Investment and Employment Responses to State Adoption of Federal Accelerated Depreciation Policies

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Abstract

In the 2000s, the U.S. federal government implemented bonus depreciation and significantly increased Section 179 depreciation allowances in an effort to stimulate business investment and employment. When the policies were enacted and enhanced, many states adopted bonus depreciation and increased their state Section 179 allowances. Other states chose to leave their depreciation polices unaltered. This paper uses this variation to estimate investment and employment responses to state adoption of the federal policies. The analysis suggests that both state bonus and state 179 allowances significantly enhance state-level investment. However, an increase in either policy significantly decreases the impact of the other. Estimates suggest that state adoption of federal bonus at the 100% rate increases investment by 17.4%. This effect decreases by 4.7% for each $100,000 of state 179 allowance. Conversely, state 179 allowances of $500,000 increase investment by 10.0%. The effect decreases by 0.47% for every 10 percentage point increase in state bonus. Neither policy affects employment. These results are consistent across sub-samples chosen to mitigate selection concerns.

Keywords : bonus depreciation, Section 179, taxation, state and local taxation, investment
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1 Introduction

In 2001 and again in 2008, the U.S. federal government enacted bonus depreciation, a policy that allowed firms to immediately deduct a "bonus" percentage of the purchase price of new capital assets from their taxable income. During the same decade, the federal government also significantly increased the allowance for Section 179 expensing which *also* accelerated the tax deduction associated with new investment. Both policies had the potential to significantly decrease the present value cost of new capital assets and were intended to stimulate both business investment and employment.

When bonus was enacted and Section 179 allowances were increased at the federal level, many U.S. states decided to adopt bonus and conform their expensing allowance to the federal Section 179 figure. Other states decided to alter their treatment of depreciation for state tax purposes to partially recognize the federal incentives. Finally, a portion of states did not respond to the federal tax incentives at all.

The main contribution of this paper is to estimate the investment and employment impacts of state-level adoption of federal bonus depreciation and state-level conformity to federal Section 179 allowances. I find that state bonus adoption and 179 conformity both have a large and significant impact on business investment. However, the impact of each incentive is limited by the state-level generosity of the other. This interactive effect is unsurprising given that increases in either policy undermines the base on which the other policy can take effect. In contrast to the investment impacts, I find that employment does not respond to state adoption of the federal investment incentives. These results provide much needed evidence for state lawmakers who heretofore have been offered little empirical guidance on the effects of state adoption of federal investment incentives.

Due to the interaction of the two policies, quantifying the impact of either policy requires that the level of the other policy be specified. For example, estimates suggest that when state Section 179 allowances are set to zero, state-level adoption of 50% bonus increases investment by 8.7%. However, when state 179 allowances are increased by $100,000, the impact of state adoption of 50% bonus is estimated to increase investment by only 4.05%. Increasing state Section 179 allowances by $500,000 increases investment by 10.00% when no state bonus is in place but by the effect decreases by 0.47% for every 10% increase in state bonus depreciation.

Establishing the magnitude and consistency of these results requires overcoming three empirical hurdles. First, while data on state-level bonus depreciation adoption has been available for some time (Lechuga (2014)), state-level panel data on Section 179 allowances had to be hand collected in order to perform the analyses contained herein.[1] Collecting these data and incorporating them into the project was critical; analyzing the the impact of state bonus alone on state investment and employment would lead to upward-biased results because states that adopt bonus are more likely

[1]Reserach Assistant Brent LeMoine was responsible for constructing the complete panel of state Section 179 allowances for the years 2000–2013 used in this analysis. These data are available upon request.

to offer significant 179 depreciation incentives which would also increase state-level investment.[2]

The second empirical hurdle is to address potential violations of the empirical model's key identifying assumption. This paper uses a difference-in-difference empirical strategy that compares investment and employment within a given industry between conforming and non-conforming states before and after the implementation of or increase in the federal policy. With industry-state, year, and industry-by-year fixed effects, the key identity assumption is that no state-level shocks are coincident with adoption of the federal policies. To make sure this assumption is not violated, a robust set of state-level time-varying controls and state time trends are added to the model. With these controls added, the identifying assumption is that no state-level shocks that are *unrelated* to the set of state political, financial, and productivity controls and state trends are coincident with the adoption of the policy. This identifying assumption is less onerous and is challenging to refute.

The final empirical hurdle is to sufficiently address selection concerns. If states that adopt the federal policies are different than those that do not, selection effects may be driving the main results. To address these concerns, a battery of balancing tests are performed and several selection biases are uncovered. Bonus adopting states (1) have higher corporate income tax rates, (2) have more Republican state legislators, (3) have smaller budget deficits, and (4) have lower gross state product per capita. States that conform to federal Section 179 allowances are different only in that they, like adopting states, (1) have more Republican state legislators. If investment and employment grows more quickly or slowly in states based on any of these characteristics or if these characteristics are correlated with important omitted variables, then estimates of the policy impacts will be biased. To make sure these biases are not driving the results, for each characteristic listed above, the preferred regression specification is rerun after states that are least likely to adopt based on that given characteristic are eliminated from the sample. This process achieves more similar treatment and control groups than in the full sample. The results across all of these subsample, selection-controlled specifications are consistent with the full sample findings.

As noted above, this study is the first to examine state adoption of either bonus depreciation or Section 179 allowances. This study is novel in two addition ways. It is the first to examine the employment effects of either bonus depreciation or Section 179 at either the federal or the state level. Additionally, it is the first to examine any responses to bonus depreciation without relying on imprecise industry-level estimates of statutory depreciation rates.[3] The findings presented herein therefore use a different empirical methodology to reinforce several recent studies that suggesting bonus depreciation is a very effective investment stimulus policy.

In addition to providing policy makers with much needed data, this paper also broadly contributes to two economic literatures. The first concerns the empirical estimation of the impact of federal tax incentives on investment behaviors (see Cummins, Hassett and Hubbard (1994), Gools-

[2]See Appendix 14 for a summary of policy overlap.

[3]Zwick and Mahon (2016) includes one table based on firm level bonus treatment.

bee (1998), Yagan (2013), Ohrn (2015)). A subset of this literature focuses on the investment impacts of bonus depreciation (see Edgerton (2010), House and Shapiro (2008), and Zwick and Mahon (2016)). The second literature to which this paper contributes is more recent and explores the impact of state business taxation on economic activity (see Giroud and Rauh (2015), Serrato and Zidar (2014), Ljungqvist and Smolyansky (2014)).

The remainder of the paper is structured as follows. Federal bonus depreciation policy and state bonus adoption are described in Section 2. Section 3 does the same for Section 179. The empirical design and related key identifying assumptions are described in Section 4. Section 5 discusses the data sources used in the analysis. Selection concerns and subsample analyses that may be used to alleviate these concerns are addressed and offered in Section 6. The main empirical results are presented in Sections 7 and 8. The heterogeneity of these results across subsamples of interest are presented in Section 9. Section 10 concludes.

2 Bonus Depreciation

Typically, businesses may deduct newly installed assets from their taxable income according to the Modified Accelerated Cost Recovery System (MACRS) (detailed in IRS Publication 946). MACRS specifies the life and depreciation method for each type of potential investment / asset class. For equipment, lives can be 5, 7, 10, 15 or 20 years and the method is called the "declining balance switching to straight line deduction method."

Table 1 examines the impact of 50% bonus on the cost of a $100 investment that has a 7-year life. MACRS specifies that $25 of the total investment may be deducted in the first year, then $21.43 in the second, etc. With a federal tax rate of 35%, this leads to tax savings of $8.75 in the first year, then $7.50 in the second. Over the course of the 7 year life, all $100 of the investment cost are deducted from taxable income, generating $35 in total in *nominal* tax shields. However, because the entire cost is not deducted from taxable income in the first year, the present value of tax savings associated with the investment are only worth $28.79.[4]

Bonus depreciation allows for an additional percentage of the total cost to be deducted in the first year. In the example, 50% percent bonus depreciation allows 50 additional dollars to be deducted in the first year the investment is made. The remaining $50 of cost is then deducted according to the original 7 year MACRS schedule. With 50% bonus there are now tax savings associated with the investment of $21.88 in the first year, $3.75 in the second year, etc. Thus, bonus depreciation accelerates the deduction of the investment and tax savings. Because firms benefit from the tax savings earlier, the present value of the investment's tax shield increases to $31.89 and the present value cost of the investment decreases by 3.1%.

[4]The $28.79 is a function of the assumed discount rate of 10%. At higher discount rates, the present value of the tax shield will be lower. 10% is used in the example because it is often the rate used in corporate net present value calculations.

Table 1: Example of Federal Tax Impact of 50% Bonus

Year	1	2	3	4	5	6	7	8	Total
MACRS Deduction	25	21.43	15.31	10.93	8.75	8.74	8.75	1.09	100
τ_f x Deduction	8.75	7.50	5.36	3.83	3.06	3.06	3.06	0.38	35
PV(τ_f x Deduction)									28.79
50% Bonus Ded.	62.5	10.72	7.65	5.47	4.37	4.37	4.37	0.545	100
τ_f x Deduction	21.88	3.75	2.68	1.91	1.53	1.53	1.53	0.19	35
PV(τ_f x Deduction)									31.89

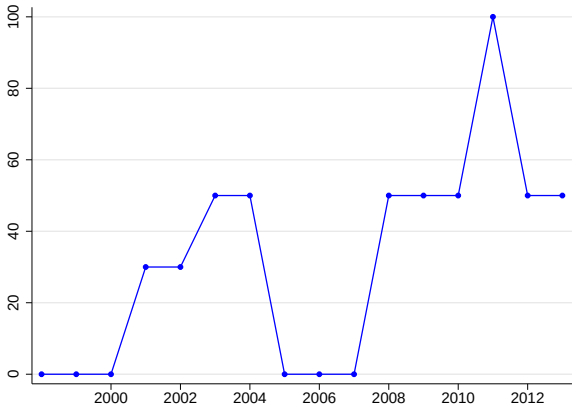
Notes: This table calculates the present value of federal tax deductions for a $100 investment under both a traditional 7-year accelerated depreciation regime and under a 50% bonus regime. The federal corporate tax rate is assumed to be 35% and the state corporate tax rate is assumed to be 7.2% - the observed percentage for states that adopted the bonus depreciation policy during years 2001 - 2011. The discount rate is assumed to be 10%.

Figure 1: Federal Bonus depreciation

(a) Bonus Rates

For Qualifying Assets Purchased		Bonus
After	Before	
09/10/2001	05/06/2003	30%
05/05/2003	01/01/2005	50%
12/31/2004	01/01/2008	0%
12/31/2007	09/09/2010	50%
09/08/2010	01/01/2010	100%
12/31/2011	01/01/2015	50%

(b) Over Time



Notes: Figure 1 presents federal bonus depreciation rates for years 2000 to 2015. Appendix B details the pieces of legislation that enacted and changed bonus rates.

