The Effect of Tax Incentives on U.S. Manufacturing: Evidence from State Accelerated Depreciation Policies

Web Supplement

Eric Ohrn

October 2019

Appendix A Bonus depreciation example

Table A1 examines the impact of 50% bonus depreciation 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 *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.[1] The after-tax present value cost of the investment is $71.21 (=100-28.79).

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 depreciation 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. The 50% bonus rate increases the present-value of tax shields and symmetrically decreases the present-value after-tax cost of the investment by $3.10 or 3.1 percentage points.

Table A1: Effect of Federal 50% Bonus Depreciation on Present Value Deductions

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)									$\boxed{28.79}$
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)									$\boxed{31.89}$

Notes: Table A1 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 depreciation regime. The federal corporate tax rate is assumed to be 35%. The discount rate is assumed to be 10%.

State bonus depreciation is inherently less valuable to firms than federal bonus depreciation because all state corporate tax rates are significantly lower than the 35% federal rate. Among all states, the average state income corporate tax rate during the sample period 7.0% (for states that collected corporate income taxes). Table A2 shows the impact of state 50% bonus depreciation on

[1] 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.

the present value of tax depreciation allowances when the corporate income tax rate is 7.0%. The 50% bonus depreciation decreases the after tax cost of the $100 by 0.058% or $0.58.

Table A2: Effect of State 50% Bonus Depreciation on Present Value Deductions

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	1.75	1.50	1.07	0.77	0.61	0.61	0.61	0.08	7.0
PV(τ_s x Deduction)									$\boxed{5.80}$
50% Bonus Ded.	62.5	10.72	7.65	5.47	4.37	4.37	4.37	0.55	100
τ_f x Deduction	4.38	0.75	0.54	0.39	0.31	0.31	0.31	0.038	7.0
PV(τ_s x Deduction)									$\boxed{6.38}$

Notes: Table A2 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 depreciation regime. The state corporate tax rate is assumed to be 7%. The discount rate is assumed to be 10%.

Appendix B State tax-adjusted user cost of capital calculations

Appendix B incorporates bonus depreciation and Section 179 allowances into the state tax-adjusted user cost framework of Mead (2001). The adjusted user costs are then calibrated and used to calculate how different levels of federal and state bonus depreciation and federal and state Section 179 allowances affect investment costs. The appendix also shows how state apportionment can be incorporated into the state tax-adjusted user cost. The apportionment-adjusted user cost demonstrates the challenges in measuring how state apportionment amplifies or mitigates the effect of state accelerated depreciation policies.

Several conclusions can be drawn from the user cost calculations. First, both state bonus depreciation and state Section 179 allowances decrease the user cost of capital. Second, as predicted in Section 3, the decrease in the average user cost due to state bonus depreciation is smaller in states with high Section 179 allowances because bonus depreciation has no effect on user costs for investments can be expensed under Section 179 rules. Third, the effect of increasing state Section 179 allowances on the user cost of newly eligible investments is decreasing in the state bonus depreciation rate. Fourth, adopting 100% state bonus depreciation for investments that cannot be expensed under Section 179 rules, decreases the user cost of capital by just under 1%. Increasing state Section 179 allowances when no bonus depreciation is offered also decreases the user cost of capital on newly eligible investments by just under 1%. These percent changes in the user cost of capital are very close to the percent change estimates in the after-tax present value cost investment costs presented in Section 2, reinforcing the use of the after-tax present value cost in calculating investment elasticities, as in Section 8.

B.1 State tax-adjusted user costs

The canonical Hall and Jorgenson (1967) user cost of capital describes the after-tax present value cost of \$1 of new investment. In a model that consider only federal taxes, Hall and Jorgenson (1967) derive the federal user cost of capital, ucc_f as

$$ucc_f = (r + \delta)\frac{1 - \xi_f - \tau_f z_f}{1 - \tau_f}$$

where r is the after-tax return on capital demanded by investors and δ is the rate of economic depreciation. τ_f is the federal corporate income tax rate, ξ_f is the federal investment tax credit, and z_f is the present value of federal depreciation deductions as defined in Section 3.

Mead (2001) extends the classic user cost of capital framework to incorporate state taxes and tax incentives and their interactions with the federal statutes. First, consider a firm that operates in only one state (all property, payroll, and sales occur only in a single state). Further assume that there are no local (sub-state) taxes. Under these assumptions, the state-specific user cost of capital, ucc_s can be written as

$$ucc_s = (r + \delta)\frac{1 - \xi_f - \xi_s - T_f z_f - (1 - T_f)\tau_s z_s}{1 - T_f(1 - \tau_s)}$$

where τ_s is the state corporate income tax rate, ξ_s is the state investment tax credit, and z_s is the present value of depreciation deductions allowed by the state. T_f is the effective federal tax rate accounting for any federal taxes deducted from the state tax bill.

$$T_f = 1 - \frac{1 - \tau_f}{1 - \tau_f \tau_s D_s}$$

where D_s is the percentage of federal corporate income taxes that may be deducted from the state corporate income tax bill.[2]

To incorporate accelerated depreciation incentives, we can rewrite z_f and z_s as

$$z_f = b_f + (1 - b_f)z_f^0 \text{ and}$$
$$z_s = b_s + (1 - b_s)z_s^0$$

where b_f and b_s are federal and state bonus depreciation rates, respectively. As in Section 3, assume

[2] While federal deductibility has some effect on the user cost, because it scales both the numerator and denominator, it does little to mitigate the effect of state accelerated depreciation policies on the user cost.

that for both z^0_f and z^0_s,

$$z^0 = \begin{cases} 1 & \text{if } I \leq \text{Section 179 allowance and} \\ z_{MACRS} & \text{if } I > \text{Section 179 allowance.} \end{cases}$$

Calibration

I begin by assuming $r = 0.07$ following Zwick and Mahon (2017) and $\delta = 0.10$ following Chirinko, Fazzari and Meyer (1999). The federal corporate tax rate during the sample period was 35% so $\tau_f = 0.35$. z_{MACRS} for the average investment is equal to 0.88 (Zwick and Mahon, 2017). No federal investment tax credit was in place during the sample period so ξ_f is set to 0.

For the sample of state-years in which either state bonus depreciation was available or states conformed to federal Section 179 allowances in 2003 or later, the average state corporate income tax rate was 7%, the average state investment tax credit was 1.8%, and average state allowed firms to deduct 13.5% of their federal income taxes from their state taxes; $\tau_s = 0.07$, $\xi_s = 0.018$, and $D_s = 0.135$. State investment tax credit and deductibility data is taken from Suárez Serrato and Zidar (2018).

