

THE U.S. STATE EXPERIENCE UNDER FORMULARY APPOINTMENT: ARE THERE LESSONS FOR INTERNATIONAL REFORM?

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While formulary apportionment eliminates the possibility of shifting income across states, it may heighten the responsiveness of businesses to formula factors. The present analysis uses variation in corporate tax policy decisions of U.S. states over the period 1986 to 2012 to better understand the consequences of formulary apportionment, estimating the tax sensitivity of employment, investment, and sales. With the inclusion of adequate control variables, results indicate that economic activity is not sensitive to U.S. state corporate tax policy choices. Still, tax policy choices have important effects on corporate tax revenues. Findings suggest important lessons regarding possible international adoption of formulary apportionment.

Keywords: international taxation, formulary apportionment, income shifting, corporate taxation, corporate tax revenue

JEL Codes: H25, H71, H73

I. INTRODUCTION

There is an understandable desire to improve systems for taxing international corporate income. Presently, tax systems rely on separate accounting, whereby multinational corporations account separately for income and expenses earned in each taxing jurisdiction. Numerous observers have criticized this system on the grounds that it is difficult to establish the true source of income, and multinational firms have become increasingly adept at shifting income from high-tax to low-tax jurisdictions.¹ Governments have often attempted to curb such income shifting behavior through regulations, yet these regulations are complicated, costly to administer, and often ineffective. Multinational corporations are also not content, as they complain of high compliance costs, substantial

¹ Empirical evidence on income shifting is well known; see the survey articles of de Mooij (2005) and de Mooij and Ederveen (2008). Clausing (2009, 2011, 2016) indicates that income shifting behavior has high revenue costs for high-tax rate governments. This issue has received policy attention of late, with hearings in the U.S. Congress and the UK Parliament, as well as attention in recent G-8 and G-20 meetings. In response, the Organisation for Economic Co-operation and Development (OECD) has launched the Base Erosion and Profit Shifting (BEPS) project, suggesting policy changes to limit tax BEPS.

uncertainty regarding ultimate tax burdens, and unfair tax-based competitive pressures from foreign firms in the global market place.

In this environment, formulary apportionment has emerged as a compelling alternative for international tax reform.² Under formulary apportionment, a firm's total income is assigned to each taxing jurisdiction based on a formula. This system has the potential for large benefits in terms of simplicity, administration, and curbing tax base erosion. However, formulary apportionment may create its own practical difficulties. For example, there are accounting concerns about the measurement of the formula components and the tax base, as well as legal concerns about the definition of a consolidated business and the impact of formulary apportionment on international tax treaties.

Beyond the pragmatic details of implementation, there are also important concerns that a formulary approach will generate its own tax distortions. For example, multinational corporations may respond to formulary apportionment by moving the activities that are used in the formula to determine the assignment of income to low-tax jurisdictions. Also, there are important questions about the revenue consequences of formulary apportionment.

This paper uses the U.S. state experience with formulary apportionment to investigate the importance of these concerns. In particular, it considers the tax sensitivity of formula factors under formula apportionment, and it evaluates the determinants of corporate tax revenue under a formulary system. The empirical analysis focuses on U.S. state corporate tax policy choices over the period 1986 to 2012, building on prior research on this question that is reviewed in Section III.

In the context of international tax policy choices, an analysis of the U.S. state experience may seem peculiar. Yet the U.S. state experience may provide insight into the dynamics of international tax competition. U.S. states are more economically integrated than countries are presently, but as globalization increases economic integration among countries may over time become more similar to the extent of economic integration observed across U.S. states.

Further, U.S. states provide a useful source of policy variation for understanding the consequences of formulary apportionment, since they retain a great deal of autonomy on corporate tax policy choices.³ U.S. states choose tax rates, formulas, and other rules independently, and states have not shied away from policy changes. These types of policy variations are used in this paper to better understand the consequences of formulary apportionment for both economic activity and revenue.

In terms of economic activity, the results demonstrate very little tax sensitivity, in contrast to some early studies of this question (reviewed below). The divergent findings may result in part from the longer time period under investigation in the present study, although there are also other explanations for these findings.

² Formulary apportionment on an international scale has been considered by the European Union in their proposals for a common consolidated corporate tax base (CCCTB), but proposals for international adoption are a long way from fruition. Still, it should be remembered that separate accounting and formulary apportionment are intellectual ideals on a spectrum of profit allocation methods. There are aspects of commonly used transfer pricing practices that have formulary elements, and there are possible hybrid options like formulary profit splits. Thus, one can also learn useful things about tendencies under each end of the spectrum that inform possible proposals in between the two ends of the spectrum.

³ Still, a common (and economically significant) federal layer of taxation exists for U.S. states.

In terms of tax revenues, this analysis suggests that tax policy decisions are important. Both higher sales weights and certain elective features of the corporate tax are associated with lower tax revenues, while higher tax rates and throwback rules (discussed below) are associated with higher corporate tax revenues.

Together with the results on economic activity, this result suggests possible policy lessons for potential international adoption of formulary apportionment. In particular, under formulary apportionment, countries will likely remain tempted to engage in tax policy competition. Efforts to ensure harmonized formulas and to protect the corporate tax base from erosion will still be important.

II. WHAT CAN WE LEARN FROM THE EXPERIENCE OF THE U.S. STATES?

U.S. states have a long experience with formulary apportionment of corporate income. After the U.S. corporate income tax was adopted in the early 20th century, U.S. states realized the difficulty of separate accounting for income and expenses in each state in an environment in which business activity is well integrated across states. Thus, by mid-century, U.S. states assigned national income to state jurisdictions by formula.⁴

At first, the common formula employed by U.S. states was based on three factors: the share of a firm's payroll, assets, and sales in a particular state, or

$$(1) \quad Tax_i = t_i \Pi_{US} \left[\frac{1}{3} \left(\frac{A_i}{A_{US}} + \frac{S_i}{S_{US}} + \frac{P_i}{P_{US}} \right) \right],$$

where the subscript i indicates a particular state, the subscript US indicates the United States, t_i is the state tax rate, Π_{US} is U.S. profit, A is assets, S is sales, and P is payroll. McLure (1980) has shown that a formulary system creates an implicit tax on the factors used in the formula, thus discouraging assets and employment in high-tax locations.⁵

⁴ A detailed history is provided in Hellerstein and Hellerstein (1998).

⁵ Two possible confusions should be cleared up. First, while a formulary approach acts as an implicit tax on the factors in the formula for profitable firms, it is *not equivalent* to a tax on the factors in the formula, typically assets, payroll, or sales. The essential difference is that the tax is proportionate to corporations' worldwide profits, net of deductible expenses. Thus, if a corporation does not earn profits, it will not incur tax liability, no matter how large their sales, assets, or employment. For example, if a firm earns no profit or even a loss, they will still remit payroll taxes (on their payroll) and sales taxes (on their receipts); however, they will not pay any income tax under either a separate accounting system or a formulary system. Only if the firm earns a profit will tax be apportioned based on the formula. Second, there are no cascading effects with the sales factor, as there might be with a poorly designed (non-VAT) sales tax that taxed purchases of business inputs. If a firm has more steps in their production process, then that will generate tax liabilities based on the *profits* of each step of the production process. Thus, consolidating the firm to be vertically integrated will not affect the resulting tax liability beyond the effect of the different distribution of the firm's unchanged profits. As an example, imagine a parts producer earns \$100 profit, split evenly in countries A and B, and a final product producer buys these parts as inputs, and then earns its own \$100 profit, split 25 percent in country A and 75 percent in country B. If the two firms consolidated, they would presumably earn about \$200 in profit, ignoring any economic motives for consolidation for simplicity. The resulting profit would be assigned in some fraction to country A and country B. The total tax bill of the two firms would not change beyond the different distribution of profits to countries A and B.