Table 2: Example of State Tax Impact of 50% Bonus

Year	1	2	3	4	5	6	7	8	Total
MACRS Deduction	25	21.43	15.31	10.93	8.75	8.74	8.75	1.09	100
τ_f x Deduction	1.8	1.54	1.10	0.79	0.63	0.63	0.63	0.08	7.2
PV(τ_f x Deduction)									5.92
50% Bonus Ded.	62.5	10.72	7.65	5.47	4.37	4.37	4.37	0.545	100
τ_f x Deduction	4.5	0.77	0.55	0.39	0.32	0.32	0.32	0.04	7.2
PV(τ_f x Deduction)									6.56

Notes: This table calculates the present value of federal and state tax deductions for a $100 investment under both a traditional 7-year accelerated depreciation regime and under a 50% bonus regime. The federal corporate tax rate is assumed to be 35% and the state corporate tax rate is assumed to be 7.2% - the observed percentage for states that adopted the bonus depreciation policy during years 2001 - 2011. The discount rate is assumed to be 10%.

Bonus depreciation was first enacted in 2001 at a rate of 30%. It was originally intended to be a temporary and counter-cyclical policy. As shown in Figure 1, in 2003, the additional first year deduction was increased to 50%. The bonus was not extended for years 2005, 2006, and 2007, but was reinstated in 2008 at the 50% rate. After 3 years at 50%, the bonus rate was increased to 100% in 2011 (often called expensing). Since 2011, bonus has held steady at 50% but was only enacted retroactively for 2014 in December of that year.

Several papers have examined the impact of federal bonus depreciation. The papers find that bonus, on average, had a lukewarm impact on the investment behavior of publicly traded firms (House and Shapiro (2008)) but was more effective at stimulating investment among smaller businesses (Zwick and Mahon (2016)). As of yet, however, no research has examined responses to state level adoption of bonus depreciation policy.

2.1 State Bonus Depreciation Adoption

When bonus depreciation was instituted at the federal level, states could choose to respond to the policy in one of three ways. First, states could fully adopt the policy. States that chose this option also allowed businesses to deduct the additional bonus percentage of newly purchased assets in the first year from their state taxable income. Second, states could completely ignore or reject bonus depreciation. Finally, states could choose to allow for some additional first year write off of new equipment expenditures but not the full federal bonus percentage.[5] State bonus policies are

[5]Several states did not have a corporate income tax during bonus depreciation years and therefore could not respond to the federal policy in any way. These states are eliminated from the analysis.

detailed in Appendix A.

State bonus depreciation is inherently less valuable to firms than federal bonus because all state corporate tax rates are significantly lower than the 35% federal rate observed during the bonus episodes. Among all states, the average state income corporate tax rate during the sample period was 7.2%. Table 2 shows the impact of 50% bonus depreciation on the present value of tax depreciation allowances when the corporate income tax rate is 7.2%. The 50% bonus decreases the after tax cost of the $100 by by on 0.064% or ¢64. 100% bonus, as was federally adopted in 2011, would decreases the after-tax cost of investment by $1.28.

2.2 Mapping Bonus Depreciation Adoption

Figure 2 maps the states that adopted, partially adopted, and rejected the bonus policy in 2001 as well as states that had no corporate income tax rates. In 2001, there were 15 full adopters and 21 rejecters. These states were spread geographically and were represented in the Northeast, South, Midwest, Mountain, and North Western States. During the second bonus episode there were only 10 full adopters and 27 rejecters. The adopters were also not as geographically dispersed across the nation. In both 2001 and 2008, five states partially adopted the policy and four had no corporate income tax rates. Figure 2 demonstrates both cross-sectional variation in 2001 and 2008 (although more in 2001) and within state variation over time in the policy.

To better visualize the within-state adoption variation, Figure 3 maps the states states that changed their bonus adoption policies at any time during the two bonus episodes. In total, 15 states changed their adoption policies. These policy changing states are geographically dispersed and therefore seem to suggest that regional factors did not influence states' decisions to adapt their adoption policies. Further descriptive analysis of potential factors influencing state adoption is left until Section 5.

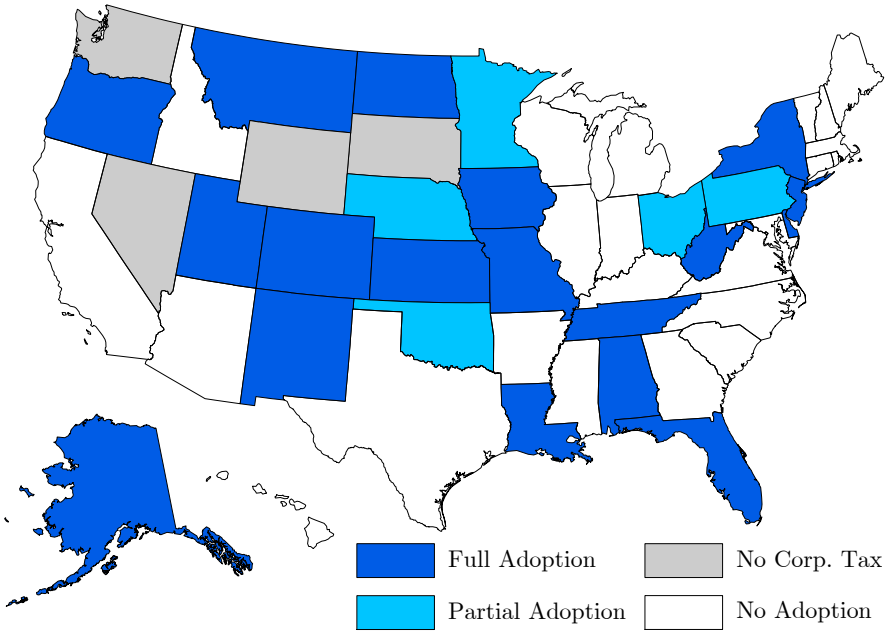
3 Section 179

Section 179 of the United States Internal Revenue Code allows a taxpayer to elect to deduct the cost of a new investment asset from their taxable income upon purchase instead of depreciating the asset according to MACRS rules. Thus, Section 179 provides immediate expensing or 100% bonus for eligible purposes. Section 179 eligibility is governed by three limitations. First, there is a dollar limitation, referred to throughout this paper as the "Section 179 allowance." The allowance is the maximum deduction that a taxpayer may elect to take in a year.[6] Figure 4(A) shows the evolution of this limitation during the years 2000–2011. The allowance was increased significantly in 2003, 2008, and again in 2010.

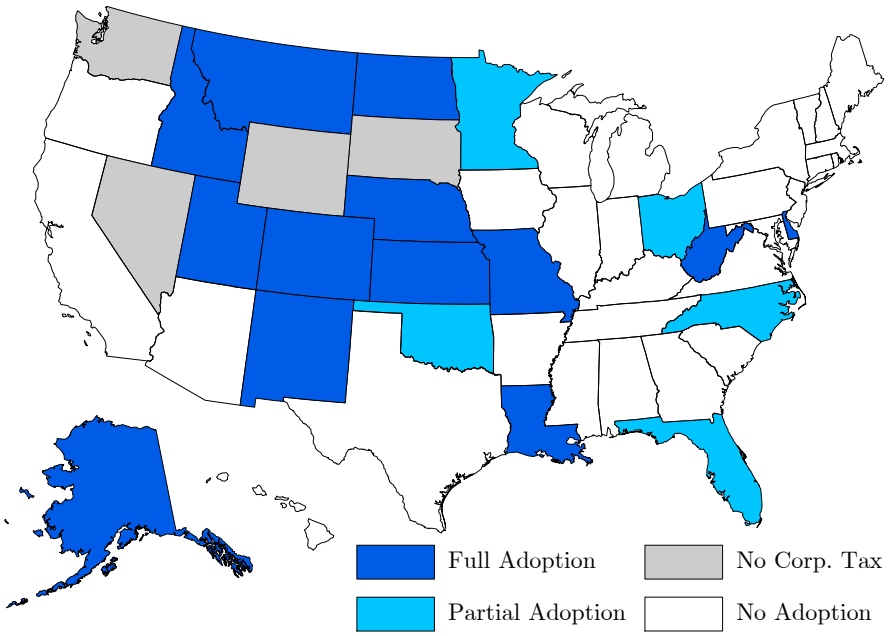
[6]The value of large vehicles beyond $25,000 could not be immediately expensed under Section 179. Building were also not eligible prior to 2010.

Figure 2: State Bonus Depreciation Conformity

(a) Adoption in 2001

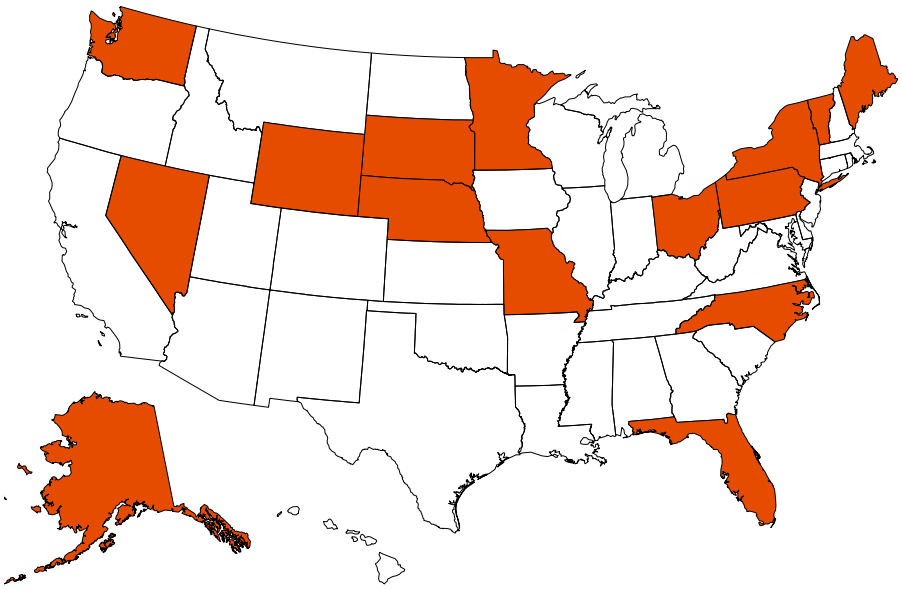


(b) Adoption in 2008



Notes: Figure 2 depicts which states fully adopted the bonus depreciation policy, partially adopted the policy, fully rejected the policy, and did not have a corporate tax in 2001 and 2008.

