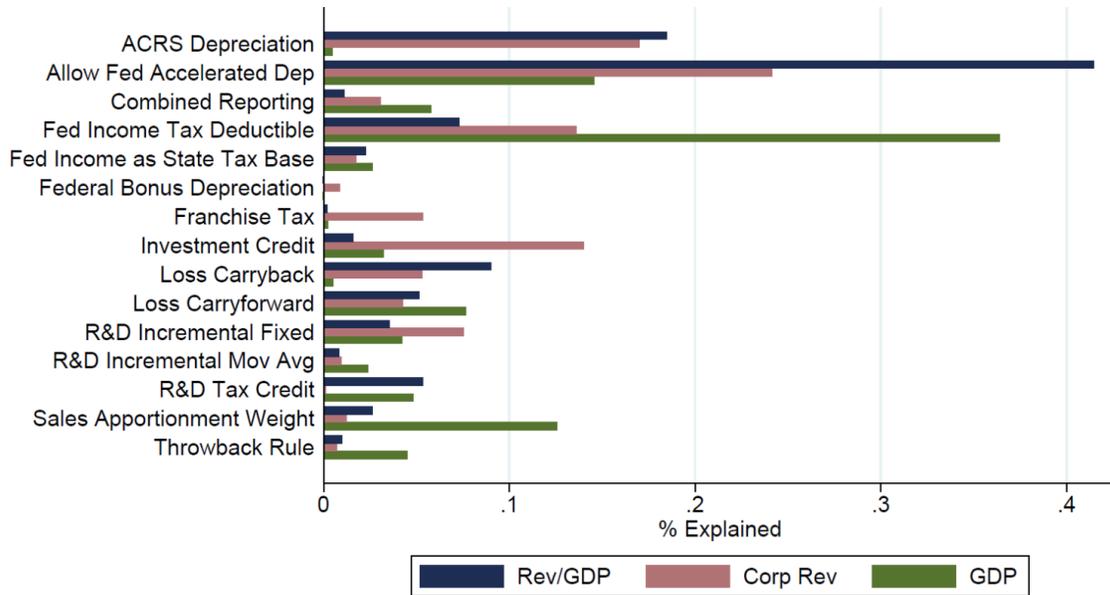
$$\beta_R(\tilde{X}_{st}) = \beta_0 + \sigma^J \sum_{k=1}^{15} \frac{\beta_k}{\sigma^J} \tilde{x}_{st}^k \quad (5)$$

where  $\sigma^J$  equals the standard deviation of the linear combination  $\sum_{k=1}^{15} \beta_k \tilde{x}_{st}^k$ . The joint interaction given by the sum of the 15 terms has a mean of 0, since  $\tilde{x}_{st}^k$  is normalized, and a standard deviation of 1 since we divide it by  $\sigma^J$ .

Column (2) shows that the coefficient  $\sigma^J$  for the joint interaction is estimated to be 1.575, which is significant both statistically and economically. For instance, relative to a state with a joint interaction term that is one standard deviation below the mean, a state with a joint interaction term that is one standard deviation above the mean is predicted to experience an additional increase in the revenue-to-GDP ratio of about 3 percentage points in response to a 1 percentage point increase in the corporate tax rate.

Columns (3) and (4) report the impacts on log revenues, and the last two columns report the impacts on log GDP. To be comparable with Serrato and Zidar (2018), we use the log keep rate ( $\log(1 - \tau)$ ) instead of the tax rate  $\tau$  as the explanatory variable for these two outcomes. Accordingly, the tax rate is replaced with the log keep rate in constructing the interaction terms. Intuitively, the keep rate should have a negative impact on tax revenues, which is confirmed by the estimates in columns (3) and (4). The estimates in the last two columns suggest a positive but small and statistically insignificant relationship between the log keep rate and the log GDP. Together, the estimates in columns (3) to (6) show that, while an increase in the log keep rate reduces the tax revenue and increases GDP at the same time, the effect on tax revenues is a much larger driver of the net effect on the revenue-to-GDP ratio. Additionally, columns (4) and (6) show that both state corporate tax revenue and state GDP are subject to statistically significant joint interactions between the log keep rate and the base rules.

