Capital Investment and Labor Demand: Evidence from 21st Century Tax Policy

E. Mark Curtis (Wake Forest)
Daniel Garrett (UPenn, Wharton)
Eric Ohrn (Grinnell)
Kevin A. Roberts (Duke)
Juan Carlos Suárez Serrato (Duke & NBER)

November 2021

Do investments in new capital help or hurt workers?

- **Foundational question:** "The Wealth of Nations," Book I, Chapter 1

  "everybody must be sensible how much labour is facilitated and abridged by the application of proper machinery...

  It is unnecessary to give any example."

–Adam Smith (1776)

Do investments in new capital help or hurt workers?

- **Foundational question:** "The Wealth of Nations," Book I, Chapter 1

  "everybody must be sensible how much labour is facilitated and abridged by the application of proper machinery...

  It is unnecessary to give any example."

  –Adam Smith (1776)

- **Relevance in the 21st century:**

1. Will new machinery eliminate human work?
2. Do tax incentives for investment increase wages or productivity?

Do investments in new capital help or hurt workers?

Surprisingly challenging question to answer

1. Workers in modern firms perform many tasks (e.g., production, R&D, marketing)
2. Few datasets measure capital stocks or employment by task
3. Plants may adopt capital due to productivity/demand shocks
4. Capital accumulation takes time

Our Approach

1. **Confidential plant-level data on manufacturing activities**
   - Identify workers that interact with machinery
   - Measure capital stocks, other inputs
2. **Tax variation in cost of equipment from bonus depreciation**
   - One of largest incentives for capital investment in U.S. history
   - Will cost $285 billion in current decade as part of TCJA

Our Approach

1. **Confidential plant-level data on manufacturing activities**
   - Identify workers that interact with machinery
   - Measure capital stocks, other inputs
2. **Tax variation in cost of equipment from bonus depreciation**
   - One of largest incentives for capital investment in U.S. history
   - Will cost $285 billion in current decade as part of TCJA
3. **Diff-in-diff event study analyses between 2001–2011**
   - Estimate effects on investment, capital, output, TFP, mean earnings, and employment by tasks and demographic groups (e.g., young, low-education, Black, Hispanic, female)
4. **Estimate structural model of factor demands**
   - Separates scale and substitution effects
   - Test additional predictions from model

Our Reduced-Form Findings

1. **Plants respond to tax incentive by increasing investment**
   - '01–'11: Investment $\uparrow$ 20%, Equipment K $\uparrow$ 10%, Structures K $\uparrow$ 3%

Our Reduced-Form Findings

1. **Plants respond to tax incentive by increasing investment**
   - '01–'11: Investment ↑ 20%, Equipment K ↑ 10%, Structures K ↑ 3%
2. **Investment coincides with large increases in employment**
   - '01–'11: Employment ↑ 10%, Production E ↑ 12%, Non-prod. E ↑ 8%
   - Bonus ↑ share of workers who are young, low-education, female, Black, and Hispanic

Our Reduced-Form Findings

1. **Plants respond to tax incentive by increasing investment**
   - '01–'11: Investment $\uparrow$ 20%, Equipment K $\uparrow$ 10%, Structures K $\uparrow$ 3%
2. **Investment coincides with large increases in employment**
   - '01–'11: Employment $\uparrow$ 10%, Production E $\uparrow$ 12%, Non-prod. E $\uparrow$ 8%
   - Bonus $\uparrow$ share of workers who are young, low-education, female, Black, and Hispanic
3. **Investment does not raise mean earnings**
   - Null effect on average earnings after accounting for composition effects

Our Reduced-Form Findings

1. **Plants respond to tax incentive by increasing investment**
   - '01–'11: Investment $\uparrow$ 20%, Equipment K $\uparrow$ 10%, Structures K $\uparrow$ 3%
2. **Investment coincides with large increases in employment**
   - '01–'11: Employment $\uparrow$ 10%, Production E $\uparrow$ 12%, Non-prod. E $\uparrow$ 8%
   - Bonus $\uparrow$ share of workers who are young, low-education, female, Black, and Hispanic
3. **Investment does not raise mean earnings**
   - Null effect on average earnings after accounting for composition effects
4. **Investment does not raise plant productivity**
   - TFP estimates rule out increases $>$ 0.8% at 95% level
   - Plant sales $\uparrow$ 8%