Calculating the effect of accelerated depreciation polices on *ucc*

Table B1 calculates the effect of federal and state depreciation policies on the state user cost of capital. Panel A. focuses on the effect of federal and state bonus depreciation on *ucc*. Panel B. focuses on the effect of federal and state Section 179 expensing allowances.

Bonus depreciation

In policy combination (A), no bonus depreciation is offered at either the federal or state level ($b_f = b_s = 0$). In the absence of bonus depreciation, the present value of depreciation allowances at both the federal and state levels is 0.88 (Zwick and Mahon, 2017). In (B), 50% federal bonus depreciation is implemented. This decreases the user cost of capital by 3.283%. In (C), state 50% bonus is adopted on top of the federal bonus rate, decreasing the user cost of capital decreases by an additional 0.445%. Although it is not represented in Table B1, implementing 100% federal bonus depreciation decreases the user cost by 6.57%. Adopting 100% bonus depreciation at the state level on top of the federal 100% bonus decreases the state user cost by 0.922%.

Policy combination (D) and (E) shows how implementing federal and state bonus depreciation at a 50% rate affects the user cost of capital for investments below the federal and state Section 179 allowance, those for which $z^0 = 1$. Implementing bonus depreciation for investments that can already be immediately expenses has no effect on the user cost of capital.

Overall, both federal and state bonus depreciation decrease the user cost of capital and incentivize investment. The effect of state bonus depreciation is smaller than the effect of federal bonus depreciation. The effect of state or federal bonus depreciation is zero for investments that qualify for Section 179 expensing. As a result, the effect of state bonus depreciation implementation on the use cost will be smaller in states will higher Section 179 allowances.

Section 179 expensing

Policy combination (F) repeats policy combination (A). Policy combination (G) adds federal Section 179 allowances as indicated by $z_f^0 = 1$ to marginal investments. This decreases the user cost of capital by 7.428%. Policy combination (H) adds state Section 179 expensing ($z_s^0 = 1$) on top of federal expensing, decreasing the user cost of capital by an additional 0.922%.

Policy combinations (I), (J), and (K) repeat the (F), (G), (H) progression of federal and state Section 179 expensing in the presence of 50% federal and state bonus depreciation. Federal Section 179 expensing decreases the user cost of capital by 3.410%. State Section 179 expensing decreases the user cost an additional 0.463%.

Overall, Section 179 Expensing decreases the user cost of capital for investments below the allowance level. The decrease in user costs decreases in magnitude as bonus depreciation is made more generous. Therefore, the effect of increases in state Section 179 allowances on the *ucc* will be smaller in states with higher bonus depreciation rates.

Table B1: User Cost of Capital and Accelerated Depreciation Incentives

Panel A. Federal and State Bonus Depreciation						
Policy Combination	z_f^0	z_s^0	b_f	b_s	ucc_s	% change
(A)	0.88	0.88	0	0	0.1598	–
(B)	0.88	0.88	0.5	0	0.1545	(A) to (B): -3.283%
(C)	0.88	0.88	0.5	0.5	0.1538	(B) to (C): -0.445%
(D)	1	1	0	0	0.1479	–
(E)	1	1	0.5	0.5	0.1479	(D) to (E): 0%
Panel B. Federal and State Section 179 Expensing						
Policy Combination	z_f^0	z_s^0	b_f	b_s	ucc_s	% change
(F)	0.88	0.88	0	0	0.1598	–
(G)	1	0.88	0	0	0.1493	(F) to (G): -7.428
(H)	1	1	0	0	0.1479	(G) to (H): -0.922
(I)	0.88	0.88	0.5	0.5	0.1538	–
(J)	1	0.88	0.5	0.5	0.1486	(I) to (J): -3.410%
(K)	1	1	0.5	0.5	0.1479	(J) to (K): -0.463%

Notes: Table B1 calculates the state user cost of capital at different levels of federal and state Section 179 expensing and bonus depreciation policies.

B.2 Apportionment

Many firms are located in or make sales in more than one state. In these cases, states rely on apportionment formulas to determine how much of a firm's total business income is taxable in a given state. Gordon and Wilson (1986) show the percentage of total profits that are apportioned to state s can be written as

$$\alpha_s = a_s^K \frac{K_s}{K} + a_s^W \frac{W_s}{W} + a_s^S \frac{S_s}{S}$$

where K_s/K is fraction of total property located in state s, W_s/W is fraction of total payroll located in state s, and S_s/S is fraction of total sales that take place in state s. a_s^K, a_s^W, and a_s^S are the apportionment weights given to property, payroll, and sales.

Mead (2001) shows that incorporating state apportionment leads to the following user cost of capital formulation:

$$ucc_s = (r+\delta)\frac{1 - \sum_{s\in S}\alpha_s\xi_s - T_f[b_f + (1-b_f)z_f] - (1-T_f)\sum_{s\in S}\alpha_s\tau_s[b_s + (1-b_s)z_s]}{1 - T_f(1 - \sum_{s\in S}\alpha_s\tau_s)}$$

where the average effective federal corporate income tax rate taking into account state deductions is