Figure 3: Bonus Depreciation Policy Changers



Notes: Figure 3 depicts which states changed their adoption of the policy at some point during either bonus episode. In total, 15 states changed thier adoption policy.

The second is limitation is the the "Section 179 limit." If a taxpayer places into service more Section 179 property than the limit, the Section 179 deduction is reduced, dollar for dollar, by the amount exceeding the limit. The final limitation is that a taxpayer's Section 179 deduction may not exceed the taxpayer's aggregate income by the taxpayer for that year.

The math in Table 1 demonstrates 1/2 the value of Section 179. When rates of return are 10%, Section 179 provides a 6.2% discount on the present value cost of capital investments. This is a large discount but, of course, is only available up to the 179 limit.

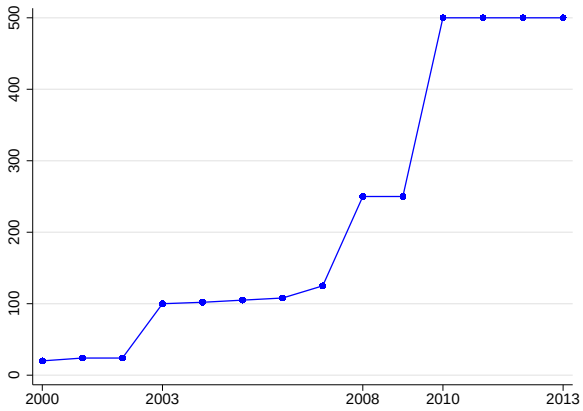
3.1 State Section 179 Conformity

In 2000, when the federal Section 179 limit was $20,000, nearly every state also allowed for full expensing of investments up to the federal limit for state tax purposes. As the Section 179 allowance increased during the years 2000–2011, most but not all states also increased their state Section 179 limits in step. Figure 4(B) depicts the percentage of states that levy corporate taxes and whose Section 179 limits conformed to the federal definition in each year during the sample period. The largest drops in the percentage of conformers are in 2003, when the federal allowance jumped from 24 to 100 thousand dollars, and in 2010, when the allowance increased from 250 to 500 thousand

Figure 4: Section 179 Allowance 2000-2011

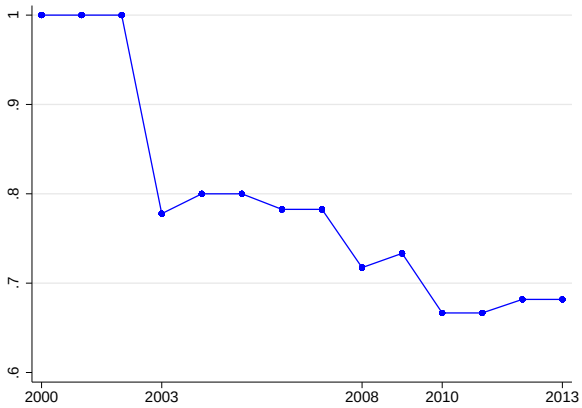
(a) Section 179 Federal Allowance

Year	Limit ($ Thousands)
2000	20
2001–2002	24
2003	100
2004	102
2005	105
2006	108
2007	125
2008–2009	250
2010–2013	500



(b) Section 179 State Conformity

Year	State Conformity (%))
2000–2002	97.8
2003	75.6
2004–2005	77.8
2006	76.1
2007	76.1
2008	69.6
2009	71.11
2010	64.44



Notes: Panel (A) of Figure 3 presents federal section 179 limits for years 2000–2011. Panel (B) presents the percentage of states that have corporate taxes and conform their definition of taxable income with federal Section 179 allowances.

dollars. Despite these large drops, in 2011, more than 60% of states still conformed to the federal allowance. Whether conforming states are different from non-conforming states is explored in Section 6.

Like bonus depreciation, the benefit of state Section 179 depreciation deductions is much lower than that of the federal deduction. At the average state tax rate of 7.2%, Section 179 provides a 1.28% discount on new investment purchases (double that of the 50% state bonus as computed in Table 2).

4 Empirical Strategies

4.1 Separate Estimation of State Bonus Adoption and Section 179 Conformity

Differences-in-differences (DD) estimation strategies are used to identify the impacts of state bonus adoption and state Section 179 conformity. In each case, the DD identifies the impact of the policy by comparing changes in investment and employment by industries located in states that adopted/conformed to the policy relative to changes in investment and employment by industries in states that did not implement the policy.

To identify the impacts of state bonus adoption, state-specific NAICS 3-digit investment or employment is regressed on an interaction between the federal bonus rate and a state adoption variable as well as other controls and fixed effects. The baseline DD regression is

$$\ln(\text{capx})_{jst} = \beta_0 + \beta_1[\text{State Bonus}_{st}] + \mathbf{X'_{st}}\boldsymbol{\gamma} + \sigma_t + \nu_{js} + \zeta_{jt} + \psi_s + \epsilon_{jst} \tag{1}$$

where j denotes NAICS 3-digit industries, s denotes state, and t denotes time. Baseline regressions also include industry-state (ν_{js}) and year fixed effects (σ_t) to control for time invariant determinants of investment and employment as well as a vector of state-level time-varying controls ($\mathbf{X'_{st}}$) and state linear time trends (ψ_s) to account for state-level trends that may affect investment or employment. Finally, industry-by-year fixed effects (ζ_{jt}) are included to eliminate concerns that industry-level trends are driving the results.

When these fixed effects, trends, and controls are included, the DD coefficient is identified by comparing the investment and employment by the same industries in adopting relative to non-adopting states as the federal policy is implemented and increased. Under these conditions, the identifying assumption is that the state bonus policies policies are independent of other state-by-year shocks that are unrelated to the robust set of state-by-year control variables that describe the state political climate, productivity, population, and finances. The point estimate of the β_1 coefficient on State Bonus is interpreted as the percent difference in investment /employment between a fully adopting and a fully rejecting state when federal bonus is set to 100%.

A similar empirical strategy can be used to identify the impact of Section 179 allowances. In

this setup, State Bonus is replaced with State 179 Allowance$_{st}$, an interaction term between state conformity to federal 179 levels and the federal level itself. For instance, if the state-level take-up of the allowance was 50% and the federal allowance was $200,000, then State 179 Allowance$_{st}$ would be equal to $100,000. State 179 Allowance is expressed in hundreds of thousands of dollars so in the given example State 179 Allowance would actually be equal to 1. Here β_1 can be interpreted as the percentage increase in investment/ employment that a state that increases its Section 179 allowance by $100,000 sees relative to a state that leaves its Section 179 allowance unchanged. Again, the identifying assumption is that the state Section 179 policies are independent of other state-by-year shocks that are unrelated to the robust set of state-by-year control variables that describe the state political climate, productivity, population, and finances.

State bonus is one such type of state-by-year shock that would violate this assumption. Symmetrically, changing state Section 179 allowances might undermine the identification of the state bonus coefficient in regression model (1). Therefore, joint estimation of state bonus adoption and state Section 179 conformity – which is described in the next subsection – is necessary to precisely identify the effects of either policy. Joint estimation is also called for because there exists a reason to believe the interaction of the two policies might be important as Section 179 allowances determine the investment base for bonus depreciation.

4.2 Joint Estimation of State Bonus Adoption and Section 179 Conformity

The impact of state bonus adoption and state 179 conformity can be jointly estimated by including each state-by-year DD variable in a single regression. This "horse race" type of regression can be written as

$$\ln(\text{capx})_{jst} = \beta_0 + \beta_1[\text{State Bonus}_{st}] + \beta_2[\text{State 179}_{st}] + \mathbf{X'_{st}}\boldsymbol{\gamma} + \sigma_t + \nu_{js} + \zeta_{jt} + \psi_s + \epsilon_{jst}. \quad (2)$$

In this specification, the identification of β_1 (β_2) is the same as above and the point estimate is made holding state 179 allowance (state bonus) constant.

While this horse race regression jointly identifies the impact of both policies, it does not take their interaction into account when doing so. To further explore how the presence of generous state 179 allowances impact the effect of state bonus take-up (and vice versa) an interaction term can be added to the horse race equation. This "interaction" specification can be written as

$$\begin{aligned}\ln(\text{capx})_i = {} & \beta_0 + \beta_1[\text{State Bonus}_{st}] + \beta_2[\text{State 179}_{st}] + \beta_3\big[[\text{State Bonus}_{st}] \times [\text{State 179}_{st}]\big] \quad (3)\\ & + \mathbf{X'_{st}}\boldsymbol{\gamma} + \sigma_t + \nu_{js} + \zeta_{jt} + \psi_s + \epsilon_{jst}.\end{aligned}$$

When the interaction term is included, the β_1 coefficient is interpreted as the percentage increase in investment/employment experienced by a state that fully adopts 100% federal bonus depreciation

relative to the increase that a fully rejecting state experiences when neither state allows for any Section 179 expensing. Similarly β_2 is the impact of an additional \$100,000 in 179 allowance when neither the treatment nor control group adopt federal bonus. The β_3 coefficient is then used to consider how much β_1 or β_2 change as Section 179 and bonus are ramped up respectively. More precisely β_3 is equal to the increase in the effect of bonus adoption (β_1) that occurs when state Section 179 allowances increase by \$100,000 and $\beta_2 + \beta_3$ is the impact of a \$100,000 increase in 179 allowances when 100% federal bonus has been fully adopted by all states. Because bonus is less effective when Section 179 allowances are high and Section 179 allowances are meaningless when bonus is fully adopted at a 100% federal level, the interaction term is predicted to be negative while its inclusion in the regression framework is predicted to increase the point estimates of β_1 and β_2.

5 Data Sources

5.1 Manufacturing Data

Measures of employees and investment come from the The Annual Survey of Manufacturers (ASM) and the Economic Census – both products of the US Census Bureau – for the years 1997-2013. The ASM is conducted annually in all years except for years ending in 2 and 7. In those years, employee and investment data are reported in the Economic Census. The ASM provides sample estimates and statistics for all manufacturing establishments with one or more paid employees – which is the entire Economic Census manufacturing census, thus statistics in all year are comparable.

The observational unit in empirical analysis is the 3-digit North American Classification System (NAICS) industry within in each state. There are 21 3-digit NAICS manufacturing industries and approximately 900 observational units.[7] The investment variable is the log of capital expenditure (in thousands of dollars) and the employment variable is the log of employees for each NAICS x State unit.

5.2 Federal and State Level Bonus Data

Federal bonus depreciation rates are taken from federal legislation. All legislation containing bonus depreciation are described in Appendix B. The bonus rates over time, as noted previously, are contained in Figure 1. From these rates and dates of implementation / repeal, Federal **Bonus** Rate is constructed. Bonus is between 0 (no bonus) and 1 (100% bonus) and varies only over time. Bonus is set equal to the maximum federal bonus percentage at any time during a given year.