Our Reduced-Form Findings

1. **Plants respond to tax incentive by increasing investment**
   - '01–'11: Investment ↑ 20%, Equipment K ↑ 10%, Structures K ↑ 3%
2. **Investment coincides with large increases in employment**
   - '01–'11: Employment ↑ 10%, Production E ↑ 12%, Non-prod. E ↑ 8%
   - Bonus ↑ share of workers who are young, low-education, female, Black, and Hispanic
3. **Investment does not raise mean earnings**
   - Null effect on average earnings after accounting for composition effects
4. **Investment does not raise plant productivity**
   - TFP estimates rule out increases $> 0.8\%$ at 95% level
   - Plant sales ↑ 8%
5. **Estimates not driven by shocks to manufacturing sector**
   - Import competition, robotization, skill intensity, and capital intensity

Results from Structural Model of Factor Demands

- **Empirical model based on Marshall (1890)–Hicks (1932)**
  - Reduced-form effects identify scale and substitution elasticities
  - Estimate model parameters via Classical Minimum Distance

Results from Structural Model of Factor Demands

- **Empirical model based on Marshall (1890)–Hicks (1932)**
  - Reduced-form effects identify scale and substitution elasticities
  - Estimate model parameters via Classical Minimum Distance
- **Production workers are complements with capital**
  - Precise scale effect responsible for 90% of employment increase

Results from Structural Model of Factor Demands

- **Empirical model based on Marshall (1890)–Hicks (1932)**
  - Reduced-form effects identify scale and substitution elasticities
  - Estimate model parameters via Classical Minimum Distance
- **Production workers are complements with capital**
  - Precise scale effect responsible for 90% of employment increase
- **Test of capital-labor complementarity**
  - Investment should increase more if labor costs are low
  - Prediction holds for non-unionized, RTW, concentrated labor markets

Results from Structural Model of Factor Demands

- **Empirical model based on Marshall (1890)–Hicks (1932)**
  - Reduced-form effects identify scale and substitution elasticities
  - Estimate model parameters via Classical Minimum Distance
- **Production workers are complements with capital**
  - Precise scale effect responsible for 90% of employment increase
- **Test of capital-labor complementarity**
  - Investment should increase more if labor costs are low
  - Prediction holds for non-unionized, RTW, concentrated labor markets
- **Do investments in new capital help or hurt workers?**
  - Increases employment, esp. production and disadvantaged workers
  - Rules out worst fears of tax-driven automation
  - Does not raise productivity growth or average earnings

Remainder of the Presentation

1. Data and Empirical Strategy
2. Reduce-Form Effects
    - Investment and Capital Stocks
    - Employment
    - Earnings
    - Productivity and Output
3. Bonus in the Context of 21st Century US Manufacturing
4. Structural Model of Factor Demands
5. Tests of Capital-labor Complementarity

Data and Policy Variation

Plant Level Confidential Census Data

Annual Survey of Manufactures (ASM)

- $\approx 60,000$ plants surveyed per year
- Large plants are oversampled
- Supplement with Census of Manufactures in years ending in $2/7$
- Balanced sample for 1997–2011

Plant Level Confidential Census Data

Annual Survey of Manufactures (ASM)

- $\approx 60,000$ plants surveyed per year
- Large plants are oversampled
- Supplement with Census of Manufactures in years ending in 2/7
- Balanced sample for 1997–2011

Outcomes

- capital investment
- capital stocks (from Census of Manufactures)
- split capital into equipment/structures
- employment by production/non-production tasks
- average earnings
- total value of shipments
- total factor productivity

Bonus Depreciation

Bonus Depreciation and Empirical Strategy

- Immediate tax deduction of a “bonus” percentage of investment costs
- Decreases PV cost of investment and gives firms cash now
- 2001–2011 average bonus of 45% Timing

Bonus Depreciation

Bonus Depreciation and Empirical Strategy

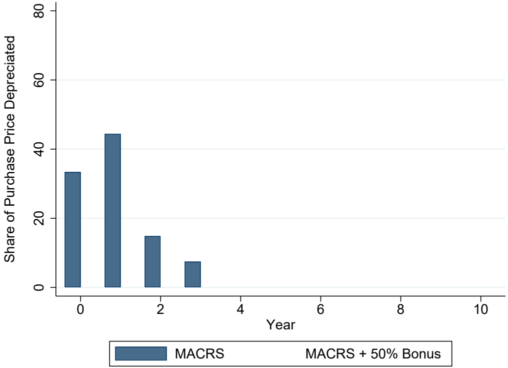
- Immediate tax deduction of a "bonus" percentage of investment costs
- Decreases PV cost of investment and gives firms cash now
- 2001–2011 average bonus of 45% Timing