Gordon and Wilson (1986) discuss how firms may respond to the incentives created by formula apportionment, rearranging their economic activities in order to lighten tax burdens. Still, it is also important to note that firm responses to particular state formulas likely depend on their own heterogeneous circumstances, and thus they may not always find it optimal to locate activity in the lower tax burden state; this is particularly the case in the presence of throwback rules.⁶ According to the Uniform Division of Income for Tax Purposes Act, sales may be “thrown back” to, and thus taxable in, the state from which the sales are shipped if the seller is not taxable in the destination state or if the buyer is the U.S. government.⁷

There have also been difficulties associated with measuring the asset part of the formula factor, due in part to the changing nature of economic value in a modern economy. While sales and employees are more easily measured, assets are increasingly intangible so their value is difficult to measure.⁸

In part due to these concerns, as well as business lobbying, many states have increased the weight on their sales factor in recent decades, often doubling it relative to weights on other factors. Some states have adopted sales-only formulas, where tax liabilities are calculated as

$$(2) \quad Tax_i = t_i \Pi_{US} \left(\frac{S_i}{S_{US}} \right).$$

Indeed over the period of the study (1986–2012), there have been many changes in state formulas for allocating corporate income. In 1986, 80 percent of states that taxed corporate income used an equal-weighted formula, and 20 percent had higher weights on sales. By 2012, in contrast, only 17 percent of states that taxed corporate income used an equal-weighted formula; the rest had formulas with a larger weight on sales. Indeed, in recent years, many states have adopted single-sales formulas, where the entire

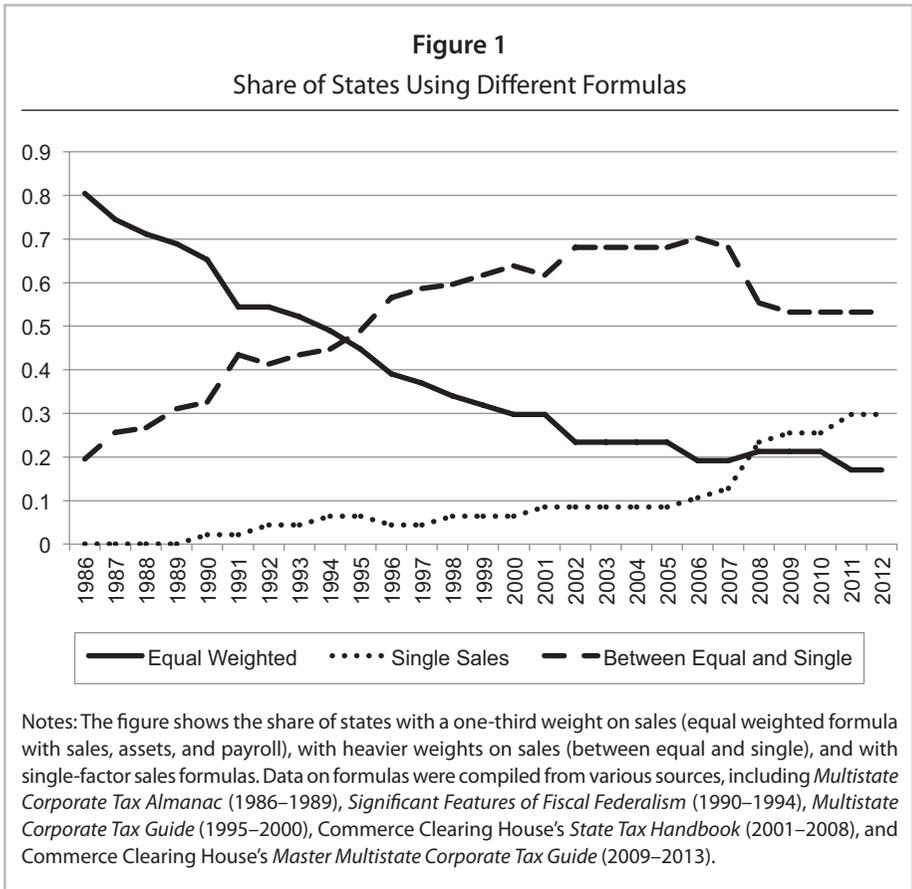
⁶ As an anonymous referee pointed out, one can construct a simple two-state example in which locating in the higher asset tax burden state is optimal if the other state is a throwback state, under particular assumptions about the relative tax rates of the two states and the division of sales between them.

⁷ The rule is triggered when the firm is not subject to taxation in the market state because nexus is not established. There is not a strong correlation between the use of throwback rules and particular state formulas in the data.

⁸ Indeed, such issues also create great havoc with the arm’s length method of separate accounting. Modern firms have sources of value that are difficult to locate, and corporations have been very successful with tax minimization strategies that shift intangible income to lightly taxed jurisdictions. See Kleinbard (2011) for many examples. It is also increasingly difficult to determine the true source of income when businesses are truly interdependent entities with synergies that allow profits to exceed what the individual businesses would earn at arm’s length. Simply put, costs and revenue streams are hard to break apart and disentangle. Indeed, these arguments favor taxing businesses in consolidated terms and/or using formula apportionment based on more easily sourced factors such as employees, payroll, or destination of sales. For a more detailed discussion of related issues, see Clausing, forthcoming.

weight is on the sales factor; by 2012, 14 states use this approach.⁹ Figure 1 shows these trends.

There is also substantial variation among states in other corporate tax policies. Some states require combined reporting, which can help ensure that large multijurisdiction firms do not avoid taxation by splitting themselves into separate corporations and manipulating transactions within the overall corporate group. Some states have throw-back rules that require firms to pay tax on income that is untaxed by other states.¹⁰ Some



⁹ Some states also allow firms to choose the formula that will apply. For example, a firm might choose a sales-only formula electively. As noted in Section IV, such choices are attractive to firms since they can choose the tax-minimizing option.

¹⁰ These provisions are related to the Interstate Income Act of 1959, Public Law 86-272.

states offer options among formula types or reporting requirements. Further, states have frequently experimented with changes in corporate tax rates as well, although for the average of all states, corporate tax rates are relatively stable over time, averaging 7.2 percent in 1986 and 6.6 percent in 2012.

While the U.S. state experience provides a valuable and diverse set of corporate tax policy experiences under formulary apportionment to study, there are also important caveats to bear in mind. U.S. states typically choose low tax rates, and the response of economic activity to tax rate differences is likely to be larger and more apparent at higher tax rates.

Also, U.S. states exist within a common federal system, and there is no analogous supranational body in most cases.¹¹ A common federal system makes it easier to determine the tax base to which the formula should apply, since most U.S. states begin with the federal definition of income as their baseline tax base. Still, the common federal system itself heightens tax competition pressures, since it facilitates economic mobility of all types. Footloose firms have an easier time relocating across states than across national boundaries due to common laws and regulations, and domestic product competition is fiercer than its international counterpart, as prices are more uniform and comparable, there are no possibilities for exchange rate fluctuations, information is more available, and goods mobility is more seamless. Also, firms are more likely to be multijurisdictional across U.S. states. For these reasons, one would expect tax competition to be fiercer *within* countries than *between* countries, so this may also reduce the applicability of the U.S. state experience.

III. PRIOR WORK

This work will build on the insights of past work on formulary apportionment both internationally and at the state level. Prior work on the international implications of formulary system includes Avi-Yonah and Clausing (2008), Avi-Yonah, Clausing, and Durst (2009), De Waegenare and Sansing (2008), Devereux and Loretz (2008a, 2008b), Eichner and Runkel (2008), Fuest, Hemmelgarn, and Ramb (2007), Hines (2010), and Pethig and Wagener (2007).

Regarding the U.S. state experience, state incentives to change formulas are well known: Anand and Sansing (2000), Edmiston (2002), and Pinto (2007) generate models of formula choice, and Omer and Shelley (2004) empirically document the trend toward higher sales factor weights. Chirinko and Wilson (2010) consider the role of political contributions and state tax policy competition over the period 1988 to 2006. They find that policymakers are sensitive to campaign contributions, and their results document the nature of tax competition among states. Chirinko and Wilson (2010) also indicate the importance of including state-specific fixed effects in specifications; without this inclusion, some of their results are counterintuitive.

¹¹ One possible pending exception would be the European Union, although the role of the EU government is substantially smaller than the U.S. federal government, and it is likely to remain so for the foreseeable future.

Mintz and Smart (2004) have a clear and compelling study of the effects of formulary apportionment on income shifting incentives, making use of Canadian data. Some, but not all, multijurisdictional firms are required to assign income to Canadian provinces by formula. Using data from the Canadian Customs and Revenue Agency over the period 1986 to 1999, they find that taxable income is far less sensitive to tax rates for firms that are required to assign income by formula.¹²

The effects of formula choices on economic activity have also received some attention, and three studies employ cross-state level data to consider the relationship between formula choice and employment, sales, and investment.¹³ First, Goolsbee and Maydew (2000) consider employment effects over the period 1978 to 1994; they find evidence that employment is sensitive to the weight on employment in the formula, and there is evidence of tax competition among states, whereby states gain employment at the expense of other states.¹⁴

Second, Gupta and Hofmann (2003) consider the impact of formula choices, tax rates, and other policy choices such as investment incentives on capital expenditure effects over the period 1983 to 1996. In the specifications that employ fixed effects, the effects of tax policy measures are smaller than in other specifications but still statistically significant.¹⁵ They note that the revenue losses associated with lower tax burdens are likely more consequential than the effects on investment magnitudes.