State bonus conformity data is drawn from Lechuga (2014), which described whether states allowed, did not allow, or partially allowed the full federal bonus depreciation in years 2001 through

[7] If each NAICS x State unit was represented there would be 1050 observation. Some industries are either not represented in some states or there are too few establishments to report confidential statistics.

2014. This data is reproduced in Table 12 and converted to a single **State Adoption** variables which takes on values between 0 and 1. State Adoption is equal to 0 if an observational unit is located in a state that fully rejects the policy in a given year. State Adoption is set equal to 1 for states that fully adopted the policy. When state bonus is adopted at X% of the federal rate, State Adoption is set to X/100. The interaction of Bonus and State Adoption yields **State Bonus**, the bonus DD variable of interest.

5.3 Section 179 Data

Federal **Section 179** allowance figures are taken from federal legislation. **State Conformity** is based on hand collected state 179 allowance levels.[8] State Conformity is equal to 1 when a state fully conforms and 0 when it sets state 179 allowances to 0% of the federal allowance. The interaction of Section 179 and State Conformity yields **State 179**, the Section 179 DD variable of interest. State 179 allowances is scaled such that State 179 coefficient is interpreted as the change in the outcome variable when a state increases its Section 179 allowances by $100,000.

5.4 Other State Level Data

Time-varying state level data is used to explore any systematic differences between states that do and do not adopt bonus depreciation and conform to federal Section 179 allowances. The sources of this data and definitions are discussed in Appendix C. Descriptive statistics of all variables are included in Appendix D.

6 Determinants of Bonus Adoption and Section 179 Conformity

A primary concern in precisely identifying the effect of state adoption of federal investment incentives is that states that choose to adopt the policies may be systematically different than those that do not adopt the policy. While these selection concerns can never be fully eliminated, they can be addressed by 1) controlling for the factors that seem to predict adoption / conformity and by 2) limiting analysis to states that are more likely to adopt the policies in order to achieve more similar "treatment" and "control" groups. This section explores these determinants. Results from regressions that limit the analysis to these more comparable groups based on this section's findings are presented in Table 11.

[8]These data are, at present time, available upon request. In the future, these data will be detailed in a data Appendix and will be made available online.

6.1 Determinants of Bonus Adoption

Table 3 explores potential determinants of state level bonus adoption during the first bonus episode, in 2001, and during the second bonus episode, in 2008. The table presents the mean and t statistics for five state-level variables across adopting and non-adopting states. In this table, adopters are defined as those states that offered any bonus depreciation during the year in question. In 2001, means are marginally statistically different for only one variable, Corp Tax Rate %, the state corporate income tax. In 2001, states were more likely to adopt bonus if they had higher state corporate income tax rates. Overall, the 2001 results suggest that states that did and did not adopt bonus were not significantly different.

In 2008, states that adopted bonus had a more Republican legislature, had smaller state budget gaps, and reported lower levels of gross state product per capita. These differences suggests that bonus adoption sensitivity to state characteristics may have increased between 2001 and 2008. Based on this observation and the differences in Corp Tax Rates between adopting and non-adopting states in 2001, the analysis in Table 11 is performed after eliminating states in the bottom quarter of Corp Tax Rate, top quarter in terms of democratic legislature, top quarter in terms of budget gaps, and top quarter in terms of GSP per capita. Limiting the sample group in these achieves more comparable control and treatment groups and mitigates concerns that states that were very unlike adopting/conforming states are responsible for the estimated parameters.

6.2 Determinants of Section 179 Conformity

Table 4 performs the same balancing test for state Section 179 conformers and non-conformers in 2004 and in 2010. These years are chosen because they coincide with large decreases in state 179 conformity. Overall, state characteristics are more similar between 179 conforming and non-conforming states than between bonus adopting and rejecting states. In sum, the analysis finds only one marginally statistically significant difference – in 2010, non-conforming states had a larger percentage of Republican legislators than non-conforming states.

Because one of the sub-sample estimates in Table 11 will already focus on states with more Republican legislators, the state 179 sample selection analysis does not any addition checks. As the results in Table 11 illustrate limiting the analysis in these ways does not significantly change the headline results of the paper. Despite the general stability of results with regard to selection issues, the set of state-level, time-varying controls described in Appendix C, as well as state linear time trends are included in most regressions as they can proxy for other potentially unobserved state level drivers of investment and employment.

The analysis now proceeds to estimate the investment and employment impacts of state bonus adoption and state 179 allowances.

Table 3: State Determinants of Bonus Depreciation Adoption

2001

	Political Determinants		
	Adopter Mean	Rejecter Mean	t stat
Dem Legislature %	47.18	55.17	(-1.482)
Dem Governor	0.467	0.400	(0.418)
	Financial Determinants		
	Adopter Mean	Rejecter Mean	t stat
Corp Tax Rate	7.395	5.791	(1.742)*
Corp Tax %	0.0710	0.0484	(1.506)
Budget Gap	0.00493	0.0203	(-1.110)
	Population/Productivity Determinants		
	Adopter Mean	Rejecter Mean	t stat
GSP per Capita	0.0349	0.0355	(-0.283)

2008

	Political Determinants		
	Adopter Mean	Rejecter Mean	t stat
Dem Legislature %	47.55	56.41	(-1.707)*
Dem Governor	0.545	0.559	(-0.0758)
	Financial Determinants		
	Adopter Mean	Rejecter Mean	t stat
Corp Tax Rate	7.395	6.393	(1.046)
Corp Tax %	0.0727	0.0594	(0.914)
Budget Gap	-0.0218	0.0962	(-2.433)**
	Population/Productivity Determinants		
	Adopter Mean	Rejecter Mean	t stat
GSP per Capita	0.548	0.805	(-3.039)***

Notes: Table 3 presents means of state level control variables for adopting and rejecting states. Adopting states are those that adopted federal bonus depreciation at any rate. t is the t statistic from the comparison of means. Statistical significance of the t-stat at the 1 percent level is denoted by ***, the 5 percent by **, and the 10 percent by *.

Table 4: State Determinants of Section 179 Conformity

2004

	Political Determinants		
	Conformer Mean	Non-Conf Mean	t stat
Dem Legislature %	48.78	57.80	(-1.678)
Dem Governor	0.472	0.333	(0.738)
	Financial Determinants		
	Conformer Mean	Non-Conf Mean	t stat
Corp Tax Rate	7.258	8.238	(-1.391)
Corp Tax %	0.0518	0.0723	(-1.171)
Budget Gap	-0.0120	0.00493	(-0.973)
	Population/Productivity Determinants		
	Conformer Mean	Non-Conf Mean	t stat
GSP per Capita	0.682	0.736	(-0.657)

2010

	Political Determinants		
	Conformer Mean	Non-Conf Mean	t stat
Dem Legislature %	52.89	61.54	(-1.879)*
Dem Governor	0.567	0.467	(0.622)
	Financial Determinants		
	Conformer Mean	Non-Conf Mean	t stat
Corp Tax Rate	6.999	7.735	(-1.241)
Corp Tax %	0.0477	0.0654	(-1.574)
Budget Gap	-0.0327	-0.0481	(0.815)
	Population/Productivity Determinants		
	Conformer Mean	Non-Conf Mean	t stat
GSP per Capita	0.741	0.797	(-0.652)

Notes: Table 4 presents means of state level control variables for adopting and rejecting states. Adopting states are those that adopted federal bonus depreciation at any rate. t is the t statistic from the comparison of means. Statistical significance of the t-stat at the 1 percent level is denoted by ***, the 5 percent by **, and the 10 percent by *.

7 Investment Impacts of State Bonus and 179

7.1 Baseline Empirical Results

Table 5 presents coefficient estimates from regression model (1) when the DD term is State Bonus and (1) again when the DD term is State 179, from regression model (2), and from regression model (3) when the outcome variable is Ln CapEx. All standard errors in this table and throughout the paper, unless noted otherwise, are clustered at the state-level.[9] Specification (1) estimates the impact of state bonus on investment without controlling for state Section 179 allowances. The results suggest that state adoption of 100% bonus depreciation increases investment by 3.8%. Although this is a large point estimate, the result is not statistically significant. Symmetrically, specification (2) estimates the impact of state Section 179 conformity without controlling for state bonus. Again, the results are sizable but statistically insignificant. The State 179 point estimate suggest that a $100,000 increase in State 179 allowance increases manufacturing investment by 1.3%.

Specification (3) includes both policies. Although the results are not statistically significant, the point estimates for State Bonus and for State 179 are now both smaller. This result is as expected given that the policies are positively correlated and both should increase investment. Under these conditions, when one policy is included but the other is omitted, the estimates will be biased upwards.

Specification (4) adds the interaction term. When the interaction is included, State Bonus and State 179 both have have a large and statistically significant effect on investment. The interaction term is negative and statistically significant meaning that as the intensity of one policy is increased, the effect of the other dissipates.[10]

The magnitudes of the estimates suggest that state adoption of 100% bonus depreciation increases investment by 17.4% when state 179 allowances are set to zero. For every $100,000 that the Section 179 allowances are increases, adoption of 100% bonus stimulates 4.7% less investment. As for the magnitude of the State 179 impact, the Specification (4) results suggest that $100,000 in state 179 allowances increase investment by 2.0% and the interaction term means that unless state 179 allowances are set at over $235,000 (4.7/2.0 x $100,000), state 179 allowances have no impact on investment when state bonus depreciation is set at 100%. The next subsection further explores the marginal impact of each policy and discusses the related elasticities.

[9] Following Cameron and Miller (2015), because both State Bonus and State 179 vary at the state level and over time, standard errors are clustered at the state level.

[10] Robustness of the Specification (4) results to different controls, fixed effects, trends, and standard error clustering choices is further explored in Appendix F. Overall, the magnitude, sign, and standard errors of State Bonus, State 179, and the interaction term are consistent across robustness specifications.

Table 5: State Bonus and Section 179 Capital Expenditure Analysis

Dependent Var:	ln CapEx			
Specification	(1)	(2)	(3)	(4)
State Bonus	0.038		0.031	0.174**
	(0.036)		(0.037)	(0.073)
State 179		0.013	0.012	0.020**
		(0.009)	(0.009)	(0.009)
Bonus 179 Interaction				-0.047***
				(0.016)
Year FE	✓	✓	✓	✓
State Controls, Time Trends	✓	✓	✓	✓
NAICS x Year FE	✓	✓	✓	✓
Adj. R-Square	0.286	0.286	0.286	0.286
State x NAICS Groups	883	883	883	883
Observations	11,987	11,987	11,987	11,987

Notes: Table 5 presents coefficient estimates from regression model (1) when the DD term is State Bonus and when the DD term is State 179, regression model (2), and regression model (3) when the outcome variable is Ln CapEx. All specifications include include year fixed effects, State x NAICS fixed effects, state linear time trends, NAICS x Year fixed effects, and a robust set if time-varying state level controls to capture the effect of changes in state politics, productivity, population, and finances. Standard errors are at the state level and are reported in parentheses. Statistical significance at the 1 percent level is denoted by ***, 5 percent by **, and 10 percent by *.