Empirical Strategy Overview

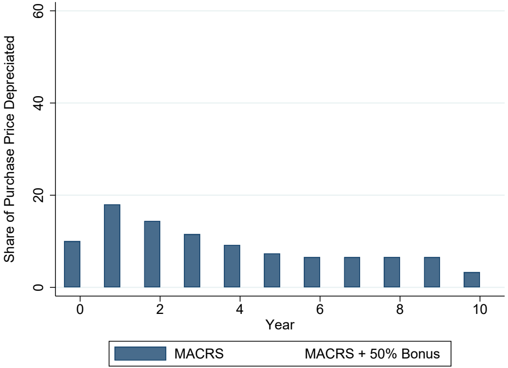
1. Identify 4-digit industries that benefit most from bonus depreciation (fixed in 2001)
2. Use variation in bonus depreciation over time (pre/post 2001)
3. Compare firm/worker outcomes across industries and over time

Quantifying Benefits from Bonus Depreciation

A. 3-year MACRS Assets



B. 10-year MACRS Assets

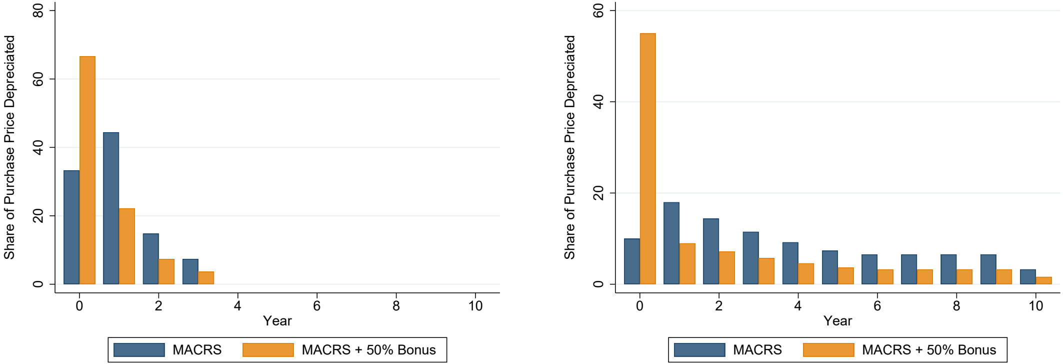


- Tax rules specify timeline of depreciation deductions D_t

Quantifying Benefits from Bonus Depreciation

A. 3-year MACRS Assets

B. 10-year MACRS Assets



- Tax rules specify timeline of depreciation deductions D_t
- Bonus depreciation: $\begin{cases} \text{Immediate depreciation} & b\% \\ \text{Remaining deductions} & (1-b)D_t \end{cases}$

Quantifying Benefits from Bonus Depreciation

- Present value of depreciation deductions for a \$1 investment

$$z_0 = \sum_{t=0}^{T} \frac{D_t}{(1+r)^t}$$

- T is the recovery period
- D_t are the deductions allowed in year t such that $\sum_t D_t = 1$
- r is discount rate

- z_0 **is smaller for long-duration assets**

Quantifying Benefits from Bonus Depreciation

- Present value of depreciation deductions for a \$1 investment

$$z_0 = \sum_{t=0}^{T} \frac{D_t}{(1+r)^t}$$

- T is the recovery period
- D_t are the deductions allowed in year t such that $\sum_t D_t = 1$
- r is discount rate

- z_0 **is smaller for long-duration assets**

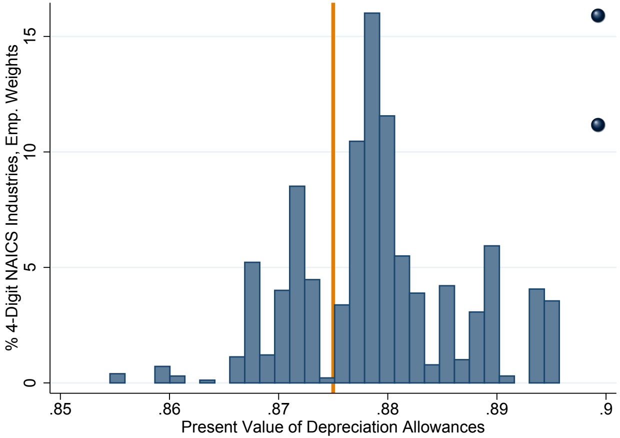
- Bonus increases PV of deductions by:

$$\underbrace{(b + (1-b)z_0)}_{\text{Bonus Depreciation}} - \underbrace{z_0}_{\text{MACRS}} = b(1 - z_0)$$