### A) Full Decomposition of Total Effects



### B) Decomposition of Total Effect on Revenue-to-GDP over Time

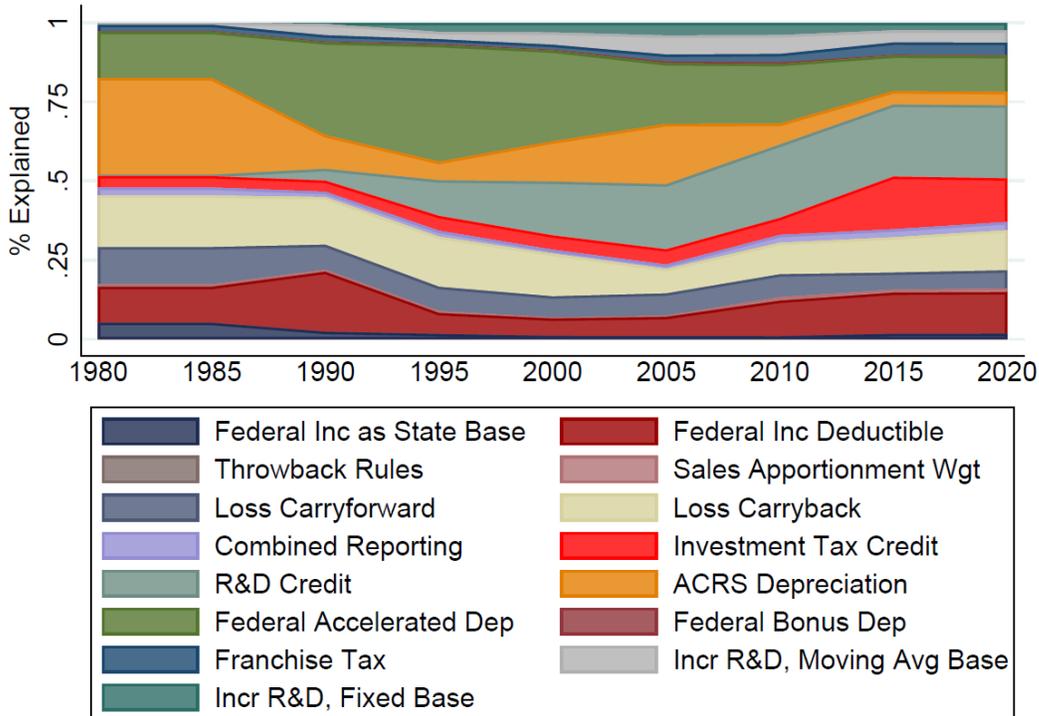


Figure 7: Decomposing the total effects of the corporate tax rate

These joint interaction terms can be decomposed into the individual interactions, which are presented in the remaining rows of table 5. Figure 7 further describes how each of the interaction terms contributes to the joint interaction for each outcome. Panel A shows the fraction of the variation in the total effect  $\beta_R(\tilde{X}_{st})$  for each outcome that is driven by each of the base controls. The five base rules whose interactions with the tax rate are most important for the overall effect of the tax rate on the revenue-to-GDP ratio are the indicator for following federal accelerated depreciation, the indicator for ACRS depreciation, the number of years for loss carryback, the indicator for federal income tax deductibility and the R&D tax credit rate.

Panel B splits this decomposition by five-year intervals, and shows that the importance of both ACRS and federal accelerated depreciation have declined over time, while the importance of both the R&D and the investment tax credit rates have grown over time and become two of the most important base rules affecting the impact of the state corporate tax rate on the revenue-to-GDP ratio in 2020.