7.2 Marginal Effects

Because the impact of State Bonus and State 179 are jointly affected by one another, examining the marginal effects of each policy is important in order to fully understand how these policies changed manufacturing investment during the years 2001–2013. This section examines the marginal effects of each policy in two ways. First, marginal effects and corresponding investment-tax elasticities are calculated at several salient levels of the adjacent policy. These results are presented in Table 6. Second, the marginal effects of each policy during years 2000–2013 are calculated. These results are presented graphically in Table 5.

The marginal effects and elasticities presented in Table 6 are calculated using the policy estimates from Table 5 Specification (4). The calculated elasticity is the elasticity of the capital expenditure with respect to the net-of-tax rate. Assuming that the average firm in the sample begin with a net of tax rate of 57.8% (35% federal corporate income tax rate and average 7.2% state income tax rate) and that 100% bonus decreases the state rate by 1.28%, state adoption of

Table 6: Marginal Effects

	State 100% Bonus Marginal Effects		
Section 179 Level	Marginal Effect	Marginal SE	∂ Ln Capx / ∂ Ln $(1-\tau)$
\$0	0.174**	(0.073)	7.909
\$100,000	0.127**	(0.059)	5.782
\$200,000	0.080*	(0.047)	3.636
\$300,000	0.034	(0.039)	1.527
\$400,000	-0.013	(0.036)	0.932

	State \$500,000 179 Marginal Effects		
Bonus Level	Marginal Effect	Marginal SE	∂ Ln Capx / ∂ Ln $(1-\tau)$
0%	0.098**	(0.043)	4.432
30%	0.027	(0.046)	1.241
50%	-0.019	(0.054)	-0.088

Notes: Table 6 presents marginal effects of State Bonus and State 179 at various levels of State 179 and State Bonus, respectively.

100% bonus increases the average firm's net-of-tax rate by 2.2%.[11] The investment-tax elasticities, ∂ Ln $(1-\tau)$, are therefore calculated by dividing the marginal effect by 0.022. Notice that under the assumption that a firm's investment level is under the state 179 allowance, Section 179 alters net-of-tax rates in the same way as 100% bonus. Thus, Section 179 marginal effects are also divided by 0.022 to find Section 179 investment elasticities.

When Section 179 is set to 0, adoption of 100% bonus increases investment by 17.4%. The corresponding investment–net-of-tax elasticity is 7.91. To be sure, this elasticity is large; manufacturing investment is very sensitive to bonus depreciation. However, it is just slightly larger than the 7.2 reported by Zwick and Mahon (2016). As Section 179 is scaled to 100, 200, 300, and 400 thousand dollars, this elasticity decreases to lower 5.78, 3.64, 1.53, and finally 0.932.

The results Table 6 are scaled to show the impact of a state adopting a \$500,000 Section 179 allowance. When bonus is set to zero, state 179 conformity increases investment by 9.8%. When bonus is ramped up to 30 and then 50%, the marginal effect decreases to 2.7% and then to approximately 0. The corresponding investment-tax elasticities are 4.43, 1.24, and -0.09.

Before moving on to examine a graphical representation of temporal marginal effects, two general points about the baseline investment estimates must be made. First, most studies that examine investment or employment responses to corporate taxation use firm-level observations. As a result,

[11] See Table 2 for more on how bonus depreciation affects effective state income tax rates.

the estimated response is an intensive margin increase in investment activity of the firm. Because the estimates presented here are based on plant-level data, they capture two additional responses that are left out of traditional estimates: (1) firms that open a new plant may place it in a certain state due to more generous state-level corporate tax incentives and (2) firms may actually choose to reallocate a plant based on state corporate tax considerations. As a result, the estimates presented here are larger not immediately reconcilable with estimates based on firm-level data.

The second important point regarding these estimates stems from the idea that a large portion of the response could generated by reallocation of investment across state borders from state without bonus and Section 179 incentives to states that offer these incentives. If this is the case, then the difference-in-difference methodology employed in this research is going to overestimate responses to the polices because as investment is added to the "treated" states, it is simultaneously subtracted from "control" states. In the extreme, if estimates were based only on reallocation, then estimates would be twice as large as the actual increase in state outcome due to the policy. However, assuming significant fixed costs in starting a new plant, reallocation is most likely the least significant channel of response.

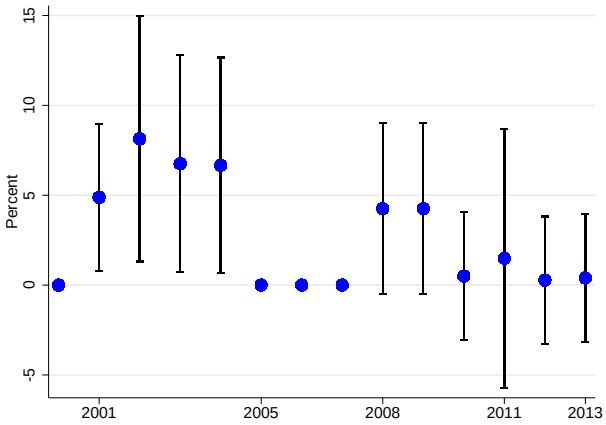
7.2.1 Graphical Marginal Effects

The results from the baseline investment specification can be used to estimate the impact of both policies during each of the years 2000–2013 while controlling for effect of the other policy. These estimated impacts are presented in Figure 5. Panel (A) plots the predicted impact of state adoption of bonus depreciation at the federal level (see Figure 1) assuming that the state has the average observed state Section 179 allowances during that year. Therefore, the estimate of the bonus impact is large when bonus is high but is tempered as state Section 179 allowances become more generous. As one might expect, the impact of bonus was the largest in 2003, when the federal bonus level was high (50%) but federal Section 179 allowances were still small – only $24,000. According to the estimates, bonus depreciation had a statistically significant impact on state investment in years 2001–2004 and a nearly significant impact in years 2008–2009. After federal Section 179 allowances increased to $500,000 in 2010, state adoption of bonus depreciation had no marginal effect on investment.

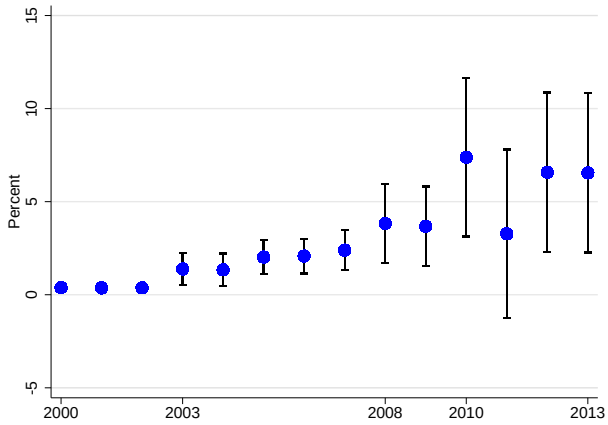
Panel (B) presents estimates of the impact of state 179 allowances. Here, the estimates are interpreted as the impact of conforming 179 allowances to the federal level (versus no 179 allowances) assuming that the state has adopted federal bonus at the average observed level in each year. These estimates are much less affected by bonus than the bonus estimates are by 179 because fewer states adopt bonus than conform to section 179 allowances. Therefore, these estimates closely mirror the rise in federal Section 179 allowances. However, the bonus significantly affects the 179 effect in 2011 when bonus was set to 100% and a larger proportion of states than usual adopted federal bonus depreciation.

Figure 5: Estimated Impact of Bonus Adoption and Section 179 Conformity

(a) Impact of Bonus Adoption



(b) Impact of 179 Conformity



Notes: Figure 5(A) uses estimates presented in Table 5 Specification (4) to predict the investment impact of adopting bonus depreciation at the federal level during the years 2000-2011 assuming the state has adopted the average Section 179 allowances in each year. Figure 5(B) uses estimates presented in Table 5 Specification (4) to predict the investment impact of conforming to the federal Section 179 allowance level (relative to no allowances) during the years 2000-2011 assuming the state has adopted federal bonus depreciation at the average state rate. Standard errors are computed using the delta method.

7.3 Graphical Analysis of State Bonus and State 179

To further explore the impact of State Bonus and 179 on investment, the DD methodology can be carried out graphically. The first step in the graphical DD analysis is to replace State Bonus with State Bonus Adoption (equal to 1 for full adopter and 0 for rejecters) interacted with time dummies for years 1997 to 2013. Regression model (3) is then reestimated with the time interactions. The model produces a series of coefficients that describe investment in adopting states vs. rejecting states in each year. The coefficients on the interactions are then centered around the mean Ln CapEx trend and equalized in years 1997 to 2001 for ease of comparison. This method creates two series: Bonus Adopting Investment and No Bonus Investment. These calendar-time plots are a graphical representation of the DD empirical strategy. The State Bonus graphical DD is presented in Panel (A) of Figure 6. The procedure is repeated for Section 179 and these results are presented in Panel (B). Panels (C) and (D) present State Bonus results but focus separately on the first and then current episode of bonus depreciation. [12] [13]

These estimates differ from those in Figure 5 in two ways. First, they are not marginal effects. That is they represent the impact of each policy assuming the other is set to zero. Second, a single

[12] Panel (D) differs from the trends in (A) only in that Bonus and No Bonus state trends are equalized prior to 2008 so that an accurate comparison of pre-trends - not pre-levels - can be acomplished visually.

[13] States adopt/reject bonus in years 1997–2000 are classified as adopted/rejected bonus in 2001. States adopt/reject bonus in years 2005–2007 are classified as those that adopted/rejected bonus in 2008.

estimate is not used to predict investment responsiveness in each year. Instead and excitingly, the investment responsiveness to each policy in each year is estimated. Due to separate year estimates, these results can be used to test the validity of the differences-in-differences research design. When bonus and 179 are turned off or are operating at low levels, investment in adopting versus non-adopting states should be equal; when bonus and 179 kick-in or are increased, investment behavior should diverge. Based on these criteria, all four panels provide strong evidence that State Bonus and State 179 policies significantly affect manufacturing investment.