- Value of bonus is higher when z_0 is small–i.e., for long-duration assets

Defining Bonus Depreciation Treatment

- Zwick & Mahon (2017) compute z_0 using tax data at 4-digit NAICS



- **Long-duration** industries: $z_0 <$ 33rd percentile in 2001
- **Short-duration** industries: $z_0 >$ 33rd percentile in 2001
- We use this indicator for four reasons:
  1. Natural break in distribution of z_0 at 33rd percentile
  2. Long/Short dichotomy does not depend on discount rate
  3. Matches prior work (Zwick & Mahon, 2017; Garret et al, 2020)
  4. Robustness: 25th/40th percentile, continues exposure (QWI)

Treatment Stability Prior Work

Bonus Depreciation Treatment Examples

Long Duration Industries:

- Dairy Products, 3115
- Springs and Wires, 3326
- Motor Vehicle Bodies and Trailers, 3362

Short Duration Industries:

- Beverages, 3121
- Screws, Nuts, and Bolts, 3327
- Railroad Rolling, 3365

Bonus Depreciation Treatment Examples

Long Duration Industries:

- Dairy Products, 3115
- Springs and Wires, 3326
- Motor Vehicle Bodies and Trailers, 3362

Short Duration Industries:

- Beverages, 3121
- Screws, Nuts, and Bolts, 3327
- Railroad Rolling, 3365

Tax rules arbitrarily classify similar machinery used in different industries as long or short duration

- Detailed in IRS Publication 946

Bonus Depreciation Treatment Examples

Cement Manufacturing (3273)

- "assets used in the manufacture of cement ... are depreciated over 15 years"

Stone Cutting (3279)

- "assets used in stone cutting and stone crushing ... are depreciated across 7 years"

Empirical Strategy

Event-study Regression Specification:

$$Y_{it} = \alpha_i + \sum_{y=1997}^{2011} \beta_y \mathbb{I}[\text{Long Duration}]_i \times \mathbb{I}[y = t]_t + \gamma \mathbf{X}_{i,t} + \varepsilon_{it}$$

- Outcome Y_{it} for plants i in year t (log investment, log employment)
- $\mathbb{I}[\text{Long Duration}]_i = 1$ for long-duration plants (2001 primary industry)
- $\beta_{1997} - \beta_{2011}$: relative outcomes for long-duration plants
- $\gamma \mathbf{X}_{i,t}$: fixed effects control for time-varying determinants of outcomes
- Cluster ε_{it} at 4-digit NAICS industry-state level

Empirical Strategy

Identifying Assumption

- Absent bonus depreciation, outcomes for long-duration industries would match those of short-duration industries

Checks

- Pretrends: stable differences prior to treatment
- Larger effects on eligible capital (equipment) than ineligible structures
- Controls:
  - state $\times$ year FE
  - plant size quintile$\times$ year FE
  - firm size quintile $\times$ year FE
  - TFP bins $\times$ year FE

Empirical Strategy

Identifying Assumption

- Absent bonus depreciation, outcomes for long-duration industries would match those of short-duration industries

Checks

- Pretrends: stable differences prior to treatment
- Larger effects on eligible capital (equipment) than ineligible structures
- Controls:
  - state $\times$ year FE
  - plant size quintile$\times$ year FE
  - firm size quintile $\times$ year FE
  - TFP bins $\times$ year FE
- Manufacturing shocks:
  - capital and skill intensity bins
  - trade exposure (China), robots

Empirical Strategy

Identifying Assumption

- Absent bonus depreciation, outcomes for long-duration industries would match those of short-duration industries