Third, Klassen and Shackelford (1998) consider the effect of sales weights in the apportionment formula on manufacturing revenue, their measure of sales, over the period 1983 to 1991. They find that in throwback states, but not in others, manufacturing revenues are sensitive to the tax rate applied to sales. Their analysis is confined to separate estimates of cross-sections of states for each year in their sample; they do not employ panel data techniques.

¹² Although taxable income is still sensitive to tax rates for firms using formulary methods, this finding is not statistically significant in all specifications. The authors interpret such tax sensitivity as indicating real responses to taxation.

¹³ There is also some promising recent work on German formulary apportionment of the trade tax at the municipality level. Early work by Thomsen, Ullman, and Watrin (2013) indicates that labor decisions are sensitive to differences in the trade tax rate across German municipalities. Peichl, Fuest, and Siegloch (2013) also provide related evidence on the wage effects of German municipality taxation.

¹⁴ While Merriman is able to replicate the main findings of Goolsbee and Maydew, he makes different choices regarding ideal specifications, and he finds that the statistical significance of the payroll burden variable is sensitive to these decisions. Merriman argues that in addition to including the payroll tax burden, the payroll weight and the tax rate should also be included separately. Merriman also argues that year fixed effects should be included and that clustered standard errors are appropriate. Once Merriman runs his preferred specification, he finds that payroll burdens are not statistically significant and negatively related to manufacturing employment. However, in a recent replication study, Merriman (2014) has questioned the robustness of these findings.

¹⁵ Results imply that an increase in the property burden (the multiple of their tax rate and the formula weight on property) of 1 percentage point in a state is associated with 0.09 percent lower new capital expenditures. There is some evidence that there is greater tax rate sensitivity in states that employ throwback rules or unitary taxation, but in general these effects are quite modest.

All three of these studies focus on a period that excludes the recent time period of rapid policy changes, so they necessarily utilize less time variation; the present analysis extends the sample period by 16–21 years. The recent decades are a particularly important period to examine, since they have been marked by a much more widespread adoption of higher sales-factor weights, as Figure 1 demonstrates. As the following analysis will show, the dynamics of tax competition may change as it becomes more widespread. In particular, “first-mover” states might experience different economic consequences from heavy sales weights in their formulas than do states that change their policies later.

There has been some promising work on state corporate tax revenues, including Gupta et al. (2009), Cornia et al. (2005), Fox and Luna (2005), and Mazerov (2001). Gupta et al. (2009) is the most fully developed analysis. The authors undertake a study of the determinants of state corporate tax revenues over the period 1982 to 2002, using data that allow controls for most important considerations. They find that states that increase sales factor weights have lower corporate revenues, but revenues increase with the tax rate. Throwback rules and broader definitions of business income increase revenues, but combined reporting has no effect. The authors note that the policy environment has continued to evolve rapidly in the years since their study, so including an additional decade of data in the present study is likely useful.

Both the economic activity and the revenue studies discussed above focus on earlier periods, and the present study allows consideration of both recent changes and longer-run effects from early changes. Further, the present work benefits from taking a comprehensive approach that considers the effects of both formula choices and other tax policy choices on a wide range of economic outcomes. More control variables are considered, allowing a full account of the structural features of state economies, macroeconomic fluctuations, and the full spectrum of policy parameters, all within the context of a longer sample period. Control variables include both a full panoply of other tax policy choices (such as combined reporting requirements, throwback rules, and choice features of the tax code) and variables measuring state-level economic growth, unemployment, workforce educational attainment, demographic variables, and other controls.

The study also has some methodological improvements over prior work. For example, not all prior studies employ state-specific fixed effects, which are important to prevent misleading statistical correlations that could easily result from omitted variables.¹⁶ Finally, many robustness checks are considered, and alternate specifications are employed that consider how tax policy changes may affect real economic decisions with a substantial lag.

IV. SPECIFICATIONS

The present analysis will undertake an investigation of how policy decisions by U.S. states under formulary apportionment affect U.S. state government corporate income

¹⁶ For example, if states that are particularly business friendly are also more likely to heavily weight the sales factor in their formulas, and one does not include state fixed effects, then one would risk attributing increases to economic activity solely to the increase in the sales factor when other aspects of states’ policies may be more important.

tax revenues as well as economic activities across U.S. states. Dependent variables are defined and summarized in Table 1. They fall into four categories: measures of employment, investment, sales, and government revenues.

The basic specifications relate the dependent variables to the explanatory variables as in the following equations, where P is a vector of tax policy choices, E and S are vectors of control variables capturing the macroeconomic conditions of states and the structure of the state economy, and where i indicates states and t indicates years. All the individual explanatory variables are summarized and described in Table 1; each regression chooses the most appropriate subset of these variables:¹⁷

$$(3) \quad \text{EmploymentMeasure}_{it} = \sum_i \alpha_i + \sum_P \beta_p P_{it} + \sum_E \beta_e E_{it} + \sum_S \beta_s S_{it} + \varepsilon_{it},$$

$$(4) \quad \text{InvestmentMeasure}_{it} = \sum_i \alpha_i + \sum_P \beta_p P_{it} + \sum_E \beta_e E_{it} + \sum_S \beta_s S_{it} + \varepsilon_{it},$$

$$(5) \quad \text{SalesMeasure}_{it} = \sum_i \alpha_i + \sum_P \beta_p P_{it} + \sum_E \beta_e E_{it} + \sum_S \beta_s S_{it} + \varepsilon_{it},$$

$$(6) \quad \text{RevenueMeasure}_{it} = \sum_i \alpha_i + \sum_P \beta_p P_{it} + \sum_E \beta_e E_{it} + \sum_S \beta_s S_{it} + \varepsilon_{it}.$$

For this investigation, state-level policy choices are of most interest. I hypothesize that policy choices will typically affect revenues and economic activity in opposite directions; policies that increase tax burdens typically raise revenue but also discourage economic activity. For example, higher tax rates increase revenue as long as Laffer curve effects do not predominate, which is unlikely at the low levels of taxation of U.S. states.¹⁸ But higher tax rates also raise the tax burden on any factors that are in the formula, presumably discouraging such activities in U.S. states.

For example, following Goolsbee and Maydew (2000), the firm's marginal tax rate is the sum of the state tax rates over the states in which it operates. If all firms are taxed according to an equal-weighted formula, as in (1), and states are indexed by i , this becomes

$$(7) \quad T = \frac{1}{3} \left[\sum_i t_i \frac{A_i}{A_{us}} + \sum_i t_i \frac{S_i}{S_{us}} + \sum_i t_i \frac{P_i}{P_{us}} \right].$$

¹⁷ For example, the state-level unemployment rate may be a useful macroeconomic control in investment or sales regressions, but it risks being mechanically correlated with the dependent variable in employment regressions.

¹⁸ Revenues will fall with increases in the tax rate if the elasticity of the tax base with respect to the tax rate is sufficiently large. Clausing (2007, 2008) finds that the revenue-maximizing corporate tax rate is likely higher than the rates found in typical OECD countries.

Table 1
Variable Descriptions, Definitions, and Summary Statistics

Name	Definition	Source	Number	Mean	Standard Deviation
Dependent Variables					
Employment (<i>lnem</i>)	Thousands of jobs, including full and part time employees, sole proprietors, partners	Bureau of Economic Analysis	1,326	3.063	3.322
Capital expenditures (<i>lnkexp</i>)	Total capital expenditures for plant and equipment (\$million)	Annual Survey of Manufacturers	1,273	2.495	2.985
Sales (<i>lnsales</i>)	Value of shipments of all products (\$million)	Annual Survey Manufacturers	1,275	76,800	87,300
Corporate tax revenue	Taxes on income of corporations and businesses, as share of GSP (%)	U.S. Census Bureau	1,325	0.340	0.250
Explanatory Variables: Tax Policy Parameters					
Payroll burden (<i>pay.burden</i>)	Multiple of corporate tax rate and payroll weight in formula	Various (appendix)	1,244	0.0189	0.0096
Asset burden (<i>assetbur</i>)	Multiple of corporate tax rate and asset weight in formula	Various (appendix)	1,244	0.0189	0.0096
<i>salesburden</i>	Multiple of corporate tax rate and sales weight in formula	Various (appendix)	1,244	0.0383	0.0199
<i>throwback</i>	Dummy variable for state throwback rule	Various (appendix)	1,245	0.560	0.497