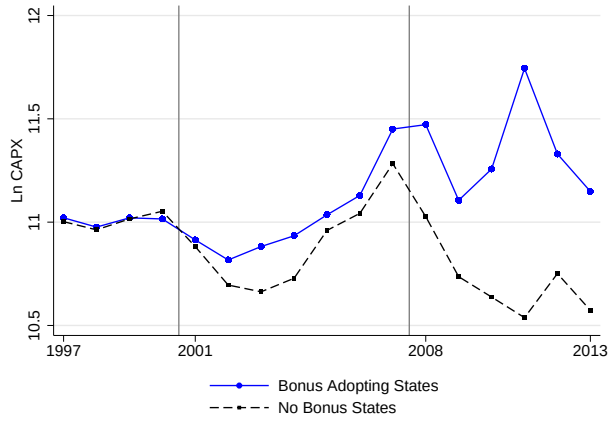
Panel (A) shows the impact of State Bonus adoption in years 1997 to 2013. In years 1997–2000, before federal bonus depreciation existed, there was no difference in investment behavior between like-industries. In 2001, investment begins to increase for adopting states. The divergence is even stronger in years 2002–2004 when bonus was increased to 50%. When bonus is turned off in 2005–2007, investment trends come back together but not all the way suggesting investment may be path dependent. While adopting state investment was slightly higher during these years it closely tracked investment by no bonus states. In 2008, when federal bonus was reinstated, the trends again diverged. The largest divergence between adopting and no bonus states was in when bonus was set at its highest rate. When bonus was scaled back in 2012, trend converge.

Panel (B) shows the impact of State 179 conformity between years 2003 and 2013. The graph shows that investment patterns in conforming and non-conforming states track one another prior to 2008 when the federal allowance was set at $100,000. After 2008, the federal 179 was increased to $250,000, the trends begin to diverge and diverge even further after 2010 when federal 179 was raised to $500,000. Overall, the panel shows that levels of State 179 below $250,000 do not impact manufacturing investment while levels of $250,000 and above have a significant impact.

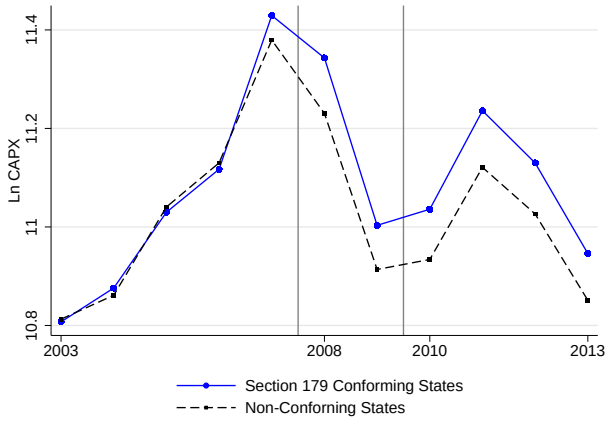
In sum, the graphical analysis supports the baseline regression results. Differences in trends between adopting/conforming and rejecting/non-conforming states are stable when bonus is turned off and the 179 allowance is low and diverge when bonus is turned on and the 179 allowance increase. Having firmly established that both State Bonus and State 179 affect manufacturing investment, the analysis now pivots to analyzing the impact of these policies on employment before exploring heterogeneity in both the investment and employment results.

Figure 6: CapEx Graphical Diff-in-Diff

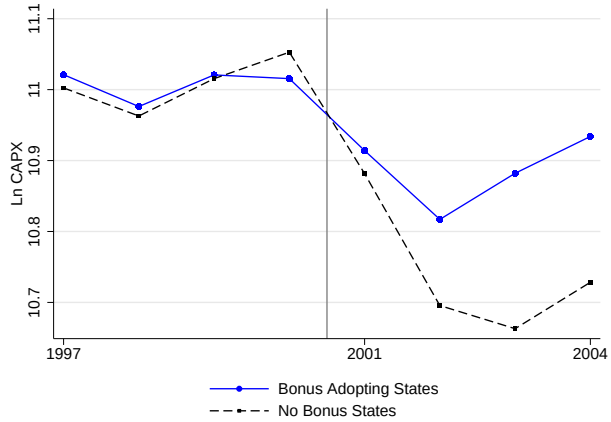
(A) State Bonus Depreciation



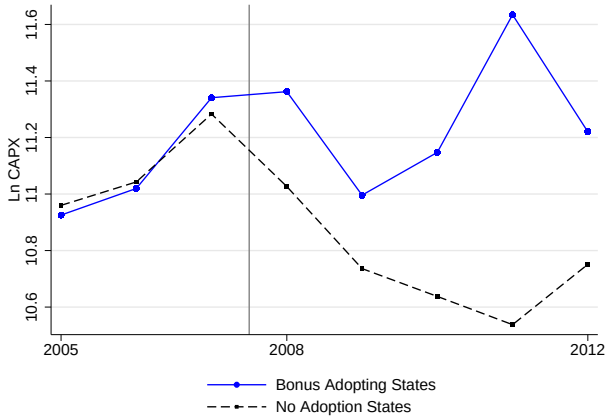
(B) State Section 179



(C) State Bonus Episode 1



(D) State Bonus Episode 2



Notes: Figures 6(A) - 6(D) presents a graphical implementation of regression model (3). To create Panel (A) Ln Capx is regressed on State Bonus Adoption interacted with year dummies and Section 179 variables and controls. The coefficient are then centered on the mean Ln Capx trend, creating treatment and control estimates. A similar procedure in which Section 179 conformity is interacted with year dummies then added to Ln Capx trends created the Panel (B) graphs. Panel (B) begins in 2003 because virtually no states did not conform prior to 2003. Panels (C) and (D) limit to the analysis to the first and second episodes of federal bonus deprecation.

8 Employment Impacts of State Bonus and 179

8.1 Baseline Employment Results

Table 7 is equivalent to Table 5 but now the dependent variable in all specifications is the log of total employees. Across all four specifications, the coefficients on State Bonus and State 179 are statistically insignificant suggesting that the empirical methodology cannot detect any employment impact due to either policy. In Specification (2), (3), and (4) the coefficient on State 179 is a precisely estimated zero. On the other hand, the coefficient on State Bonus is larger and indicates that, while statistically insignificant, State Bonus is associated with between a 1.9 and 2.1% increase in total employment.

Table 7: State Bonus and Section 179 Employment Analysis

Dependent Var:	ln Emp			
Specification	(1)	(2)	(3)	(4)
State Bonus	0.019		0.021	0.020
	(0.017)		(0.018)	(0.032)
State 179		-0.001	-0.002	-0.002
		(0.007)	(0.007)	(0.007)
Bonus 179 Interaction				3.0×10^{-5}
				(0.010)
Year FE	✓	✓	✓	✓
State Controls, Time Trends	✓	✓	✓	✓
NAICS x Year FE	✓	✓	✓	✓
Adj. R-Square	0.691	0.690	0.691	0.690
State x NAICS Groups	933	933	933	933
Observations	12,864	12,864	12,864	12,864

Notes: All specifications present estimates from variants of equation (3). The dependent variable in specifications (1) through (4) is the log of total employess. All specifications include include year fixed effects, State x NAICS fixed ffects, state linear time trends, NAICS x Year fixed effects, and a robust set if time-vaying state level controls to capture the effect of changes in state politics, productivity, population, and finances. Standard errors are at the state level and are reported in parentheses. Statistical significance at the 1 percent level is denoted by ***, the 5 percent by **, and the 10 percent by *.

8.2 Other Responses to State Bonus and Section 179

In light of the magnitude of the State Bonus coefficient, the following subsection examines the impact of the policies on other employment and wage variables. Table 8 replicates Specification (4) but varies the dependent variable. In Specification (1) the dependent variable is now the log of total production workers (a subset of employees). In Specifications (2) and (3), the dependent variables are the log of average salaries (total payroll / total employees) and the log of average production worker wages (total production wages / production workers).

Table 8: Other Responses to State Bonus and Section 179

Dependent Var:	Ln Prod Wrkers	Ln Avg Salary	Ln Avg Wage
Specification	(1)	(2)	(3)
State Bonus	-0.005	0.026***	0.018*
	(0.036)	(0.009)	(0.010)
State 179	-0.001	0.002	0.003
	(0.008)	(0.002)	(0.002)
Bonus x 179	0.006	-0.006**	-0.002
	(0.010)	(0.002)	(0.003)
Year FE	✓	✓	✓
State Controls	✓	✓	✓
NAICSxYear FE	✓	✓	✓
Adj. R-Square	0.701	0.826	0.778
Groups	922	915	910
Observations	12,778	12,774	12,723

All specifications present estimates from variants of equation (3). The dependent variable in Specification (1) is the log of production workers. The dependent variable in Specification (2) is the log of average salary which is computed as the total annual payroll divided by the total number of workers. The dependent variable in Specification (3) is the log of average wages which is computed as the total annual wages divided by the total number of production workers. The dependent variable in Specification (4) is the log of value added. The All specifications include Year, State x NAICS, and NAICS x Year Fixed Effects as well as time-varying state controls and state linear time trends. Standard errors are clustered at the state level and are reported in parentheses. Statistical significance at the 1 percent level is denoted by ***, the 5 percent by **, and the 10 percent by *.

The results presented in Table 8 indicate that while neither policy has an effect of workers, State Bonus seems to increase average salaries and also has a positive but marginally significant effect on the wages of production workers. There are at least two plausible explanations of these results. The first is that the cash windfall from bonus is used to increase salaries and wages (mostly non production worker payments). The second is that while firms do not increase employees in response to state bonus, they do substitute to more highly skilled, more highly paid, and more administration-like positions. This second theory would be the more likely of the two if firms made especially technical investment in response to bonus. Unfortunately, the ASM data cannot shed light the types of investments made in response to the policies. The analysis now proceeds to discuss the heterogeneity of the investment and employment results before concluding.

9 Heterogeneity of Results

Having estimated the investment and employment impacts of the policy for all industry-by-state observations during the entire sample period, the analysis now moves on to examine the impact of the policy among several subsamples. First, the impact of the policy is estimated during years 1997–2004 and then 2005–2013, time periods corresponding to the first and second episodes of bonus depreciation. Based on the balancing tests performed in Section 6 and the observation that more states chose to adopt the first bonus iteration, it seems that the 2001–2004 federal bonus episode may be a better experiment than the second episode. This analysis will also answer whether there are decreasing or increasing marginal returns to state 179 allowances as the policy impacts are estimated separately from $20,000 to $100,000 and from $100,000 to $500,000. As noted in the graphical analysis, its seems that 179 allowances at lower levels may not stimulate investment.