$$T_f = 1 - \frac{1-\tau_f}{1-\tau_f \sum_{s\in S}\alpha_s\tau_s D_s}.$$

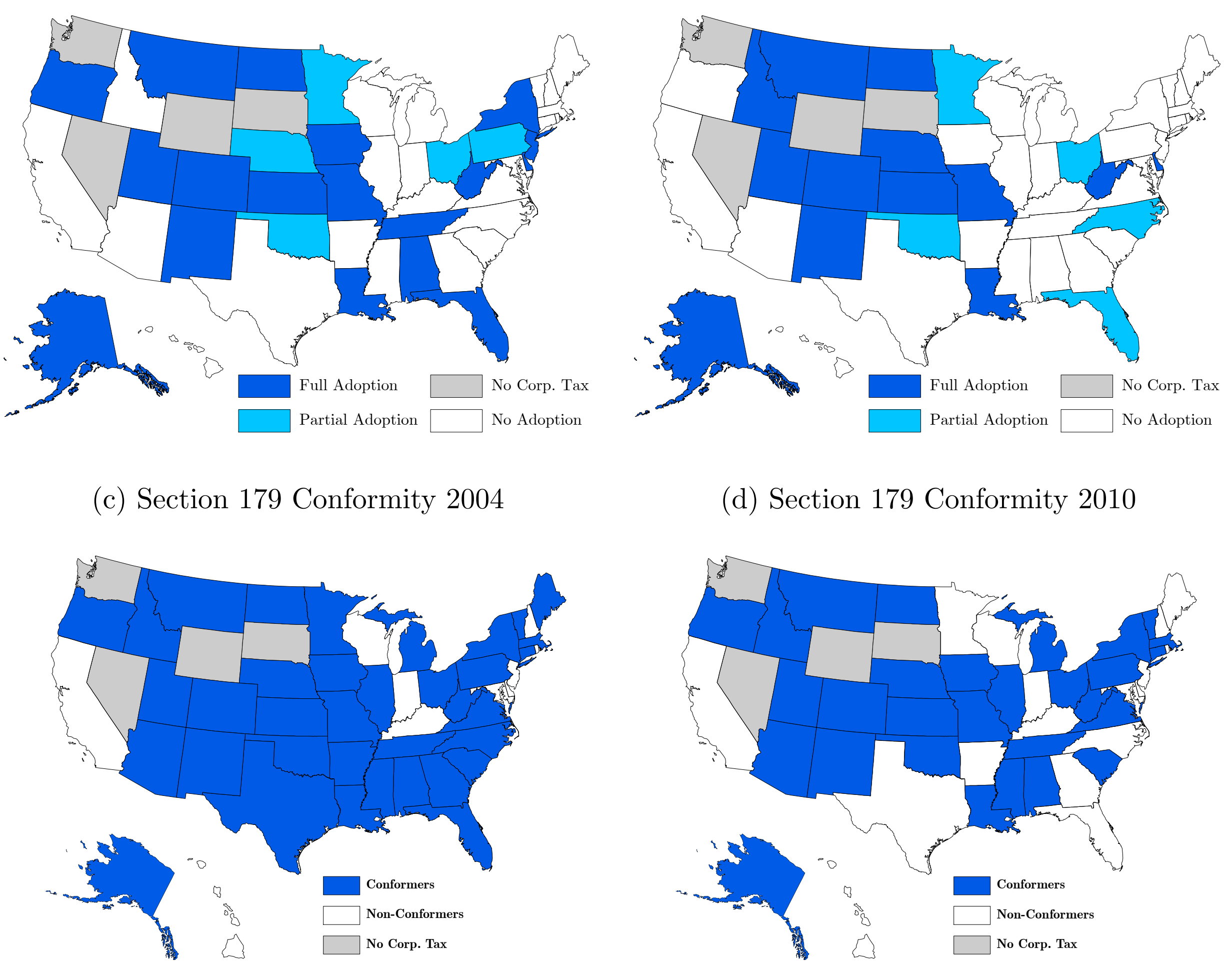
The key insight in terms of state accelerated depreciation policy is that the effect of b_s or z_s will have the most effect when α_s is large. While time-varying state-level data on weights a_s^K, a_s^W, and a_s^S are available, data on the portion of capital, wages, and sales made in each state by the ASM sample are not. Therefore, it is hard to empirically explore how state apportionment interacts with state accelerated depreciation policies.

Appendix C Additional description of state policy adoption

Appendix C provides further description of state adoption of federal bonus depreciation and Section 179 expensing. Section C.1 maps adoption of the policies. Section C.2 provides adoption rates, federal bonus rates, and federal Section 179 allowances during the sample period. Section C.3 describes how the state policies covary in 2004 and 2010.

C.1 Mapping state policy adoption

Figure C1: Mapping State Bonus Adoption & Section 179 Conformity



(a) Bonus Adoption 2001

(b) Bonus Adoption 2008

(c) Section 179 Conformity 2004

(d) Section 179 Conformity 2010

Notes: Panels (a) and (b) of Figure C1 map bonus depreciation adoption in 2001 and 2008. Panels (c) and (d) map Section 179 conformity in 2004 and 2010.

C.2 Accelerated depreciation adoption rates and generosity over time

Table C1: State Bonus Depreciation Adoption and Section 179 Conformity

	(A) Bonus Depreciation			(B) Section 179		
Year	Bonus Rate (%)	Adopters	Percent	Allowance ($1,000)	Conformers	Percent
Pre 2000	0	–	–	$\leq$20	45	100
2001	30	20	44.4	24	45	100
2002	30	18	40.0	24	45	100
2003	50	19	42.2	100	34	75.6
2004	50	20	44.4	102	35	77.8
2005	0	–	–	105	35	77.8
2006	0	–	–	108	35	77.8
2007	0	–	–	125	34	75.6
2008	50	16	35.6	250	31	68.8
2009	50	17	37.8	250	30	66.7
2010	50	16	35.6	500	28	62.2
2011	100	19	42.2	500	29	64.4
2012	50	18	40.0	500	29	64.4
2013	50	18	40.0	500	29	64.4
2014	50	17	37.8	500	30	66.6

Notes: Table C1 describes state adoption of federal bonus depreciation and state conformity to federal Section 179 allowances during the years 1997–2014. Bonus depreciation rates and Section 179 allowances are taken from IRS Form 4562 1997–2014. Adopters are the number of states that fully or partially adopted federal bonus depreciation. Conformers are states that fully conform to federal Section 179 rules. The bonus adoption rate and Section 179 conformity rates are calculated only for states that collect corporate income taxes.

C.3 Policy Overlap

Table C2: Overlapping Adoption of Bonus and Conformity to 179

	S179 Non-Conformers	S179 Conformers	Total
2004			
Bonus Rejecter	10	21	31
Bonus Adopter	0	14	14
Total	10	35	45
2010			
	S179 Non-Conformers	S179 Conformers	Total
Bonus Rejecter	17	16	33
Bonus Adopter	0	12	12
Total	17	28	45

Notes: Table C2 presents cross-tabulations of states that partially or fully adopt bonus depreciation and states that fully conform to federal Section 179 rules in 2004 and in 2010.

Appendix D Alternative Specifications

Table D1: Effect of State Accelerated Depreciation Policies; Alternate Specifications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Log(CapX)	Log(CapX)	Log(CapX)	Log(CapX)	Log(CapX)	Log(CapX)	Log(CapX)
State Bonus	0.184**	0.216***	0.201***	0.180**	0.0711*		0.0588
	(0.0785)	(0.0744)	(0.0732)	(0.0788)	(0.0403)		(0.0424)
State 179	-0.00260	0.00487	0.0163*	0.0206**		0.0165**	0.0141*
	(0.0140)	(0.0103)	(0.00821)	(0.00782)		(0.00770)	(0.00810)
State Bonus × State 179	-0.0234	-0.0437**	-0.0474***	-0.0420**			
	(0.0238)	(0.0197)	(0.0160)	(0.0173)			
Year FE	✓	✓	✓	✓	✓	✓	✓
State NAICS FE	✓	✓	✓	✓	✓	✓	✓
Controls		✓	✓	✓	✓	✓	✓
NAICS Year FE			✓	✓	✓	✓	✓
State Trends				✓	✓	✓	✓
State NAICS Groups	1022	1022	1022	1022	1022	1022	1022
Observations	13047	13047	13047	13047	13047	13047	13047
Adj. R^2	0.000584	0.0221	0.0453	0.0407	0.0398	0.0399	0.0401