Table 1 (Continued) Variable Descriptions, Definitions, and Summary Statistics

Name	Definition	Source	Number	Mean	Standard Deviation
<i>comb.rep</i>	Dummy variable for state requiring combined reporting	Various (appendix)	1,237	0.379	0.485
<i>ptinc.tax</i>	Personal income tax, top rate	Various (appendix)	1,352	0.059	0.031
<i>lic.gsp</i>	Corporate license and other fees as a share of GSP	U.S. Census Bureau	1,325	0.064%	0.165%
<i>throw × sb</i>	Multiple of throwback dummy and sales burden	Constructed	1,231	0.0192	0.0207
<i>forchoice</i>	Dummy if corporations have a choice of formula	Various (appendix)	1,249	0.085	0.279
<i>comb.rep.ch</i>	Dummy if firms have choice of combined reporting	Various (appendix)	1,237	0.150	0.358
<i>rate</i>	Corporate tax rate, top rate	Various (appendix)	1,368	0.070	0.029
<i>salesw</i>	Weight on sales in formula	Various (appendix)	1,249	0.505	0.205
Explanatory Variables: Economic Conditions Parameters					
<i>natl.unem</i>	National (U.S.) unemployment rate	Bureau of Labor Statistics	1,377	0.061	0.015
<i>unem</i>	State unemployment rate	Bureau of Labor Statistics	1,377	0.057	0.019

Table 1 (Continued) Variable Descriptions, Definitions, and Summary Statistics

Name	Definition	Source	Number	Mean	Standard Deviation
<i>GSP (lngsp)</i>	Gross State Product (\$million)	Bureau of Economic Analysis	1,326	182,875	241,182
<i>GSPPC (lngsppc)</i>	Gross State Product per capita (\$/person)	Population data, Census	1,326	33,430	16,150
<i>osurplus (hoper.sur)</i>	Business income of private enterprises (\$million)	Bureau of Economic Analysis	1,326	65,850	90,100
Explanatory Variables: Structure of State Economy					
<i>ba.degree</i>	Share of state population with a bachelor's degree (%)	U.S. Census Bureau	1,377	24.1	5.89
<i>manuf.ratio</i>	Ratio of total employment in the manufacturing sector	Bureau of Economic Analysis	1,324	0.1005	0.0458
<i>youngshare</i>	Share of population age 18 and under	U.S. Census Bureau	1,300	0.255	0.023
<i>oldshare</i>	Share of population age 65 and over	U.S. Census Bureau	1,300	0.126	0.020
region dummies	Dummies for states from various regions	Crone (2005)	1,515	Varies	Varies
<i>share</i>	Share of business tax returns that are flow-through entities	U.S. Internal Revenue Service	1,150	0.680	0.096

Table 1 (Continued) Variable Descriptions, Definitions, and Summary Statistics

Name	Definition	Source	Number	Mean	Standard Deviation
Other Variables Used for Policy Probits					
<i>meansalesw</i>	Mean sales weight in state formulas, by year	Constructed	1,377	0.503	0.089
<i>meanrate</i>	Mean corporate tax rate of states, by year	Constructed	1,377	0.070	0.002
<i>rep</i>	Dummy if republicans control state legislative and executive branches	Klarner Politics Dataset (appendix)	1,271	0.196	0.397
<i>dem</i>	Dummy if democrats control state legislative and executive branches	Klarner Politics Dataset (appendix)	1,271	0.243	0.429
<i>elecyr</i>	Dummy variable if election year in state	U.S. Statistical Abstract	1,316	0.273	0.446
<i>debtgsp</i>	State debt as a share of GSP	State Government Finances	1,286	0.071	0.040
<i>aidgsp</i>	State federal aid as a share of GSP	U.S. Census Bureau	1,214	0.034	0.013

If the firm moves workers from high-tax to low-tax states, it will reduce its marginal tax rate. Assuming that the total payroll is unchanged, moving payroll toward a particular low-tax state j changes the firm's marginal tax rate following

$$(8) \quad \frac{\partial T}{\partial P_j} = \left(\frac{1}{3P_{us}} \right) \left[t_j - \sum_{i \neq j} t_i \frac{P_i}{\sum_{i \neq j} P_i} \right].$$

As long as the tax rate in the state with increased jobs is lower than the weighted average of other states' tax rates, the firm's marginal tax rate on U.S. income declines.¹⁹

U.S. states have often increased the sales factor weights in recent decades. Indeed, the weight on the sales factor directly lessens the burden on other factors, so one would expect tax-sensitive firms to be more likely to locate productive factors (assets and employment) in high sales-factor states. However, a higher sales weight will reduce corporate revenues for states where their asset and employment activity shares are higher than their sales shares. Indeed, dominant productive firms in local economies often lobby for increases in the sales factor in the formula.

In theory, if states consume roughly in line with their production, and if all states moved to a sales-only formula, the overall tax burden would be unchanged for firms, and state revenues would also be unchanged. But since firms often lack nexus in a particular state, not all sales generate associated corporate tax revenues under the present system. (The issue of nexus is discussed further in the revenue analysis below.) Further, since states vary in their formula choices, firms may be able to lower their overall tax burden by taking advantage of these differences and altering the location of their activities accordingly.

Discretionary features of the corporate tax policy environment may also lighten tax burdens on corporations. Some states allow firms to choose among different formulas or to choose whether to utilize combined reporting. If firms are allowed to choose, they are likely to make informed choices that lessen their tax burden.

Some states attempt to counter these revenue-reducing tax competition pressures. For example, some states employ throwback rules. States that use throwback rules require firms to pay tax on income that is untaxed by other states. Also, some U.S. states require combined reporting. I use dummy variables to capture such features of the state corporate tax code.

Control variables will allow for the effects of the health of the state economy, structural features of the state economy, and time-specific and state-specific effects. All variables are described and summarized in Table 1; the data sources are described in detail in Appendix 1 of the online appendix.²⁰

¹⁹ Some caveats may apply in the presence of throwback rules, as discussed in Section II.

²⁰ See Clausing, Kimberly, "Selected Research Papers," Economics Department, Reed College, <http://www.reed.edu/economics/clausing/#papers>. The direct link to the appendix is: <http://www.reed.edu/economics/clausing/Online%20Appendix%20for%20Clausing%20NTJ%20Dec2015.pdf>.

V. RESULTS

A. Employment Activity

Results from the employment specifications are presented in Table 2. Specifications 1 to 3 employ state fixed effects; Column 1 provides the results from the most basic model, and Columns 2 and 3 add more explanatory variables. Columns 4 to 6 repeat these specifications, adding year fixed effects in addition to state fixed effects. The ideal specification is shown in the results of Column 6, which controls for state effects, year effects, and the complete set of other theoretically indicated control variables. I include the other results for comparison.²¹

The tax burden is measured by the payroll burden variable, which is the simple multiple of the payroll weight and the tax rate. The payroll burden variable measures the relevant tax incentive affecting firms with payroll in a particular state. In all cases aside from the first specification, the coefficient on this variable is either statistically insignificant or unexpectedly positive. In the first (and simplest) specification, however, it is both negative and statistically significant.

Throwback rules and combined reporting requirements are negatively associated with employment in some specifications, though their empirical magnitudes are zero or very small in the full specifications. The variable that indicates corporate license fees relative to GDP is also negatively associated with employment; however, given the extremely low mean of this variable, its empirical magnitude is also very small.²²

Most control variable results are as expected. Economic conditions are associated with employment in the hypothesized directions. High national unemployment rates are associated with lower employment in states; this variable is dropped from the time-effects specifications due to lack of state-level variation. State-level gross domestic product is positively associated with employment.

Several variables are used to capture structural features of the economy; in specifications 2 and 5, higher GSP per-capita states also have higher employment. In specifications 3 and 6, this variable changes sign, but several other control variables are introduced, including the share of the population with a college degree (positively associated with employment in specification 6), the ratio of workers that are in manufacturing (positively associated with employment levels), and the share of young (age 18 and under) and old (age 65 and over) in the population, both of which are negatively associated with employment.

²¹ While the explanatory power of the Column 6 specifications is typically quite high here (and in later tables), it is worth noting that much of the explanatory power is a result of the control variables and the fixed effects, not the policy variables. The policy variables typically account (together) for less than 15 percent of the explanatory power of the regression.

²² Increasing license fees by 25 percent of the mean value for this variable is associated with 0.1 percent lower employment. While this is a small effect, effects may be larger for the small number of states that have very large license fees. Personal income tax rates are positively associated with employment.