Second, the effects of the policies are estimated as the sample is progressively limited to industry-by-year observations in the top three quartiles and then top half of the sample according to state corporate tax rates (rates above 4.9% and above 6.9%). The primary reason for this analysis is to determine whether the investment and employment responses are primarily driven by intensive margin responses at established plants or by the allocation of new and reallocation of existing operations across states. For businesses already established in a state, both tax incentives are worth more when the state corporate tax rates are higher. However, firms looking to allocate or reallocate production should choose locations that have low state corporate tax rates *and* generous state bonus and 179 policies. Thus, if the impacts of the policies are larger in high corporate tax rate states, the intensive margin responses are likely the primary drivers. If however, the impacts are larger in low corporate tax rate states, the extensive and reallocation effects of the policies are likely to be the primary reason the policies stimulate investment.

Finally, the analysis is limited to exclude groups that were least likely to adopt bonus to conform to section 179 allowances according to the balancing tests performed in Section 6. By

eliminating these less likely adopters, more comparable treatment and control groups are established and estimates of the policy are less likely to be based on omitted state characteristics than are associated with industries in these least alike states.

Table 9: Investment and Employment Impacts by Time Period

Dependent Variable:	ln CapX		ln Emp	
Time Period	Prior to 2005	After 2004	Prior to 2005	After 2004
Specification	(1)	(2)	(3)	(4)
State Bonus	0.094	0.196	-0.038	0.064
	(0.131)	(0.126)	(0.037)	(0.051)
State 179	-0.100**	0.015*	-0.047***	-0.000
	(0.038)	(0.009)	(0.017)	(0.005)
Bonus x 179	0.133	-0.055**	0.122**	-0.013
	(0.150)	(0.026)	(0.047)	(0.011)
Adj. R-Square	0.209	0.236	0.517	0.586
Groups	826	841	889	920
Observations	5,850	6,137	6,103	6,761

Notes: All specifications present estimates of regression model (3) and include time and NAICS x Year fixed effects, state-specific NAICS fixed effects, as well as state time-varying controls. The dependent variables in Specifications (1) and (2) is the log of capital expenditures. The dependent variable in Specifications (3) and (4) is the log of employees. Specifications (1) and (3) limit the analysis to years prior to 2005. Specifications (2) and (4) limit the analysis to years after 2004. Standard errors are clustered at the state-industry-state level. Statistical significance at the 1 percent level is denoted by ***, the 5 percent by **, and the 10 percent by *.

Table 9 presents estimates of regression model (3) both for investment and employment during years 1997–2004 and years 2005–2013. The point estimates indicate that both State Bonus and State 179 have a larger impact on investment during the later part of the sample period. The interaction term is only negative in years the later period suggesting that Section 179 only swamped bonus during the second bonus episode. Both of these finding are consistent with the marginal effects and graphical analyses presented in Subsections 7.2 and 7.3.

The employment estimates from the split sample analysis are intriguing. The positive interaction term in Specification (3) indicates that in years 1997–2004, the two policies had complementary impacts. When a state adopted bonus and conformed to 179 its employment increased. In the later period there are no statistically significant results. One interpretation of these results is that in the first period cash windfalls from the policies were used to increase employment; in the later period cash windfalls were not. Overall the evidence presented in Table 9 confirms the graphical

evidence which suggests that there are increasing returns to State 179 allowances and that there may have been some employment response to the investment incentives when both policies were enacted during the first episode of bonus.

Table 10 presents estimates from regression model (3) when the sample is limited by state corporate income tax rates. On the investment side, point estimates on the bonus decreases as tax rates are increased. State 179 estimates go down then up as the tax rate is increased. The bonus pattern is consistent with a significant portion of policy response due to within firm allocation and reallocation across state lines. Assuming that no businesses would allocate or reallocate production to states in the top half of the corporate income tax distribution to take advantage of depreciation incentives, one can estimate the proportion of bonus response due to allocation / reallocation as $(0.174 - 0.142)/(0.174)$. This back of the envelope calculation implies that approximately 18% of the investment response to bonus is due to within-firm allocation and reallocation of business activity across state lines. The same exercise suggests that 65% is due to within firm movement. The estimated employment effects are increasing in the tax rate but are not statistically significant.

Table 10: Investment and Employment Impacts by State Corporate Tax Rates

Dependent Variable:	ln CapX			ln Emp		
State Corp Tax Rate	$> 0\%$	$> 4.9\%$	$> 6.9\%$	$> 0\%$	$> 4.9\%$	$> 6.9\%$
Specification	(1)	(2)	(3)	(4)	(5)	(6)
State Bonus	0.174**	0.137	0.142	0.003	0.012	-0.017
	(0.073)	(0.085)	(0.089)	(0.024)	(0.027)	(0.029)
State 179	0.020**	0.013	0.007	-0.000	-0.003	-0.002
	(0.009)	(0.009)	(0.015)	(0.004)	(0.005)	(0.011)
Bonus 179 Interaction	-0.047***	-0.033*	-0.036	-0.000	-0.001	0.009
	(0.016)	(0.017)	(0.022)	(0.006)	(0.007)	(0.010)
Adj. R-Square	0.286	0.267	0.273	0.705	0.684	0.648
State x NAICS Groups	883	759	400	933	806	433
Observations	11,987	9,502	4,066	12,864	10,253	4,426

Notes: All specifications present estimates of regression model (3) and include time and NAICS x Year fixed effects, state-specific NAICS fixed effects, as well as state time-varying controls. The dependent variables in Specifications (1)–(3) is the log of capital expenditures. The dependent variable in Specifications (4)–(6) is the log of employees. Specifications (1)–(3) and (4)–(6) progressively limit the investment then employment analysis to states with higher corporate tax rates. Standard errors are clustered at the state-industry-state level. Statistical significance at the 1 percent level is denoted by ***, the 5 percent by **, and the 10 percent by *.

Table 11 presents estimates of regression model (3) when the sample is limited to those states most likely to adopt the policies based on the balancing analysis in Section 6. Overall, coefficient magnitudes are similar to baseline estimates or larger although many are not statistically significant potentially due to the smaller sample size. The estimates suggest that differences in state characteristics between states that do and do not enact the policies are not driving the headline empirical results presented in Table 5.

This most striking result from Table 11 is presented in (3) which limits the analysis to states that were in better financial situations. Among industries in these states, adopting of 100% bonus increased investment by 27.3. These results suggest that industries in states that were already doing well and were to afford bonus further increased investment and potentially future growth. As a result, adoption of bonus might have had distrobutional consequences. This point is further discussed in the following and concluding section.

Table 11: Limiting by Bonus Adoption 179 Conformity Determinants

Dependent Variable:	ln CapX			
Selection:	High Corp Tax	Low Dem Leg %	Low Budget Gap	Low GSP/Capita
Specification	(1)	(2)	(3)	(4)
State Bonus	0.137	0.175**	0.278***	0.173*
	(0.085)	(0.077)	(0.077)	(0.089)
State 179	0.013	0.010	0.020**	0.021
	(0.009)	(0.011)	(0.009)	(0.014)
Bonus 179 Interaction	-0.033*	-0.042**	-0.073***	-0.043*
	(0.017)	(0.019)	(0.018)	(0.022)
Adj. R-Square	0.267	0.303	0.267	0.268
State x NAICS Groups	759	792	866	862
Observations	9,502	8,797	8,897	8,377

Notes: All specifications present estimates of regression model (3) and include time and NAICS x Year fixed effects, state-specific NAICS fixed effects, as well as state time-varying controls. The dependent variables in Specifications (1)–(3) is the log of capital expenditures. The dependent variable in Specifications (4)–(6) is the log of employees. Specifications (1)–(3) and (4)–(6) progressively limit the investment then employment analysis to states with higher corporate tax rates. Standard errors are clustered at the state-industry-state level. Statistical significance at the 1 percent level is denoted by ***, the 5 percent by **, and the 10 percent by *.

10 Conclusion

The empirical results presented in this paper suggest that both state adoption of federal bonus depreciation and state conformity to federal Section 179 allowances have a large and significant impact on manufacturing investment. The impact of either policy on investment is blunted as the generosity of the other policy is increased. Estimating the impact of either policy therefore can only be done when the level other is specified. For example, when the bonus is 50% and federal Section 179 allowances are set at 0, investment by industries in adopting states increases by 8.75% relative to investment by industries in rejecting states. This impact decreases to only 4.05% if both adopting and rejecting states set their Section 179 allowances by $100,000. Conversely, when a state sets its Section 179 allowances to $250,000, investment is estimated to increase by 5.00% when bonus is set to 0%. When bonus is set to 50%, this impact adjusts to 2.65%. Assuming that no firm would choose to reallocate business activity into states in the top half of corporate income taxes due to investment incentives, a large portion – between 18 and 65% – of the investment response is due to firm-level allocation or reallocation of productive assets.

Estimates indicate that neither policy affected employment. This is counter-intuitive under the assumption that capital and labor are not perfect substitutes. There are two potential explanations for this result. First, it could be that the capital investment that was done as a result of depreciation incentives simply replaced old worn out machines and no additional employees were needed to operate the new machinery. This explanation, however, can only account for some of the divergence between increased investment and level employment because at least part of the investment response seems to be due to reallocation. Even when replacement capital is moved between states, the employment in the destination state should increase by the amount necessary to operate the equipment. Thus, replacement investment cannot be the only explanation for the zero effect of the policies on employment. The second possible explanation is that investments made in response to the state depreciation incentives were in largely investments in new technologies that required fewer employees per dollar of investment asset. This explanation could lead to decreases in employment associated with intensive margin investment responses and only slight increases associated with reallocative investments for a zero sum effect.

The lesson to be learned from this project for state governments is clear: adopting federal depreciation incentives leads to increased business investment in your states. In a competitive context, even small incentives that marginally decrease present value investment costs have large impacts. This lesson may be generalizable to future federal business incentives and in other federal incentive policy contexts such as the Earned Income Tax Credit and the Supplemental Nutritional Assistance Program.

The lessons to be learned by the federal government are more abstract. The first is that state equity considerations should perhaps play a role in future investment policy decisions; the states

that adopt federal policies benefit while states that do not suffer. This inequality of outcomes is a problem if the states that are able to adopt the policy from a budgetary perspective may be already better off than the states that are not able. Thus, federal incentives may increase state inequality. Second, if the federal government wishes to stimulate employment – as it stated in bonus and Section 179 legislation – then it should have used a policy directed at employment not investment. More generous treatment of depreciation for tax purposes led to more investment but not more employment at the state level. If these results generalize to the federal context then federal investment incentives achieved more investment but none of the hoped for increases in employment; the federal government got exactly what it paid for.