Notes: Table D1 presents coefficient estimates from specifications in the form of equation (1). Specification (1) includes year (time) and NAICS × State (observation-level) fixed effects. Specification (2) adds time-varying state controls. Specification (3) adds state-specific linear time trends. Specification (4) adds NAICS × year fixed effects and is equivalent to the baseline specification, (column 1, Table 3). Specifications (5), (6), and (7) estimate only the effect of State Bonus, only the effect of State 179, and State Bonus and State 179 without their interaction in the presence of the full suite of control variables, fixed effects, and state-specific linear time trends. Standard errors are clustered at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix E Table 2 Robustness

Table E1: Predicting State Adoption of Accelerated Depreciation Policies; LPM Model, Lagged Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	$\mathbb{1}$(Bonus)	$\mathbb{1}$(Sect. 179)	$\mathbb{1}$(Both)	$\mathbb{1}$(Bonus)	$\mathbb{1}$(Sect. 179)	$\mathbb{1}$(Both)	$\mathbb{1}$(Bonus)	$\mathbb{1}$(Sect. 179)	$\mathbb{1}$(Both)
L.Log(GSP/Pop)	-0.144	0.358	0.227	-0.290	0.479	0.0856	-0.0546	-0.256	-0.0946
	(0.327)	(0.299)	(0.360)	(0.211)	(0.392)	(0.294)	(0.226)	(0.360)	(0.363)
L.Log(Pop)	-0.0516	-0.136**	-0.176***	0.470	-1.624	-0.915	1.768	-1.965	1.626
	(0.0574)	(0.0592)	(0.0545)	(0.545)	(1.112)	(1.020)	(2.013)	(2.006)	(3.726)
L.Corp Tax %	-0.714	-2.726	-1.503	-0.397	0.0434	-0.832	0.460	0.0759	-0.384
	(1.618)	(1.660)	(1.558)	(0.810)	(0.602)	(0.892)	(1.398)	(0.830)	(1.728)
L.Budget Gap	-0.105	-0.200**	-0.0654	-0.0761	-0.0513	-0.0785	-0.0835	-0.0831	-0.102
	(0.114)	(0.0898)	(0.100)	(0.0994)	(0.107)	(0.104)	(0.107)	(0.115)	(0.120)
L.Corp Rate	4.044**	-4.357	-1.325	-0.327	0.714	0.134	-0.486	0.644	-0.877
	(1.640)	(2.892)	(2.489)	(0.535)	(1.238)	(0.787)	(2.191)	(1.882)	(2.621)
L.Dem Leg %	-0.00553*	-0.00669	-0.00562	-0.00318	0.00413	-0.00353	-0.00195	-0.00166	-0.00412
	(0.00316)	(0.00449)	(0.00367)	(0.00296)	(0.00381)	(0.00318)	(0.00169)	(0.00306)	(0.00310)
L.Dem Gov	0.105	0.0239	0.162**	0.0157	-0.0541	-0.00225	-0.0320	0.00916	-0.0147
	(0.0767)	(0.0752)	(0.0778)	(0.0309)	(0.0461)	(0.0324)	(0.0210)	(0.0366)	(0.0350)
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
State FE				✓	✓	✓	✓	✓	✓
State Trends							✓	✓	✓
Observations	389	303	303	389	303	303	389	303	303
Adj. R^2	0.0635	0.154	0.133	0.839	0.821	0.800	0.891	0.904	0.873

Notes: Table E1 uses linear probability models to predict the adoption of accelerated depreciation policies based on lagged state economic, political, and demographic characteristics. The outcome variable in specifications (1), (4), and (7) is the use of bonus depreciation. The outcome variable in specifications (2), (5), and (8) is conformity to the federal Section 179 allowance. The outcome variable in specifications (2), (5), and (8) is both use of bonus depreciation and conformity to the federal Section 179 allowance. All specifications include year fixed effects. Specifications (4)–(6) add state fixed effects. Specifications (7)–(9) add state-specific linear time trends. Standard errors are presented in parentheses and clustered at the state level. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$

Table E2: Predicting State Adoption of Accelerated Depreciation Policies; Logit Model

	(1) $\mathbb{1}$(Bonus)	(2) $\mathbb{1}$(Sect. 179)	(3) $\mathbb{1}$(Both)
main			
Log(GSP/Pop)	-53.53***	-24.48	-0.00768
	(20.31)	(46.34)	(19.07)
Log(Pop)	4.046	19.94	-12.19
	(14.24)	(62.88)	(21.99)
Corp Tax %	-78.26*	-104.4	-91.00
	(46.86)	(101.0)	(62.25)
Budget Gap	-6.028	4.064	-5.639
	(4.206)	(7.682)	(4.437)
Corp Rate	72.40	-9179.9	153.6
	(61.82)	(448454.1)	(102.2)
Dem Leg %	-0.0569	0.0516	-0.181
	(0.0606)	(0.140)	(0.114)
Dem Gov	-1.870	-1.888	-1.244
	(1.324)	(2.221)	(1.447)
Year FE	✓	✓	✓
State FE	✓	✓	✓
Observations	110	72	80

Notes: Table E2 uses a logit model to predict the adoption of accelerated depreciation policies based on state economic, political, and demographic characteristics. The outcome variable in specification (1) is the use of bonus depreciation. The outcome variable in specification (2) is conformity to the federal Section 179 allowance. The outcome variable in specifications (3) is both use of bonus depreciation and conformity to the federal Section 179 allowance. All specifications include state and year fixed effects. Standard errors are presented in parentheses and clustered at the state level. Observations are smaller because logit models that include fixed effects are estimated as conditional logits, which use a subsample of observations. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$

Appendix F Adoption and rejection event study graphs

Appendix F presents a series of event study graphs that show how trends in gross state product (GSP) per capita growth rates and state budget gaps differ between adoption and non-adopting groups of states before and after adoption or rejection decisions.

The first series of graphs, presented in Figure F1, shows how trends in state GSP and state budget gap outcomes differ between states that adopted bonus depreciation during the years 2001–2004 and those that did not (in panels (a) and (b)) and between states that adopted bonus depreciation during the years 2008–2010 and those that did not (panels (c) and (d)). The coefficients in all panels are produced by regressing the outcome on year indicators interacted with a bonus depreciation adoption indicator and year fixed effects. State fixed effects are included when estimating coefficients in panels (c) and (d) because the outcome variable is measured in levels, as opposed to changes as in panels (a) and (b).