Table 2
Employment Regressions
State Fixed Effects (1–3), State and Year Fixed Effects (4–6)
(Dependent Variable: Ln of Employment)

	(1)	(2)	(3)	(4)	(5)	(6)
<i>pay.burden</i>	-10.94* (0.566)	1.191* (0.313)	-0.153 (0.118)	0.765* (0.338)	1.221* (0.315)	-0.201 (0.111)
<i>natl.unem</i>	-0.956* (0.217)	-0.812* (0.0978)	-1.082* (0.0411)			
<i>throwback</i>		-0.0273* (0.00765)	-0.00464 (0.00287)		-0.0275* (0.00772)	-0.00856* (0.00272)
<i>comb.rep</i>		-0.0139* (0.00406)	-0.000428 (0.00157)		-0.0156* (0.00414)	-0.00218 (0.00149)
<i>lngsppc</i>		0.369* (0.00573)	-0.690* (0.0155)		0.365* (0.0353)	-0.681* (0.0176)
<i>pinc.tax</i>			0.180* (0.0629)			0.158* (0.0605)
<i>lic.gsp</i>			-6.808* (1.881)			-9.248* (1.771)
<i>lngsp</i>			0.859* (0.0111)			0.866* (0.0105)
<i>ba.degree</i>			0.000402 (0.00045)			0.00101* (0.00048)
<i>manuf.ratio</i>			0.928* (0.0481)			0.711* (0.0556)
<i>youngshare</i>			-1.419* (0.0801)			-1.777* (0.0840)
<i>oldshare</i>			-0.248 (0.127)			-0.767* (0.143)
Fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Year effects?	No	No	No	Yes	Yes	Yes
N	1,122	1,102	1,032	1,122	1,102	1,032
R ²	0.258	0.853	0.981	0.832	0.857	0.984

Notes: Standard errors are in parentheses. Asterisk denotes significance at the 5 percent level.

B. Investment Activity

Table 3 considers how tax policy variables affect investment across U.S. states, using data on capital expenditures from the Annual Survey of Manufacturers. Again, fixed state effects are necessary, and Columns 1 to 3 show results with fixed state effects, while Columns 4 to 6 show estimates with both state and year fixed effects. As before, Column 6 is my preferred specification, but the others are included for comparison.

The main tax policy variable of interest is the measure of tax burden on physical assets, the product of the corporate tax rate and the weight on assets in the formula. In this table, reflecting a long literature (reviewed in Hassett and Newmark (2008)) suggesting the importance of allowing adjustment to tax policy changes, I include a five-year measure of the tax burden variable. This captures the possibility that real economic investment likely responds to changes in tax treatment with a lag; even if tax policy changes are partially anticipated, it may take some time for companies to alter investment. Therefore, I constructed a five-year average factor tax burden that averages the current year's tax burden and the burdens over the four years prior.

In the first specification, without additional controls, there is a statistically significantly negative relation between this tax burden and capital expenditures; however, the results of all other empirical models shown in Columns 2 to 6 show tax effects that are statistically indistinguishable from zero.^{23, 24} Other tax policy measures (the throwback rule, required combined reporting, the personal income tax, and corporate license fees) are typically statistically insignificant, with the exception of a single negative effect of personal income taxes in Column 6.

Economic control variables have the expected associations with capital expenditures, with state-wide unemployment associated with lower capital expenditure, and gross state product associated with increased capital expenditure. Structural control variables indicate a positive relationship between GSP per-capita and investment, and between the manufacturing ratio in the economy and investment. There is a negative relationship between the share of the population with a college degree and investment, and demographic variables have mixed effects.

²³ Results with just the contemporaneous tax burden variable often have unexpectedly statistically significantly positive relationships between tax burdens and capital expenditures. This is puzzling, and some potential explanations do not clarify this result. For example, it is not due to a time trend in capital expenditures, whereby capital expenditures decrease over time, at the same time sales weights are increasing (and thus asset weights decreasing). In general, capital expenditures are *increasing* over this time period. Instead, I suspect the result stems from idiosyncratic features of the data and that therefore this puzzling finding is spurious.

²⁴ As noted above, firm responses to state formulas vary with their particular circumstances.

Table 3
Capital Expenditure Regressions
 State Fixed Effects (1–3), State, Year Fixed Effects (4–6)
 (Dependent Variable: Ln of Capital Expenditures)

	(1)	(2)	(3)	(4)	(5)	(6)
<i>5y.assetbur</i>	-15.47* (1.950)	2.768 (2.304)	1.105 (2.289)	2.770 (2.077)	3.949 (2.073)	1.675 (2.080)
<i>unem</i>	-5.683* (0.535)	-5.394* (0.499)	-3.596* (0.607)	-5.250* (0.882)	-3.391* (0.975)	-2.887* (1.023)
<i>throwback</i>		0.0446 (0.0456)	0.0836 (0.0455)		-0.0198 (0.0416)	0.0292 (0.0424)
<i>comb.rep</i>		0.00709 (0.0215)	0.0268 (0.0218)		-0.0144 (0.0199)	0.0135 (0.0204)
<i>lngsppc</i>		0.508* (0.0399)	0.382 (0.266)		0.998* (0.196)	-0.150 (0.291)
<i>pinc.tax</i>			-1.669 (1.072)			-3.969* (1.005)
<i>lic.gsp</i>			34.40 (27.29)			-15.21 (25.14)
<i>lngsp</i>			0.687* (0.193)			0.473* (0.180)
<i>ba.degree</i>			-0.0207* (0.00649)			-0.0218* (0.00681)
<i>manuf.ratio</i>			6.049* (0.858)			3.943* (0.964)
<i>youngshare</i>			4.364* (1.349)			-0.526 (1.384)
<i>oldshare</i>			4.339* (2.021)			-7.523* (2.216)
Fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Year effects?	No	No	No	Yes	Yes	Yes
N	937	928	874	937	928	874
R ²	0.139	0.269	0.349	0.417	0.430	0.483

Notes: *5y.assetbur* is the average of the current year's asset tax burden and the four prior years. Standard errors in parentheses. Asterisk denotes significance at the 5 percent level.

C. Sales Activity

There is an important limitation of U.S. state sales data that should be noted. This limitation also affects the key paper from the prior literature on this question, by Klassen and Shackelford (1998). Data are based on the shipments of goods, and thus the origin of sales and not the destination of sales, the factor used in state formulas. While it would be much preferable to use data based on the destination of sales, these data are not available, so it is not possible to assess the correlation between these two sales variables. In the discussion of extensions in Section V.F below, I am able to compare results using retail sales data without affecting any inferences, but retail sales data capture only one sector of the economy.

Table 4 reports regressions on sales across U.S. states, following similar specification choices as above. Columns 1–3 report the results of the model with state fixed effects, and Columns 4–6 report specifications with both state and year fixed effects; Column 6 is the preferred specification. An additional policy variable is considered, the interaction between the sales burden and the throwback rule dummy variable. This is intended to capture the fact that sales burdens will be larger if states are also taxing income that is earned in another state.

In most specifications, the sales burden variable is statistically insignificant; the only exception is an anomalous positive sign in specification 1. Throwback rules have a negative effect on sales in specification 5 but are otherwise statistically insignificant. The throwback/sales burden interaction term always has a negative sign, but it is never statistically significant. Of course, these results may reflect the noisiness of the data rather than any true lack of tax responsiveness. In particular, for non-throwback states, the sales factor tax burden would only be affected by sales to customers in the state, not by sales to other states. For throwback states, however, one might expect this problem to be smaller, since sales out of state may also increase tax burdens.

Control variables typically have the expected effects. Lower unemployment or higher gross state product increase sales, and states with higher per-capita GSP and manufacturing ratios tend to have higher sales. Corporate license fees have a negative association with sales; in specification 6, an increase in license fees of 25 percent of the mean value for this variable reduces sales by 1.1 percent.

D. Discussion of Activity Results

The above results indicate very few negative tax burden effects on employment, investment, or sales. What is one to make of this finding? It may simply be the case that, at low tax rates, economic activity is not that responsive to the tax burdens associated with formulary apportionment. Employment and investment decisions may be determined by more important considerations, and sales may be determined by the location of customers.²⁵

²⁵ Also, as noted above, data constraints limit our ability to measure the destination of sales, and this too may be responsible for the lack of tax response.

Table 4
Sales Regressions
 State Fixed Effects (1–3), State and Year Fixed Effects (4–6)
 (Dependent Variable: Ln of Sales)

	(1)	(2)	(3)	(4)	(5)	(6)
<i>sales.burden</i>	9.556*	0.0364	-0.0885	-0.255	0.0125	-0.0847
	(0.726)	(0.526)	(0.487)	(0.414)	(0.483)	(0.465)
<i>unem</i>	-2.222*	-2.109*	-0.888*	-4.406*	-1.561*	0.764
	(0.495)	(0.252)	(0.258)	(0.445)	(0.451)	(0.435)
<i>throwback</i>		-0.0220	-0.0145		-0.0626*	-0.0342
		(0.0327)	(0.0285)		(0.0308)	(0.0277)
<i>throw × sb</i>		-0.493	-0.209		-0.300	-0.402
		(0.637)	(0.554)		(0.593)	(0.532)
<i>comb.rep</i>		-0.00710	0.00766		-0.0187	0.00651
		(0.0111)	(0.00976)		(0.0105)	(0.00949)
<i>lngsppc</i>		0.818*	0.793*		1.481*	0.803*
		(0.0152)	(0.103)		(0.0987)	(0.122)
<i>pinc.tax</i>			-0.485			-1.219*
			(0.428)			(0.421)
<i>lic.gsp</i>			-47.84*			-66.11*
			(12.73)			(12.26)
<i>lngsp</i>			0.403*			0.387*
			(0.0727)			(0.0701)
<i>ba.degree</i>			-0.0281*			-0.0244*
			(0.00283)			(0.00314)
<i>manuf.ratio</i>			4.161*			3.246*
			(0.342)			(0.393)
<i>youngshare</i>			-1.448*			-3.394*
			(0.515)			(0.547)
<i>oldshare</i>			4.162*			1.249
			(0.813)			(0.947)
Fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Year effects?	No	No	No	Yes	Yes	Yes
N	1084	1064	998	1084	1064	998
R ²	0.146	0.787	0.858	0.782	0.825	0.877

Notes: Standard errors in parentheses. Asterisk denotes significance at the 5 percent level.