Checks

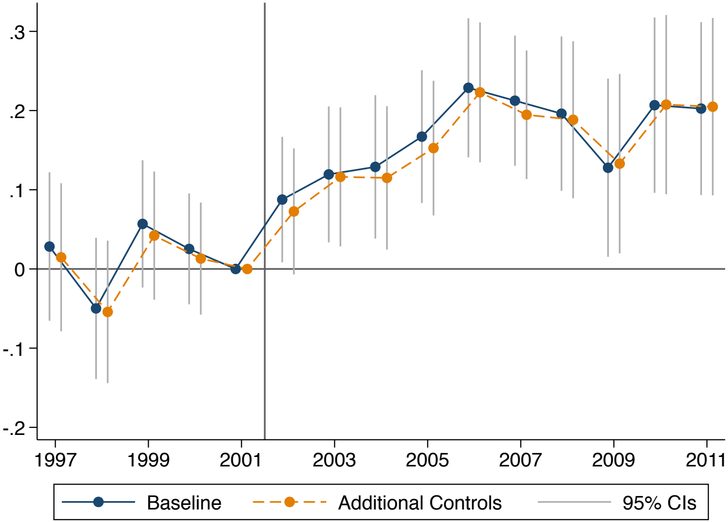
- Pretrends: stable differences prior to treatment
- Larger effects on eligible capital (equipment) than ineligible structures
- Controls:
  - state $\times$ year FE
  - plant size quintile$\times$ year FE
  - firm size quintile $\times$ year FE
  - TFP bins $\times$ year FE
- Manufacturing shocks:
  - capital and skill intensity bins
  - trade exposure (China), robots
- Robustness:
  - Entry (QWI data)
  - ICT exposure
  - Borrowing costs
  - Producers of capital goods
  - Business cycle exposure
  - Local Spillovers

Bonus Depreciation Today

1. Tax Cuts and Jobs Act: 100% bonus depreciation from 2018–2022
   - Biden tax plan does not include repeal/extension
   - Depreciation deductions would be affected by book income tax
2. Treasury: Bonus depreciation will cost $285 billion (2019–2028)
3. Economists and policymakers worry bonus encourages automation Quotes
4. Countries around the world have used similar policies
   - Canada, China, Germany, Japan, Poland, UK
5. Bonus and similar policies are now being used to
   - Transition to environmentally sustainable production methods
   - Stimulate investment in response to COVID-19

Effects of Bonus Depreciation on Investment and Employment

Log Capital Investment

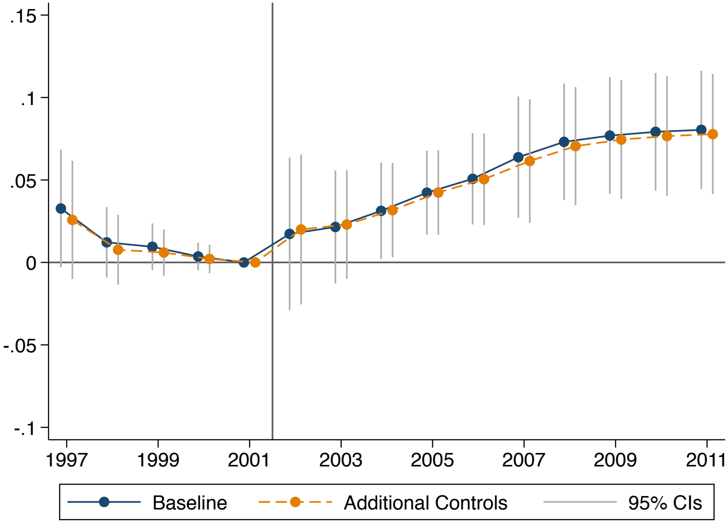


Log Capital Investment (Diff-in-Diff)

	(1)	(2)	(3)	(4)	(5)
Bonus	0.170***	0.156***	0.151***	0.152***	0.158***
(SE)	(0.029)	(0.028)	(0.028)	(0.028)	(0.029)
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Plant & Year FE	✓	✓	✓	✓	✓
State×Year FE		✓	✓	✓	✓
PlantSize_{2001} ×Year FE			✓	✓	✓
TFP_{2001} ×Year FE				✓	✓
FirmSize_{2001} ×Year FE					✓

- Similar results on IHS of investment and $\frac{I}{K}$ More
- Comparable magnitudes to Zwick & Mahon (2017) More