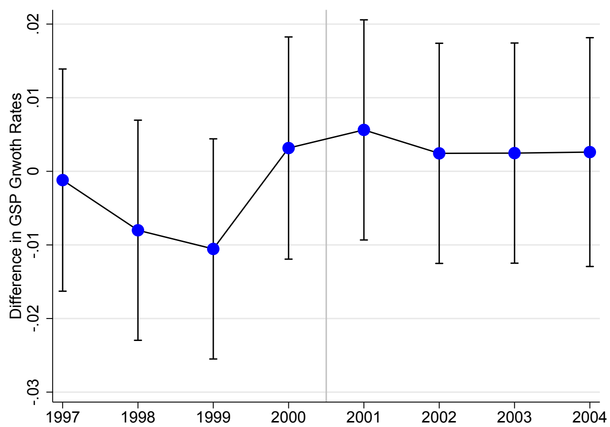
The second series of graphs, presented in Figure F2, shows how trends in GSP and state budget gaps differ between states that stopped conforming to federal Section 179 expensing allowances and those that did not around the time of the non-conformity decision. To produce the coefficients in both panels, the outcome is regressed on year relative to non-conformity indicators and year fixed effects. State fixed effects are included when estimating the coefficients in panel (b) because the outcome variable is measured in levels. Coefficients on the relative year indicators are plotted.

The third series of graphs, presented in Figure F3, shows how trends in GSP and state budget gaps differ between states that adopted or rejected bonus depreciation in years other than 2001 or 2008. The states that adopted bonus depreciation in years other than 2001 or 2008 are Florida in 2004, Illinois in 2011, Iowa in 2003, Maine in 2011, North Carolina in 2003, Oregon in 2010, Pennsylvania in 2011. The states that rejected bonus depreciation in years other than 2001 or 2008 are Florida in 2003, Idaho in 2010, Illinois in 2012, New Jersey in 2002, New York in 2003, Oklahoma in 2003, Pennsylvania in 2012, and Tennessee in 2003. To produce the coefficients in all four panels, the outcome is regressed on year relative to adoption or rejection decision indicators and year fixed effects. State fixed effects are included when estimating the coefficients in panels (c) and (d) because the outcome variable is measured in levels. Coefficients on the relative year indicators are plotted.

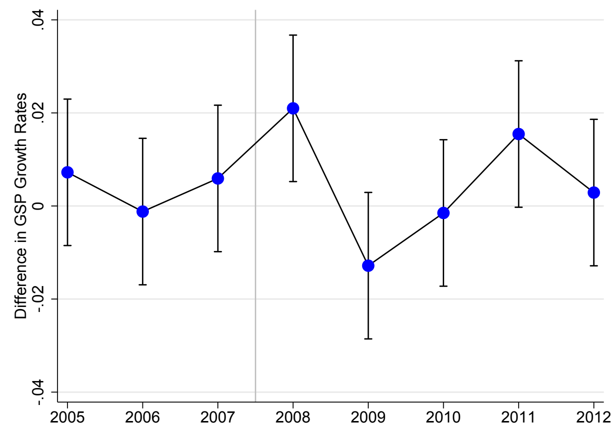
Coefficients in 9 of the 10 panels show no divergence in state GSP per capita or state budget gap prior to adoption or rejection decisions indicating changes in state economic health are unlikely to cause states to adopt or reject the federal policies. The one exception is panel (b) of Figure F3 which shows that state budget gaps increase just prior to adoption of bonus depreciation in years other than 2001 or 2008. Analysis presented in column (6) of Table 3 suggests these pretrends downward bias the baseline policy estimates.

Figure F1: GSP Growth Rates and Budget Gaps, Bonus Adopters vs. Non-Adopters

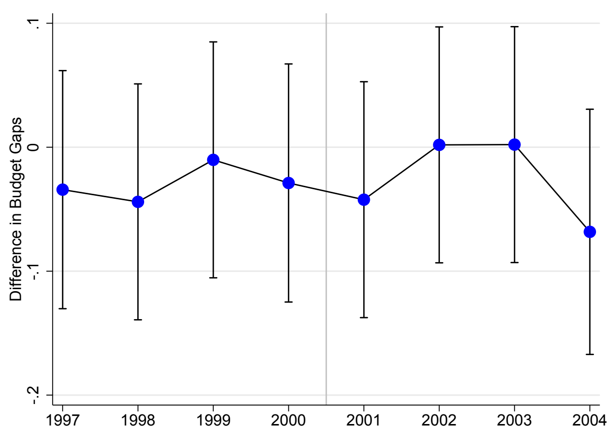
(a) GSP Growth Rates, 2001–2004 Adoption



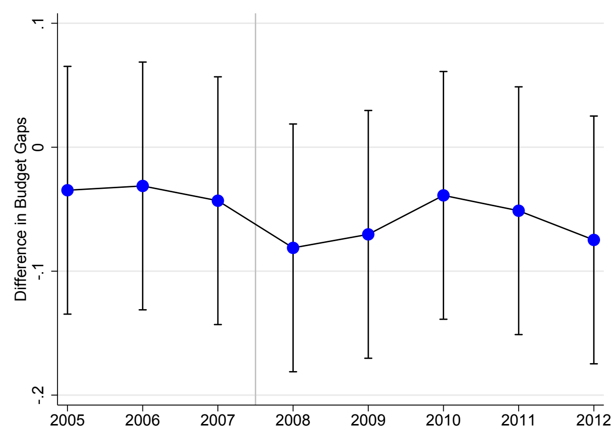
(b) GSP Growth Rates, 2008–2010 Adoption