Other factors may also be at work. Each state contains a multitude of multijurisdictional firms that face different tax treatments depending on their individual circumstances, where they operate, and where they sell. While one generally expects rising tax burdens to reduce the taxed activity, revealing such a response may be difficult due to the heterogeneity of firm circumstances. Further, as in any econometric exercise, the “true” tax effects may also be masked by other factors that create difficulties in parsing the underlying economic relationships in the data. Simply put, many factors change over time and across states, and separating out tax influences may be difficult.

It is also important to remember that this evidence comes from the U.S. state experience, where corporate tax rates are low, averaging 7 percent during this sample period. It is likely that real economic activity is more responsive to tax burdens at higher tax rates, and this consideration would imply a larger tax response at the international level than one finds among U.S. states. At the same time, it is also the case that employment and investment mobility is likely far greater *within* countries than *between* countries; this consideration implies smaller tax responses at an international level than one would find at a subnational level.

The present results contrast with some, but not all, prior work on U.S. states. As discussed above, Goolsbee and Maydew (2000) find that employment is responsive to tax burden differences across states, Gupta and Hofmann (2003) find small capital expenditure responses in some specifications, and Klassen and Shackelford (1998) find that sales are sensitive to tax burdens in throwback states. However, these studies all employ data that end by the mid-1990s, 16 to 21 years before the end of the present study. Further, some specifications do not include adequate controls, such as state-specific effects. As I describe below, my inclusion of better control variables and a longer (and more recent) time period explain the differences in results.

Considering the employment analysis first, there are several differences between my study and Goolsbee and Maydew’s (2000). They use the time period 1978 to 1994, whereas I use the period 1986 to 2012. Both studies use the same key policy variable, the payroll tax burden, and both control for the national unemployment rate, a measure of state income (though the measures differ), and state fixed effects. In my specifications, I include both additional policy variables and additional terms that address features of the state economy. Both studies include year effects in some specifications, and in fact Goolsbee and Maydew’s tax burden variable becomes statistically insignificant in these specifications. When I restrict my sample to the years that overlap with Goolsbee and Maydew, I obtain more negative and/or statistically significant payroll burden coefficients, indicating results that are more similar to those of Goolsbee and Maydew. Nonetheless, my preferred specifications still do not show negative statistically significant effects of the state payroll burden. In general, some of the difference in the results is likely due to the time period studied, but other differences are likely a result of specification choice. Merriman (2014) has found similar results.²⁶

²⁶ While Merriman can replicate the main findings of Goolsbee and Maydew, his ideal specifications, which include year effects as well as the inclusion of the tax rate and the payroll weight alongside the payroll burden variable, do not show statistically significant effects of tax burdens on manufacturing employment. Similar to the present study, Merriman (2014) finds that including more recent years lowers the point estimate on the payroll burden variable, although in the preferred specification, there is no statistically significant effect in either time period.

In the investment analysis, there are also differences in both time period and specification choice. Gupta and Hofmann (2003) consider the time period 1983 to 1996. Their key tax burden variable is the same one I use, the multiple of the tax rate and the formula share. Their control variables include a measure of the size of the manufacturing sector, but they do not include the other control variables that I use, and most specifications do not include state fixed effects. Instead, they control for a measure of tax incentive count (and its square), government expenditures, and energy prices. When I restrict my sample to the years that overlap with Gupta and Hofmann, the asset tax burden is statistically indistinguishable from zero in five of six specifications, but it is statistically negative in Column 1, the simplest specification. This contrasts with the results of Gupta and Hofmann; they find statistically significant negative tax burden effects in all models, though the point estimate of the effect is only one-third the size in their one fixed effects model. Thus, it appears that most of the differences in the investment analysis are due to inadequate controls in Gupta and Hofmann, although the time period studied could also be a contributing factor.

Finally, in the sales analysis, my results can be contrasted with Klassen and Shackelford (1998), who consider the period 1983 to 1991. Their key policy variable is again the same as my own: a tax burden calculated as the multiple of the tax rate and the formula weight on sales. As in this study, they control for throwback rules and the interaction between throwback rules and the tax burden variable. But their only other controls are a measure of pro-business government (proxied by Republican governors) and manufacturing value added. They do not include other controls or state fixed effects. Instead, they consider simple cross-section regressions of data, with each year of data as a separate regression; they report mean coefficients and t-statistics across regressions. When I confine my analysis to the years of overlap with Klassen and Shackelford, I do not find any negative effects of tax burdens on sales. I suspect that the different results are due to the fact that Klassen and Shackelford include minimal control variables and no state fixed effects.

There are reasons to expect that tax responsiveness could change over time. For example, one hypothesis is that first-mover states that increased the sales factor weights during a period when other states were largely using the traditional formula would have gained a larger competitive advantage relative to other states, in comparison to late-mover states that changed their formulas in a context where many other states had already adopted formulas with disproportionately heavy sales weights.²⁷

In the online Appendix 2, I report a uniform analysis of the early subsample of the data during years prior to 1996. There are a few changes in the results. For the analysis of employment, there are more negative and/or statistically significant effects of payroll tax burdens, although this result does not hold in all specifications. For the capital expenditure analysis regressions, the contemporaneous asset tax burden is also statistically indistinguishable from zero in most cases.²⁸ For the sales regressions, there are some

²⁷ As other states follow, first-movers are likely to see eroding benefits of higher sales weights over time.

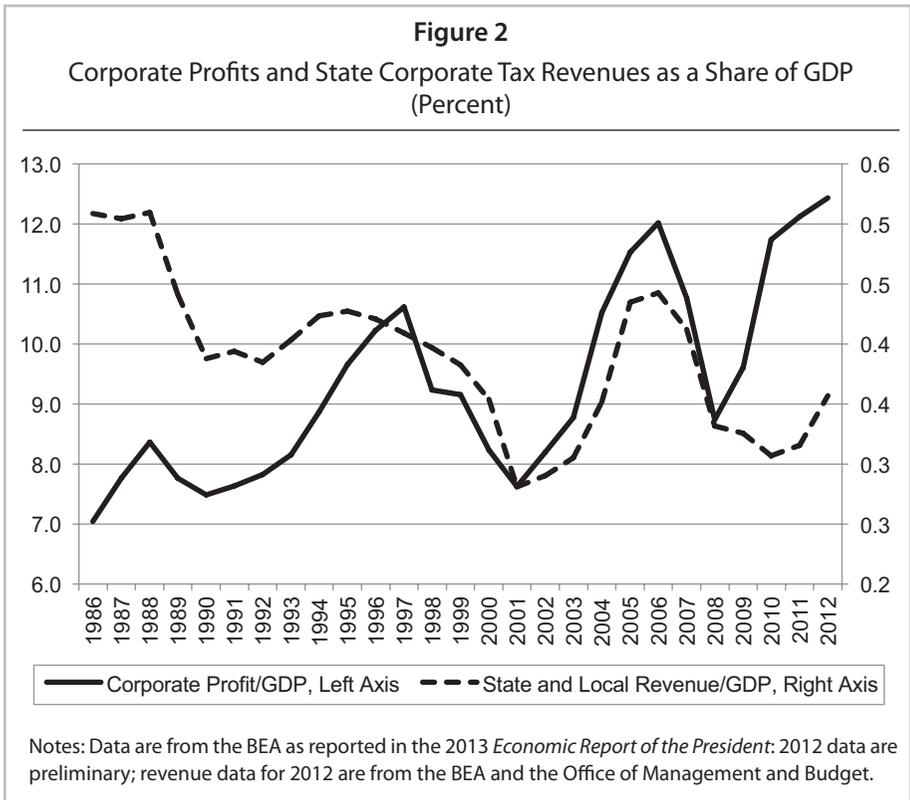
²⁸ In Table 3, the same pattern holds, but that table uses a five-year asset tax burden policy variable to allow for lags in investment response. Due to the short period of the early subsample, I use the contemporaneous tax burden variable in Appendix 2 of the online appendix.

negative tax effects for throwback states. These results offer some rather limited support for the first-mover hypothesis above, where states that alter formulas relatively early are more likely to gain at the expense of other states before tax competition becomes pervasive. However, even in these specifications, the results are mixed; many of the findings indicate little tax responsiveness of formula factors.