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Appendix A State Bonus Policies

Table 12: Bonus Depreciation State Adoption

State	Bonus Episode 1	Bonus Episode 2	Special
Alabama	Full Adopter	Full Rejecter	
Alaska	Full Adopter	Full Adopter	No Bonus for Oil and Gas Corps
Arizona	Full Rejecter	Full Rejecter	
Arkansas	Full Rejecter	Full Rejecter	
California	Full Rejecter	Full Rejecter	
Colorado	Full Adopter	Full Adopter	
Connecticut	Full Rejecter	Full Rejecter	
Delaware	Full Adopter	Full Adopter	
Florida	Full Adopter but 2003	1/7 Adopter	
Georgia	Full Rejecter	Full Rejecter	
Hawaii	Full Rejecter	Full Rejecter	
Idaho	Full Adopter	Full Rejecter	
Illinois	Full Rejecter	Full Rejecter but for 2011	
Indiana	Full Rejecter	Full Rejecter	
Iowa	Full Adopter but for 2001, 2002	Full Rejecter	
Kansas	Full Adopter	Full Adopter	
Kentucky	Full Rejecter	Full Rejecter	
Louisiana	Full Adopter	Full Adopter	
Maine	2001 Full Adopter 2002 2 Yr Postponed After 2002 5%	Rejecter but 2011, 2012: 10%	
Maryland	Full Rejecter	Full Rejecter	

Notes: Full Rejecters are those states that allowed for no bonus depreciation. Full Adopters are those states that allowed for the statutory federal level of bonus depreciation. Data is taken from "State Conformity with Federal Bonus Depreciation Rules" by Jessica Lechuga, posted on Bloomber BNA. Dark gray rows are states that were full adopters during both bonus episodes. Light gray states are those that fully adopted for a sub sample of years or partially adopted the federal policy.

Table 12A: Bonus Depreciation State Adoption Continued

State	Bonus Episode 1	Bonus Episode 2	Special
Massachusetts	Full Rejecter	Full Rejecter	
Michigan	Full Rejecter	Full Rejecter	
Minnesota	20% Adopter	20% Adopter	
Mississippi	Full Rejecter	Full Rejecter	
Missouri	2001, 2002 Adopter	Full Adopter	
Montana	Full Adopter	Full Adopter	
Nebraska	32% Adopter	Full Adopter	
Nevada			No Corporate Income Tax
New Hampshire	Full Rejecter	Full Rejecter	
New Jersey	Full Rejecter but for 2001	Full Rejecter	
New Mexico	Full Adopter	Full Adopter	
New York	Pre 2003 Full Adopter	Full Rejecter	Bonus Allowed if in Resurgence Zone or New York Liberty Zone
North Carolina	30%Adopter in 2003, 2004	15% Adopter	
North Dakota	Full Adopter	Full Adopter	
Ohio	1/6 Adopter	1/6 Adopter	Corporate Franchise Tax Phased out in 2010
Oklahoma	2001, 2002: 20% Adopter; 2003: Full Adopter	2008, 2009: 20% Adopter; 2010+: Full Adopter	
Oregon	Full Adopter	2009, 2010: Full Adopter but for 2009, 2010	

Notes: Full Rejecters are those states that allowed for no bonus depreciation. Full Adopters are those states that allowed for the statutory federal level of bonus depreciation. Data is taken from "State Conformity with Federal Bonus Depreciation Rules" by Jessica Lechuga, posted on Bloomber BNA. Dark gray rows are states that were full adopters during both bonus episodes. Light gray states are those that fully adopted for a sub sample of years or partially adopted the federal policy.

Table 12B: Bonus Depreciation State Adoption Continued

State	Bonus Episode 1	Bonus Episode 2	Special
Pennsylvania	3/7 Adopter	Full Rejecter but for 2011	
Rhode Island	Full Rejecter	Full Rejecter	
South Carolina	Full Rejecter	Full Rejecter	
South Dakota			No Corporate Income Tax
Tennessee	Full Rejecter but for 2001, 2002	Full Rejecter	
Texas	Full Rejecter	Full Rejecter	
Utah	Full Adopter	Full Adopter	
Vermont	Full Rejecter	Full Rejecter	Allowed for Individuals prior to 2008
Virginia	Full Rejecter	Full Rejecter	Allowed for Qualifying Disaster Property
Washington			No Corporate Income Tax
West Virginia	Full Adopter	Full Adopter	
Wisconsin	Full Rejecter	Full Rejecter	
Wyoming			No Corporate Income Tax

Notes: Full Rejecters are those states that allowed for no bonus depreciation. Full Adopters are those states that allowed for the statutory federal level of bonus depreciation. Data is taken from "State Conformity with Federal Bonus Depreciation Rules" by Jessica Lechuga, posted on Bloomber BNA. Dark gray rows are states that were full adopters during both bonus episodes. Light gray states are those that fully adopted for a sub sample of years or partially adopted the federal policy.

Appendix B Bonus Depreciation Legislation

- The Job Creation and Workers Assistance Act of 2002 enacted 30% bonus depreciation for property placed into service after September 10, 2001.
- The Jobs and Growth Tax Relief Reconciliation Act of 2003 increased the bonus level to 50% for property placed into service after May 5, 2003, and before January 1, 2005.
- Bonus depreciation expired December 31, 2004.
- The Economic Stimulus Act of 2008 reintroduced the bonus depreciation at a 50% rate for capital placed into service after January 1, 2008.
- American Recovery and Reinvestment Act of 2009 extended the bonus at the 50% rate through 2009.
- The Small Business Jobs and Credit Act of 2010 further extended the depreciation at the same rate through 2010. However, SBJCA was not signed into law until September 27, 2010, so for the majority of 2010 businesses may have been under the impression that the bonus depreciation might not be available on new capital expenditure.
- The Tax Relief and Unemployment Insurance Reauthorization and Job Creation Act of 2010 (signed on December 17, 2010) raised the bonus rate to 100% for property placed into service after September 8, 2010, and before January 1, 2012. Property placed into service during 2012 garnered the 50% bonus.
- The American Taxpayer Relief Act of 2012 extended bonus depreciation at a rate of 50% for 2013.
- The Tax Increase Prevention Act of 2014 which was signed into law on December, 2014 retroactively extended bonus through year 2014.

Appendix C State Control Variables

Controls Taken from The Book of States

- Corp Rev % – the percentage of total state revenue derived from state corporate income taxes
- State Budget Gap – total state deficit as a fraction of total state revenue
- Democratic Legislator % – percentage of democratic state legislators that identify as Democrats
- Democratic Governor – an indicator equal to 1 if the governor is a Democrat

Controls Taken from the Tax Foundation

- Corp Tax Rate – top marginal corporate income tax rates

Controls Taken from the Census

- State Population

Controls Taken from the BEA

- Gross State Product

Appendix D Descriptive Statistics

Table 13: Descriptive Statistics

	mean	median	std dev	min	max	count
Policy Variables						
State Bonus	0.0783	0	0.189	0	1	12,592
State 179	1.409	0.250	1.720	0.200	5	12,592
Outcomes						
CapEx(millions)	165.6	66.57	337.1	0	6,828.5	12,592
Employees	16,454.4	8,755	23,884.8	0	39,6422	12,592
Prod Wrkrs	11,647.2	6,295	16,452.9	0	22,3017	12,575
Wages / Prod Wrkr	34.23	33.02	11.05	0	114.8	12,415
Payroll / Emp	40.71	39.09	13.02	0	128.3	12,465
State Controls						
Dem Legislature %	51.98	51.08	15.27	11.43	115.0	12,592
Dem Governor	0.455	0	0.498	0	1	12,592
Corp Tax Rate	0.0720	0.0700	0.0195	0.00260	0.120	12,592
Corp Tax %	0.0599	0.0525	0.0339	0	0.329	12,592
Budget Gap	0.000550	-0.0543	0.434	-0.394	8.249	12,592
GSP (billions)	290.9	195.7	328.5	15.53	2215.7	12592
Population (millions)	3.708	1.299	5.576	0.0449	38.41	12,592

Notes: All specifications present estimates from variants of equation (1). The dependent variable in specifications (1) through (3) is the log of capital expenditures. The dependent variables in specifications (4) through (6) is the log of employees. All specifications include include Year fixed effects. Specifications (2), (3), (5), and (6) a robust set of controls to capture changes in state politics, productivity, population, and finances. Specifications (3) and (6) also include NAICS x Year fixed effects. Standard errors are clustered at the by state-specific industries and are reported in parentheses. Statistical significance at the 1 percent level is denoted by ***, the 5 percent by **, and the 10 percent by *.

Appendix E Policy Overlap

Table 14: Overlapping Adoption of Bonus and Conformity to 179

	2004		
	179 Conformers	179 Non-Confs	Total
Bonus Rejecter	9	22	31
Bonus Adopter	0	14	14
Total	9	36	45
	2010		
	179 Conformers	179 Non-Confs	Total
Bonus Rejecter	15	18	33
Bonus Adopter	0	12	12
Total	15	30	45

Notes: Table 14 presents a cross tab that describes the number of states according to their bonus adoption and 179 conformity in 2004 and in 2010.

Appendix F Robustness of Baseline Investment Results

Table 15: Robustness of Baseline CapEx Analysis

Dependent Var:	ln CapEx			
Specification	(1)	(2)	(3)	(4)
State Bonus	0.158	0.219	0.182	0.174
State X NAICS SE	(0.075)**	(0.075)***	(0.070)***	(0.068)**
State SE	(0.081)*	(0.075)***	(0.079)**	(0.073)**
NAICS SE	(0.057)**	(0.062)***	(0.053)***	(0.053)***
State 179	0.014	0.013	0.014	0.020
State X NAICS SE	(0.009)	(0.010)	(0.008)*	(0.010)*
State SE	(0.013)	(0.012)	(0.011)	(0.009)**
NAICS SE	(0.007)*	(0.008)	(0.007)*	(0.010)*
Bonus 179 Interaction	-0.017	-0.047	-0.047	-0.047
State X NAICS SE	(0.020)	(0.020)**	(0.017)***	(0.017)***
State SE	(0.024)	(0.021)**	(0.021)**	(0.016)***
NAICS SE	(0.016)	(0.016)***	(0.015)***	(0.014)***
Year FE	✓	✓	✓	✓
State Controls		✓	✓	✓
NAICS x Year FE			✓	✓
State Time Trends				✓
Adj. R-Square	0.073	0.091	0.276	0.286
State x NAICS Groups	915	883	883	883
Observations	13,034	11,987	11,987	11,987

Notes: All specifications present estimates from variants of equation (3) with Ln CapEx as the dependent variable. All specifications include year and State x NAICS Fixed Effects. Specifications (2) though (4) progressively add time-varying state controls, NAICS x Year FE and state linear time trends. Clustered standard errors are reported in parentheses. Statistical significance at the 1 percent level is denoted by ***, the 5 percent by **, and the 10 percent by *.