(c) Budget Gap, 2001–2004 Adoption



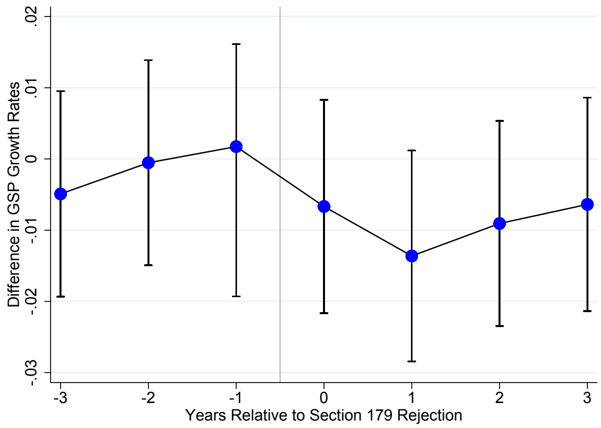
(d) Budget Gap, 2008–2010 Adoption



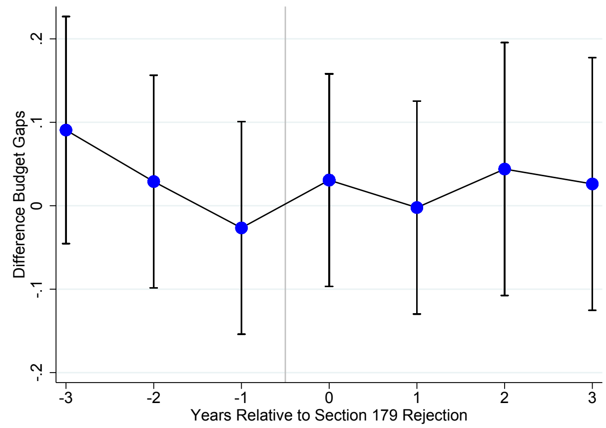
Notes: Panel (a) depicts how GSP growth rates differ between states that adopted bonus depreciation during the years 2001–2004 to those that did not. Panel (b) depicts how GSP growth rates differ between states that adopted bonus depreciation during the years 2008–2010 to those that did not. Panel (c) depicts how state budget gaps differ between states that adopted bonus depreciation during the years 2001–2004 to those that did not. Panel (d) depicts how state budget gaps differ between states that adopted bonus depreciation during the years 2008–2010 to those that did not. To estimate the coefficients in all panels, the outcome is regressed on year indicators interacted with a bonus depreciation adoption indicator and year fixed effects. State fixed effects are included when estimating coefficient in panels (c) and (d).

Figure F2: GSP Growth Rates and Budget Gaps: Section 179 Conformers vs. Non-Conformers

(a) State GSP Δ%, 2001–2004 Adopters



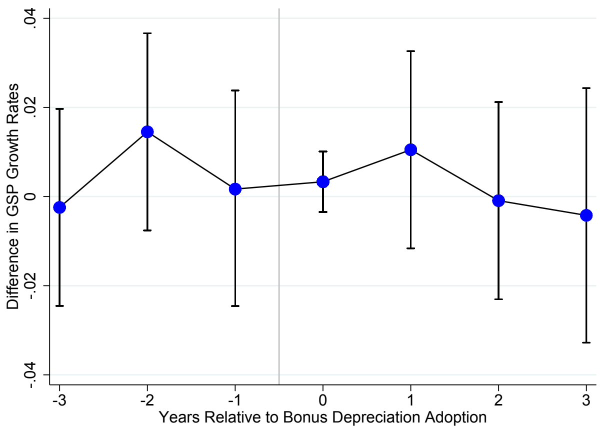
(b) State GSP Δ%, 2008–2012 Adopters



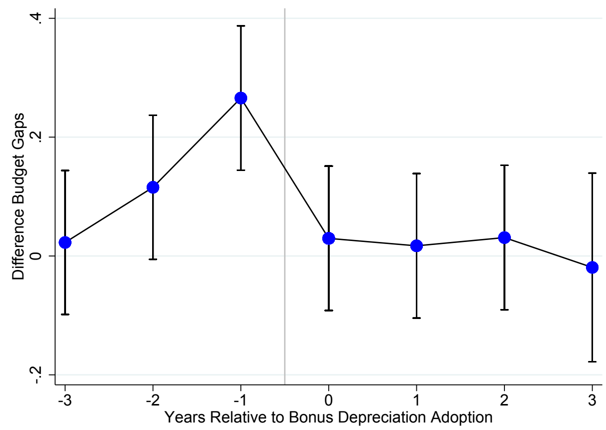
Notes: Panel (a) depicts how GSP per capita growth rates differ between states the continue to conform to the federal Section 179 allowance against states that choose to stop conforming in year 0. Panel (b) depicts how state budget gaps differ between states that continue to conform to the federal Section 179 allowance against states that choose to stop conforming in year 0. To produce the coefficients in both panels, the outcome is regressed on year relative to year 0 indicators for non-conforming states and year fixed effects. State fixed effects are included when estimating coefficients in panels (b)because the outcome variable is measured in levels, as opposed to changes (as in panel (a)).

Figure F3: GSP Growth Rates and Budget Gaps: Abnormal Adopters and Rejecters

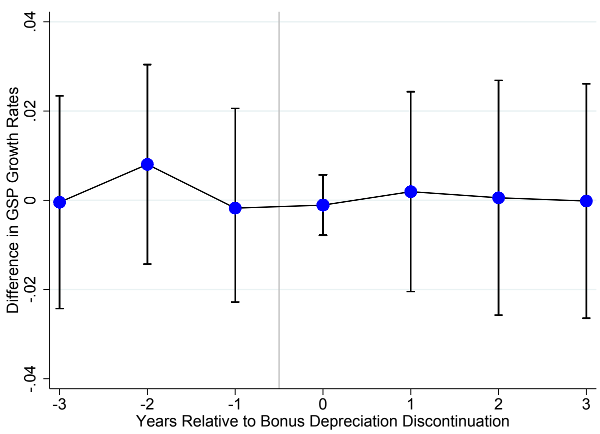
(a) GSP Growth Rate; Abnormal Adopters



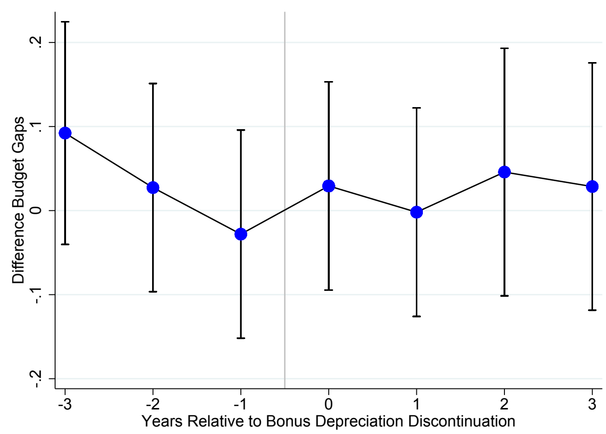
(b) Budget Gap; Abnormal Adopters



(c) GSP Growth Rate; Abnormal Rejecters



(d) Budget Gap; Abnormal Rejecters



Notes: Panel (a) plots the difference in GSP growth rates between states that adopted bonus depreciation in years other than 2001 or 2008 relative to other states around the time of adoption. Panel (b) plots difference in state budget gaps between states that adopted bonus depreciation in an abnormal year relative to other states around the time of adoption. The states that adopted bonus depreciation in years other than 2001 or 2008 are Florida in 2004, Illinois in 2011, Iowa in 2003, Maine in 2011, North Carolina in 2003, Oregon in 2010, Pennsylvania in 2011. Panel (c) plots the difference in GSP growth rates between states that rejected bonus depreciation in years other than 2001 or 2008 relative to other states around the time of rejection. Panel (d) plots the difference in state budget gaps between states that rejected bonus depreciation in years other than 2001 or 2008 relative to other states around the time of rejection. The states that rejected bonus depreciation in years other than 2001 or 2008 are Florida in 2003, Idaho in 2010, Illinois in 2012, New Jersey in 2002, New York in 2003, Oklahoma in 2003, Pennsylvania in 2012, and Tennessee in 2003. To estimate the coefficients in all panels, the outcome is regressed on relative year indicators interacted with an adopter or rejecter indicator and year fixed effects. State fixed effects are included when estimating coefficients in panels (c) and (d) because the outcome variable is in levels, as opposed to changes (as in panels (a) and (b)).