Figure 8 depicts the average value of  $\beta_R(\tilde{X}_{st})$ , the total effect of the tax rate on the revenue-to-GDP ratio, for each year  $t$  from 1980 to 2020. The total effect declined significantly between early 1980s and 2000, increased somewhat between 2000 and 2010, dropped significantly in 2011, and has been roughly flat since then. Two of the most dramatic changes occurred in 1981 and 2011, two years with the most base changes as shown previously in the right panel of figure 1. In particular, as shown in panel A of figure 3, the average R&D credit rate increased significantly from 5.7 percent in 2010 to 7.5 percent in 2011, which reduces the total impact of the tax rate on the revenue-to-GDP ratio given the significantly negative coefficient for the interaction between the R&D credit rate and the tax rate reported in the second column of table 5.

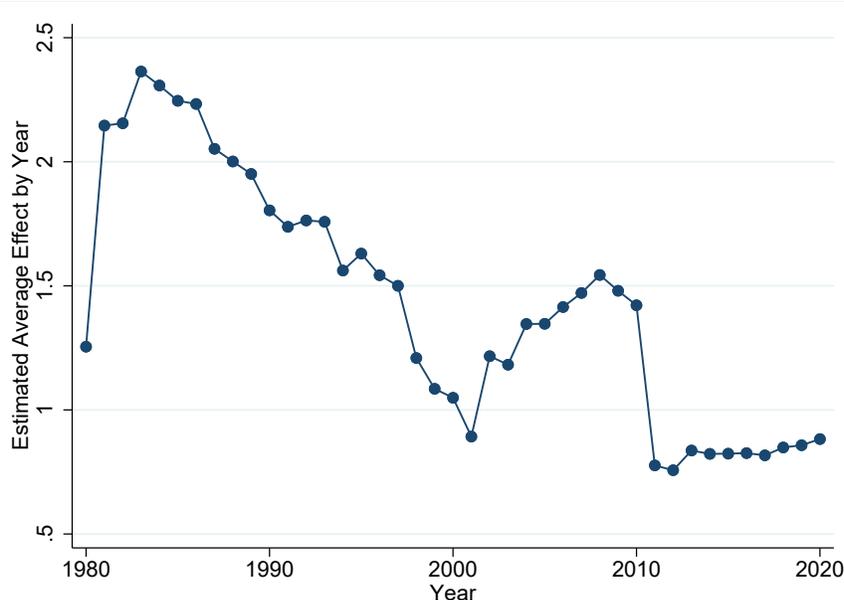


Figure 8: Total effect of the state corporate tax rate on the revenue-to-GDP ratio by year

Overall, the total effect in 2020 was less than half of what it had been in early 1980s. This is consistent with the descriptive evidence in favor of narrowing tax bases reported in the previous section. In other words, the impact of the tax rate on the revenue-to-GDP ratio was much smaller in 2020 than early 1980s because of the narrowing of the state corporate tax base in the last four decades.

## 6 Conclusion

We study how the state corporate tax rate and 15 measures of the state corporate tax base have been evolving since 1980, with a particular focus on changes from 2011 to 2020. We find the average corporate tax rate across the 50 states declined from 6.7 percent in 2010 to 6.1 percent in 2020, the lowest value observed in our data covering 1980-2020. The last decade also saw a significant number of changes in the tax base, including a drop in the number of states with a franchise tax from 28 to 13, and an increase in the average R&D tax credit rate from 5.7 to 7.5 percent. Overall, the state corporate tax base has become narrower over time, reducing the state corporate tax revenue as a share of state GDP (the revenue-to-GDP

ratio). Together, the changes have increased the explanatory power of the state corporate tax structure, especially the tax rate, in accounting for the variation of the revenue-to-GDP ratio across states and over time. However, the narrower tax base also reduced the marginal effect of the state corporate tax rate on the revenue-to-GDP ratio.