Indeed, it is likely that other factors are also at work in explaining the divergent results of this study and earlier work. In particular, many of the earlier findings may be sensitive to specification choice. In the present analysis, I include more control variables than prior work in terms of structural variables that relate to the characteristics of state economics and in terms of policy variables. In addition, I include both state and year effects. These factors are important for explaining the differences in results.

E. Government Corporate Tax Revenue

This time period was characterized by a large increase in the importance of corporate profits. Figure 2 shows corporate profits as a share of GDP for the United States as a whole (left axis), as well as U.S. state and local corporate tax revenues relative to GDP (right axis). Over the past quarter century, corporate profits have increased from



7 percent of GDP to over 12 percent of GDP; though they fluctuate with the cyclical position of the economy, there is a clear upward trend. State and local corporate tax revenues also fluctuate with the state of the economy but, if anything, there is a small downward trend over this time period.

Table 5 reports regressions considering determinants of state government corporate tax revenues as a share of GSP; Columns 1 to 3 include results with state fixed effects, and Columns 4 to 6 include state and year fixed effects. Again, Column 6 is my preferred specification. Policy choices are associated with important revenue changes. Tax rates are positively and statistically significantly associated with revenues in all specifications. An increase in the tax rate of 1 percentage point is typically associated with a share of corporate tax revenue in GSP that is about 5 percent higher.²⁹

Higher sales weights are associated with lower revenues in specifications 1, 4, 5, and 6 with 95 percent confidence, in specification 2 with 89 percent confidence, and always have a negative sign. Taking the average sales weight coefficient from this table, this implies that moving from an equal-weighted formula to one that double-weights sales is associated with a share of corporate tax revenue in GSP that is about 2.5 percent lower.^{30,31} In theory, states with higher sales weights need not receive lower revenues if states consume in proportion to their output (and may even receive higher revenue in some circumstances). However, in practice, firms selling in a particular state often lack “nexus” and thus do not generate tax payments, so the loss of revenue from high-production firms need not be offset by gains in revenue from high-sales firms. Indeed, nexus is an important issue in state corporate taxation.³² Beyond that, many factors may influence the revenue consequences of formula choices.

States with throwback rules are associated with higher revenues, and other tax policy variables often have statistically insignificant coefficients. The effects of control variables are as expected. Higher state unemployment is associated with lower corporate tax revenues, and higher corporate profits, measured by operating surplus, are associated with higher revenues. As the share of business returns that are pass-through entities increases, corporate tax revenues decrease.

These results confirm some of the earlier findings of the literature, including Gupta et al. (2009) and Fox and Luna (2005). Gupta et al. (2009) include a comprehensive

²⁹ As the average tax coefficient in this table is 1.644, an increase in the tax rate of 1 percentage point is associated with an increase in the ratio of tax revenue to GSP of about 0.0164. The mean corporate tax revenue to GSP ratio is 0.34, so the associated revenue to GSP ratio is 4.8 percent higher.

³⁰ The average sales weight coefficient in this table is -0.0498 , including the two statistically insignificant results as zero. A sales weight that is 17 percentage points higher is associated with a lower ratio of tax revenue to GSP of about $0.17 \times (-0.0498) = 0.0083$. The mean corporate tax revenue to GSP ratio is 0.34. The associated revenue to GSP ratio is thus 2.5 percent lower.

³¹ Note that, while this is the statistical relationship revealed by the data set in this time period, this of course need not imply that future changes in the sales weight would be associated with the same changes in revenue.

³² Nexus, or a taxable physical presence, is usually required for a jurisdiction to collect tax on an entity. There is no one clear definition of nexus beyond what is required to establish a taxable presence; rules vary by state and are continuously evolving.

Table 5
Corporate State Income Tax Revenue/GSP Regressions
State Fixed Effects (1–3), State and Year Fixed Effects (4–6)

	(1)	(2)	(3)	(4)	(5)	(6)
<i>rate</i>	1.648* (0.298)	1.622* (0.332)	1.494* (0.336)	1.591* (0.264)	1.799* (0.292)	1.710* (0.293)
<i>salesw</i>	-0.133* (0.0199)	-0.0426 (0.0266)	-0.0334 (0.0266)	-0.0510* (0.0215)	-0.0627* (0.0234)	-0.0524* (0.0232)
<i>unem</i>	-1.553* (0.173)	-1.355* (0.184)	-1.446* (0.186)	-2.527* (0.255)	-1.934* (0.312)	-2.310* (0.317)
<i>lnoper.sur</i>		0.0724* (0.0274)	0.0592* (0.0279)		0.0122 (0.0295)	-0.0177 (0.0299)
<i>share</i>		-0.393* (0.116)	-0.337* (0.118)		-0.420* (0.168)	-0.388* (0.171)
<i>throwback</i>			0.0620* (0.0162)			0.0456* (0.0142)
<i>comb.rep</i>			-0.00894 (0.00802)			-0.0258* (0.00733)
<i>for.choice</i>			0.00347 (0.0138)			0.00466 (0.0122)
<i>comb.rep.ch</i>			-0.00784 (0.00902)			-0.0215* (0.00910)
Fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Year effects?	No	No	No	Yes	Yes	Yes
N	1122	959	947	1122	959	947
R ²	0.147	0.144	0.162	0.390	0.364	0.388

Notes: Standard errors in parentheses. Asterisk denotes significance at the 5 percent level.

treatment of possible policy endogeneity and find that this consideration affects their results. When controlling for policy endogeneity, higher weights on the sales factor are associated with reduced corporate tax revenues; higher tax rates are associated with higher tax revenues in both cases. Their treatment of policy endogeneity uses a two-stage least squares approach, first generating predicted values of the tax rate and sales weight and then analyzing how these policies affect revenues. While I consider policy

endogeneity below through a probit analysis of tax policy changes, the baseline regressions here also confirm the substantive findings of Gupta et al. (2009) on the empirical relationship among sales weights, tax rates, and corporate revenues. I also confirm their finding that throwback rules are associated with increased revenues. Like both Gupta et al. (2009) and Fox and Luna (2005), I find that the share of firms that are flow-through entities is statistically significantly associated with reduced corporate tax revenues.

F. Extensions

I consider several extensions and robustness checks. Results are summarized briefly here, but all tables are available from the author upon request. First, as noted above, I analyzed subsamples of the data set focusing on the early and later time periods. Indeed, there are some changes in the results when the sample is limited to early years (ending in 1995). As noted above, some activity appears to be a bit more tax sensitive in the early time period. In addition, in the revenue regressions, in both pooled and fixed effects specifications, the sales weight term no longer has a negative effect on tax revenues when the sample is restricted to early years.

Second, all of the above analyses were done using specifications that deliberately excluded Alaska, Hawaii, and the District of Columbia, as is the tradition in much state-level empirical research. Still, all results were checked without this exclusion, and this exclusion does not affect any of the main policy conclusions.

Third, I included alternate measures of the dependent variables when possible. For employment, there are other Bureau of Economic Analysis (BEA) series that show non-farm, private payroll, and manufacturing employment. There are also measures from surveys of foreign multinational firms with U.S. affiliates that show employment and manufacturing employment. Finally, a measure of labor force participation can be constructed by taking the ratio of the labor force to the working age population. In most cases, the tax policy results were broadly quite similar. The one exception was labor force participation, which showed a persistent negative relationship to payroll burdens in fixed effects specifications.

For capital expenditure, one may also consider a series on property, plant, and equipment investments by foreign multinational firms; like capital expenditure, these variables were not negatively related to asset burdens in the fixed effects specifications. For sales, the Census reports a retail sales figure every five years. While this entails fewer observations than the Annual Survey of Manufacturers sales data, the tax policy variable results were similar.³³

Fourth, I included variables reflecting the mean tax burdens of other states, and I also experimented with variables that reflected the mean tax burdens of neighboring

³³ I also ran the activity regressions (employment, assets, and sales) with the inclusion of corporate revenues as a share of GSP as a control, as suggested by one commentator. This might be warranted since it would control for the overall burden of corporate taxes, independent of particular formula factor tax rates. However, this inclusion did not affect any of the important results, and the control variable itself was rarely statistically significant.

states. In neither case did this inclusion affect the main results, and these variables were themselves typically statistically insignificant.³⁴ I also investigated the possibility of geographic policy spillovers across states without finding supporting evidence.³⁵

Finally, I considered the likely possibility that real economic activities like employment and sales may also (like investment) respond to changes in tax treatment with a lag. In particular, even if tax policy changes are partially anticipated, it may also take some time for companies to alter employment or sales activity in response. Therefore, I constructed a five-year average factor tax burden that averages the current year's tax burden and the burdens over the four years prior. In these specifications, the overall flavor of the results is similar, though there are a few changes. In two of the employment regressions, Columns 3 and 6, the tax burden variable becomes statistically negative, though very small in magnitude. All other results are similar.