Appendix G Randomization Inference

A concern difference-in-differences studies is that they may over-reject the null hypothesis when error terms are serially correlated (Bertrand, Duflo and Mullainathan, 2004). To combat these concerns I perform a randomization inference test similar to the one used in Chetty, Looney and Kroft (2009).[3]

I begin by randomly assignment units from one state another state's annual series of State Bonus, State 179, and State Bonus × State 179 during from 1997–2013. I assign each state's policy adoption series without replacement. This effectively randomizes the state tax policies while maintaining the underlying structure of the data. I then replicate the baseline analysis from column (1) of Table 3. I store the State Bonus, State 179, State Bonus × State 179 coefficients from the regression then repeat the process another 1,999 times.

Panel (a) of Figure G1 displays an empirical CDF of the 2,000 placebo State Bonus coefficients. No parametric smoothing is applied; the CDF looks smooth because of the large number of points used to construct it. The vertical black line represents the real State Bonus effect size from the baseline specification. Only 1 out of the 2,000 placebo coefficients is larger than the original difference-in-differences estimate of 0.180, implying a randomization-based p-value of 0.0005. As this estimate suggests statistical significance at the 1% level, this ranomization-inference test suggests the state-level clustering generates conservative standard error estimates.

Panel (b) of Figure G1 presents the empirical CDF of the 2,000 placebo State 179 coefficients. Here, 76 of the 2,000 placebo coefficients are larger than the baseline State 179 estimate of 0.0206, implying a randomization-based p-value of 0.036. This randomization based p-value is smaller than the baseline State 179 p-value.

Panel (c) of Figure G1 presents the empirical CDF of the 2,000 placebo State Bonus × State 179 coefficients. 6 of the 2,000 placebo coefficients are more negative than the baseline State Bonus × State 179 estimate, implying a randomization-based p-value of 0.003. Again, this randomization based p-value is smaller than the baseline State Bonus × State 179 p-value.

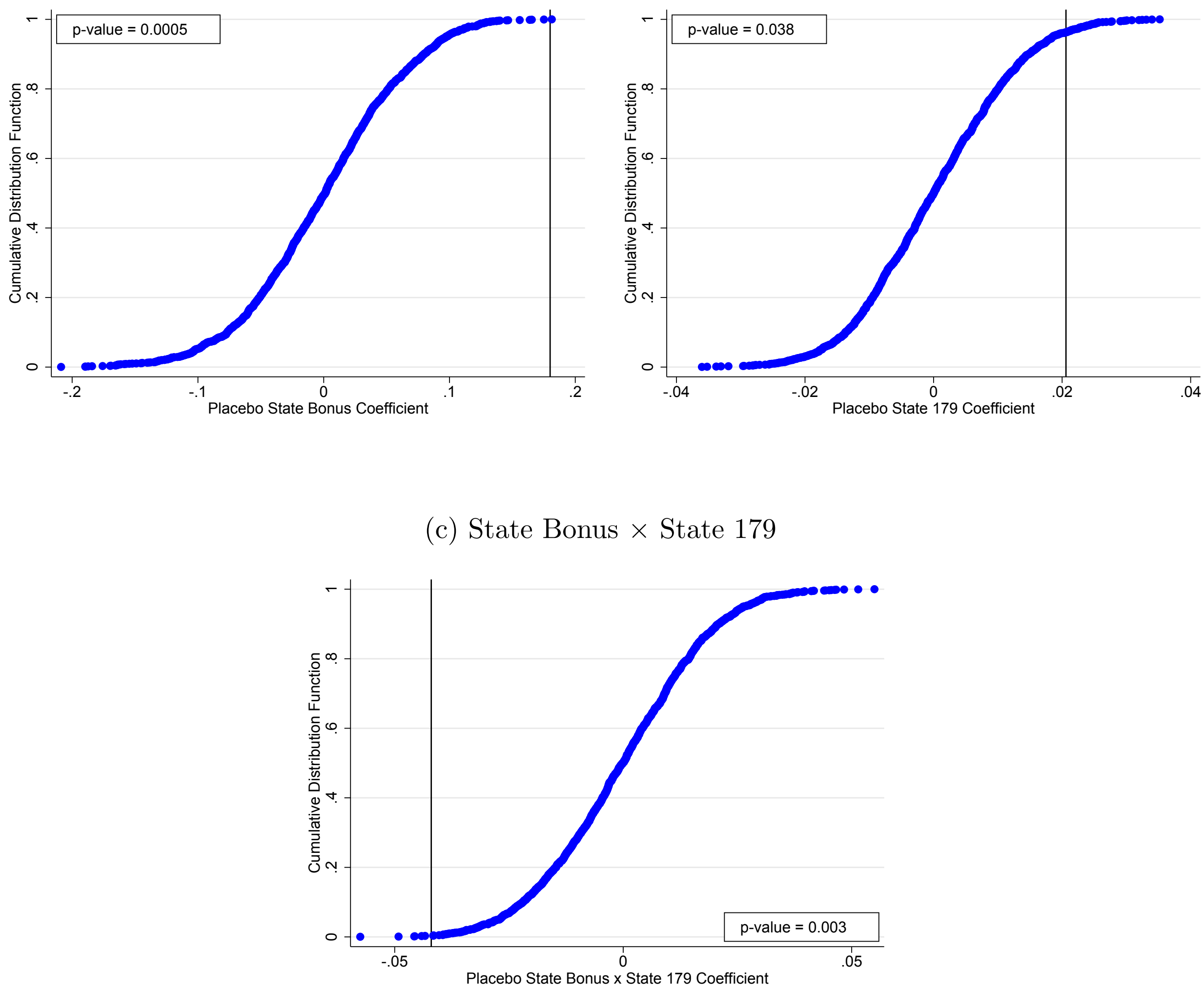
[3] Paz and West (2019) show randomization-based inference tests dramatically outperform conventional clustering methods difference-in-differences specifications with unbalanced panels and a small number of treated groups.

Figure G1: Randomization Inference CDFs

(a) State Bonus

(b) State 179

(c) State Bonus × State 179



Notes: Each panel of Figure G1 plots an empirical distributions of placebo coefficients from regressions in which the outcome is regressed on randomly assigned State Bonus, State 179, and State Bonus × State 179. The vertical lines show the treatment effect estimate reported in column (1) of Table 3. Non-parametric p-values represent the probability an observation is greater in magnitude than the baseline effect estimates.

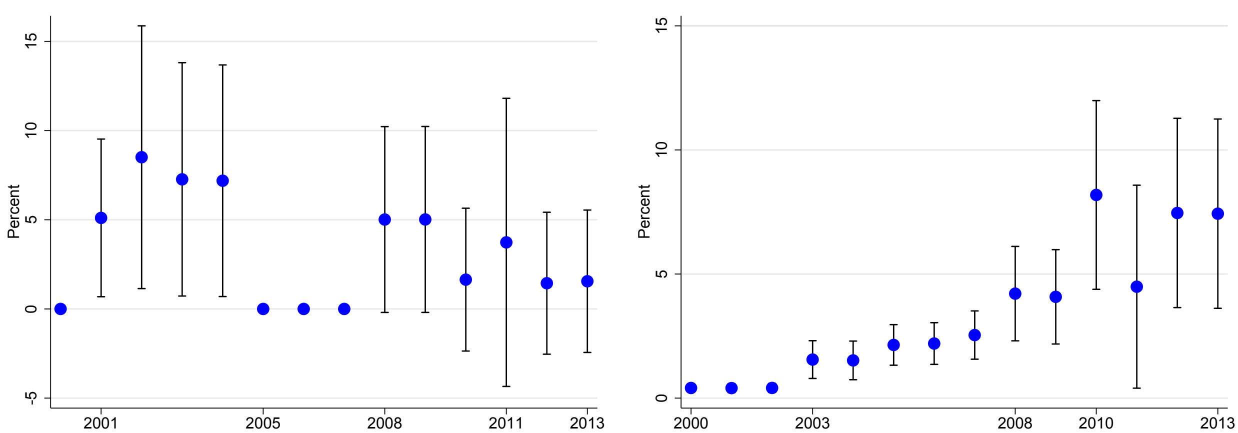
Appendix H Marginal Effects

To further understand the interaction between the two policies and their effect on investment, Figure H1 presents estimates of the effect of both policies during each of the years 2000–2013 while controlling for the effect of the other policy. Panel (a) plots the predicted impact of state adoption of bonus depreciation at the federal level assuming that the state has the average observed state Section 179 allowances during that year (see Table C1 for average levels in a given year). Therefore, the estimated effect of bonus depreciation is large when bonus depreciation is high but is tempered as state Section 179 allowances become more generous over time. As one might expect, for the average state, the impact of bonus depreciation was the largest in 2003, when the federal bonus level was high – 50% – but federal Section 179 allowances were still small – only $100,000. 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 Section 179 allowances. Here, the estimates are interpreted as the impact of conforming to federal Section 179 allowances assuming that the state has adopted federal bonus depreciation at the average observed level in each year. These estimates are much less affected by bonus depreciation than the bonus depreciation estimates are by Section 179 conformity because fewer states adopt bonus depreciation than conform to section 179 allowances. Therefore, these estimates closely mirror the rise in federal Section 179 allowances. However, bonus depreciation significantly reduces the State 179 effect in 2011 when bonus depreciation was set to 100% and a larger proportion of states than usual adopted federal bonus depreciation.

Figure H1: Estimated Effect of State Adoption of Accelerated Depreciation Policies

(a) Effect of Bonus Depreciation Adoption (b) Effect of Section 179 Adoption



Notes: Figure H1 uses the baseline estimates presented in Table **??** specification (1) to predict the investment impact of adopting each accelerated depreciation policy at the federal rate in a given year while adopting the other at the average rate observed in the data. Panel (a) depicts the effect of adoption of federal bonus depreciation on investment while granting the average rate of Section 179 allowances in each year 2000–2013. Panel (b) depicts effect of adoption of federal Section 179 allowances on investment while granting bonus depreciation at the average rate in each year 2000–2013. Vertical bars represent 95% confidence intervals. Standard errors are computed using the delta method.

Appendix I Elasticity Calculation Details

Precise estimates of Appendix $\mathcal{E}_{\text{BONUS}}$ and $\mathcal{E}_{179}$ depend on measuring how state bonus and state Section 179 adoption affect the present value of the after-tax cost of investment. Because the methodology utilized does not directly measure these policy effects, I rely on outside estimates for their measurement.

Assuming a discount rate of 7%, Zwick and Mahon (2017) estimates that 50% federal bonus reduced the present value of after-tax cost of $1 of investment 2.73 cents. Extrapolating this estimate, suggests that 100% bonus or Section 179 expensing decreases the present-value after-tax cost of $1 of investment by 5.46 cents.

The average state corporate income tax rate for states that adopt bonus / conform to Section 179 allowances is approximately 7%. Because state corporate tax rates are only 20% as high as the federal tax rate, 100% bonus or Section 179 expensing should decrease the present-value after-tax cost of $1 of investment by 1.092 cents.

The present-value after-tax cost of $1 of investment is equal to $(1 - \tau_{\text{fed}} - \tau_{\text{state}}) =$ 1 - 0.35 -0.07 = 0.58 or 58 cents when the investment is fully expensed and 58 + 1.092 = 59.092 cents under normal MACRS rules. State 100% bonus adoption / Section 179 conformity decreases the present value after-tax cost of investment from 59.092 to 58 cents or by 1.883%.

References

Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan. 2004. "How Much Should We Trust Differences-In-Differences Estimates?" *The Quarterly Journal of Economics*, 119(1): 249–275.

Chetty, Raj, Adam Looney, and Kory Kroft. 2009. "Salience and Taxation: Theory and Evidence." *The American Economic Review*, 99(4): 1145–1177.

Chirinko, Robert S, Steven M Fazzari, and Andrew P Meyer. 1999. "How Responsive is Business Capital Formation to its User Cost?: An Exploration with Micro Data." *Journal of public economics*, 74(1): 53–80.

Gordon, Roger, and John D Wilson. 1986. "An examination of multijurisdictional corporate income taxation under formula apportionment." *Econometrica: Journal of the Econometric Society*, 1357–1373.

Hall, Robert E, and Dale W Jorgenson. 1967. "Tax Policy and Investment Behavior." *The American Economic Review*, 57(3): 391–414.

Mead, Charles Ian. 2001. "State user costs of capital." Federal Reserve Bank of Boston.

Paz, Lourenço S, and James E West. 2019. "Should We Trust Clustered Standard Errors? A Comparison with Randomization-Based Methods." National Bureau of Economic Research.

Suárez Serrato, Juan Carlos, and Owen Zidar. 2018. "The structure of state corporate taxation and its impact on state tax revenues and economic activity." *Journal of Public Economics*, 167: 158 – 176.

Zwick, Eric, and James Mahon. 2017. "Tax Policy and Heterogeneous Investment Behavior." *The American Economic Review*, 107(1): 217–248.