Dynamic concerns can also be addressed by adding lags for individual policy variables in each year. Following Chirinko and Wilson (2011), I estimated the main specifications of Tables 2, 3, and 4 (investigating employment, capital expenditures, and sales), including the contemporaneous policy variable as well as four lags, for the following four years. In all cases, results were quite similar. In the case of employment, there were no important changes. In Column 1, some lags were statistically significant, but the total cumulative effect was unchanged. In the other columns, the coefficients on the lags of tax burden variables were statistically insignificant. For the capital expenditure regressions, the fourth lag was statistically significant in Column 1, but the cumulative effect was again unchanged; in other equations, no coefficients on the lag terms were statistically significant. In the sales specifications, the same pattern held of similar cumulative effects in Column 1 and insignificant coefficients on the lagged variables in subsequent specifications.

G. Policy Endogeneity Concerns

Studies on the consequences of tax policy are often plagued by concerns of endogenous relationships between policy parameters and dependent variables. For example, if state policy makers choose sales weights and tax rates with the hope of improving

³⁴ One difficulty with this approach is that it is redundant with including year effects, which captures any distinct characteristic of a particular year, such as the national unemployment rate or the average tax burden of other states. Still, this is the approach used by Goolsbee and Maydew (2000), though Merriman (2014) quibbles with this decision, arguing that year fixed effects are a more ideal specification choice. Nonetheless, I also investigated the inclusion of average tax burdens of other states, which is possible for Columns 1 to 3 of the main results tables, since these tables exclude year fixed effects. In almost every one of these specifications (three specifications each for payroll, assets, and sales), this new average tax burden variable was statistically insignificant and did not affect the nature of the results. The one exception was Column 1 of the sales specifications, where the average tax burden on sales in other states was associated with increased sales; however, this result disappeared in the fuller models of Columns 2 and 3.

³⁵ I found no evidence for such regional spillover effects and, as a consequence, I did not include these variables in the policy probit analysis or attempt to look at neighboring state policies in the main regression specifications.

disappointing economic conditions, we may find a negative relationship between employment and lower sales weights due to that policy impetus, even if the lower sales weight eventually boosts employment. Or perhaps some policy environments are inherently more business-friendly, and in these environments states adopt lower tax rates and payroll/asset weights in their formulas but also undertake myriad other policy changes that affect underlying economic fundamentals. In both cases, we would be concerned of biased results, although the nature of the bias is in the opposite direction in these two examples.

In several respects, the above analyses are responsive to these concerns. For example, variables are typically included that reflect the underlying economic conditions of the state (gross state product, unemployment, etc.). Also, the key tables in the text all include state-specific fixed effects, which should address some of the “business climate” concerns. Many specifications also include year effects that should capture macroeconomic shocks as well as other time-specific phenomena.

However, it is also useful to examine possible determinants of policy changes. Therefore, I examined two probit analyses, considering the determinants of state decisions to increase the sales weight in their apportionment formulas (online appendix Table A4) or to lower corporate tax rates (online appendix Table A5). These analyses are discussed in more detail within online Appendix 3. They provide substantial evidence that tax policy changes are not explained well by seemingly plausible observable variables, thus reducing possible policy endogeneity concerns.³⁶

VI. CONCLUSIONS AND POLICY IMPLICATIONS

U.S. states have a long experience with the formulary apportionment of corporate income. In comparison to separate accounting, formulary apportionment substantially reduces concerns regarding the shifting of income from high-tax to low-tax states. In particular, corporations have no incentive to alter the location of paper profits across state boundaries, since corporate tax liabilities are based on *national* income and the factors in the formula, factors that reflect the underlying real economic activities. Indeed, Mintz and Smart (2004) provide compelling evidence of reduced tax sensitivity of taxable income under formulary apportionment.

Under separate accounting, firms have more flexibility in how they account for where income is earned, and a long body of empirical research demonstrates that corporations are eager to reduce their tax liabilities by utilizing such flexibility. Indeed, due to tax-motivated transfer pricing and income shifting, the booking of global income is quite sensitive to tax rate differences across countries.

Still, this does not mean that tax competition disappears under formulary apportionment. Gordon and Wilson (1986) have shown that firms face tax incentives to distort

³⁶ This result stands in contrast to Gupta et al. (2009); they find that policy endogeneity is an important consideration in their analysis of state corporate tax revenues.

the location of formula factors in order to reduce their tax burdens. In the U.S. states, policymakers have responded to business lobbying by systematically lowering the weight on assets and payroll in their apportionment formulas, and by raising the sales weight, in an attempt to lure tax-sensitive jobs and investments to their states. In 1986, the beginning of this study, 80 percent of states used an equal-weighted formula, but by 2012 only 17 percent of states that taxed corporate income had an equal-weighted formula, choosing instead formulas with higher weights on sales.

There is some evidence, particularly in Goolsbee and Maydew (2000), that state policymakers were initially successful in attracting jobs from other states with such strategies, although evidence indicates that these policies were “beggar thy neighbor” since states that gained employment did so at the expense of other states.³⁷ However, in the extended time period of this study, 1986 to 2012, there is scant evidence that state employment, investment, or sales are sensitive to corporate tax policy parameters once an adequate set of control variables is included in the analysis.

Of course, these findings may reflect in part the difficulty of sorting out the true tax response when many variables are changing at the same time and when firms are heterogeneous in their circumstances. Yet these findings suggest some cautious optimism for advocates of international formulary apportionment. Formulary apportionment has the potential to reduce income shifting incentives without generating accompanying large tax responses in economic activity such as employment and investment.³⁸

However, it is important to note that tax rates in U.S. states are typically much lower than those found at the national level, so tax responsiveness of real activity may be higher internationally in the presence of higher tax rates. Conversely, tax competition is also likely to be fiercer *within* countries than *between* countries because of the greater mobility of capital and labor, easier corporate relocation, and more intense product price competition due to seamless goods mobility, better information, and the absence of exchange rate fluctuations. Indeed, tax competition pressures generally increase as countries become more globally integrated.

The absence of economic activity responses to tax burdens under formulary apportionment in this analysis of U.S. states may be related to the extended time period of this study, although there are also other important differences between this study and earlier analyses of this question. Still, it is possible that the dynamics of tax competition under formulary apportionment change over time. If countries have the flexibility to adopt distinct formulas, there may be a temptation to pursue “beggar thy neighbor” policy choices in an attempt to lure economic activity from other jurisdictions; however, these strategies may prove ineffective if they are adopted by many jurisdictions.

³⁷ “Beggar thy neighbor” tax policy competition is distinguished from tax policy changes that simply affect local economic activity or revenues without having adverse effects on other jurisdictions.

³⁸ Still, it may be increasingly difficult to measure formulas based on assets given the intangible nature of important economic assets in modern economies.

The analysis also provides evidence that tax competition pressures may be harmful to government revenues, as findings indicate that tax revenues are sensitive to tax policy choices regarding tax rates, sales weights, and throwback rules. This particular finding suggests that international coordination to choose harmonized formulas — and to harmonize other aspects of tax base definition — may be particularly desirable. Such harmonization would certainly reduce both compliance costs and the potential for double-taxation (and double-non-taxation).³⁹ Also, tax base harmonization would reduce tax competition pressures and tax base erosion.

For these reasons, policymakers contemplating formulary apportionment at an international level should carefully consider how much freedom states have to set their own policies regarding the corporate tax base. In the European Union, proposals for a common consolidated corporate tax base assume that the member states will be able to agree on the formula and other defining characteristics of the tax base. This limits tax competition pressures to the setting of the tax rate.

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³⁹ While this paper has not considered compliance costs, there is substantial theoretical and empirical backing for the idea that tax harmonization across states will reduce compliance costs dramatically. For example, Gupta and Mills (2003) find that compliance costs increase as entities file in more U.S. states. This is consistent with survey findings by Slemrod and Venkatesh (2002, p. 31), which indicate that "taxpayers selected the establishment of complete uniformity among state and local corporate income tax rules and conformity to federal rules as the most likely to simplify tax compliance."

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