Log Capital Stock

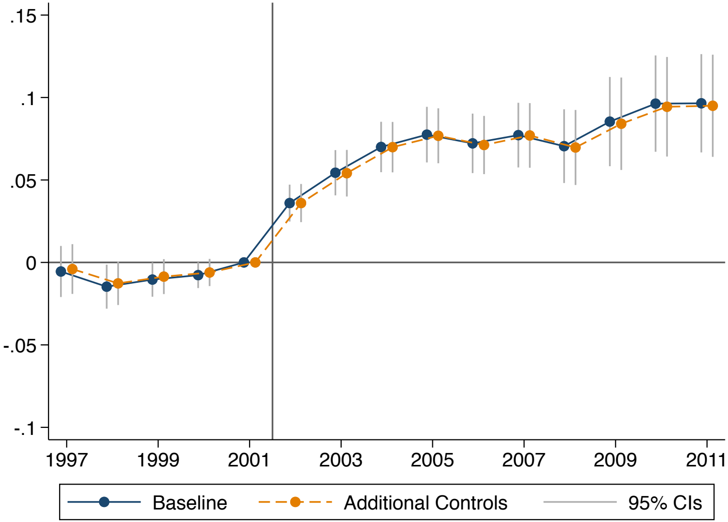


Log Capital Stock (Long Differences)

	(1)	(2)	(3)	(4)	(5)	(6)
	Log Total Capital		Log Equipment		Log Structures	
Bonus	0.080***	0.078***	0.105***	0.096***	0.041**	0.032*
(SE)	(0.018)	(0.019)	(0.019)	(0.019)	(0.018)	(0.019)
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]	[0.023]	[0.090]
Plant FE	✓	✓	✓	✓	✓	✓
State×Year FE	✓	✓	✓	✓	✓	✓
PlantSize_{2001}×Year FE		✓		✓		✓
TFP_{2001}×Year FE		✓		✓		✓
FirmSize_{2001}×Year FE		✓		✓		✓

- 3-times larger effects for eligible capital equipment

Log Plant Employment



Log Plant Employment (Long Differences)

	(1)	(2)	(3)	(4)	(5)	(6)
	Log Total Emp.		Log Prod. Emp.		Log Nonprod. Emp.	
Bonus	0.097***	0.095***	0.116***	0.115***	0.091***	0.081***
(SE)	(0.015)	(0.016)	(0.016)	(0.017)	(0.025)	(0.026)
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.002]
Plant FE	✓	✓	✓	✓	✓	✓
State×Year FE	✓	✓	✓	✓	✓	✓
PlantSize_{2001}×Year FE		✓		✓		✓
TFP_{2001}×Year FE		✓		✓		✓
FirmSize_{2001}×Year FE		✓		✓		✓

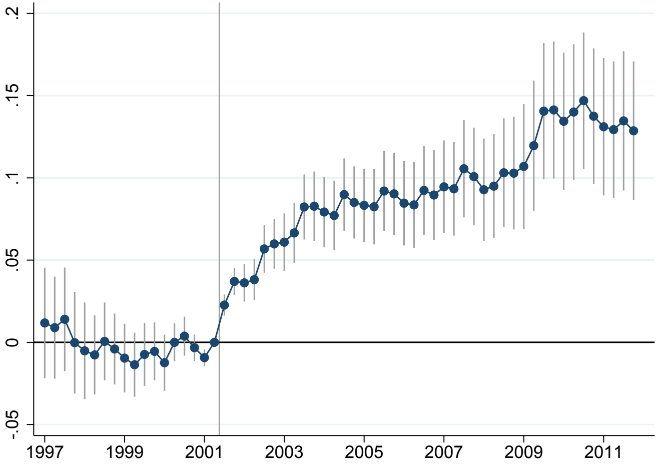
- Larger effects on workers that interact with new equipment

More

Quarterly Workforce Indicators Data

- QWI aggregates data from the Longitudinal Employer-Household Dynamics (LEHD) to the state-4-digit NAICS level
  - Include roles of plant entry/exit
- We focus on manufacturing sector to match ASM/CM
- Employment and earnings data split by age, education, gender, race and ethnicity

Log Employment (QWI Data)

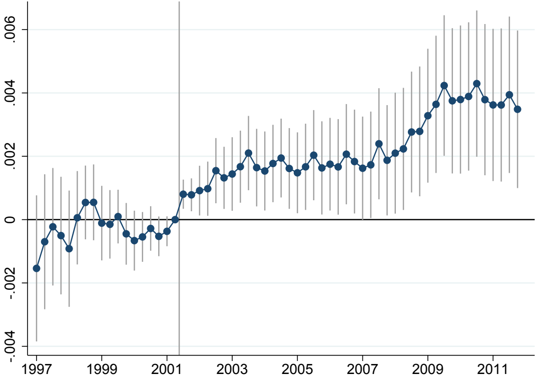


$$DiD = 0.097^{***}(0.016)$$

Small, Young Firms

Employment Effects by Education and Age

Fraction High School or Less Education

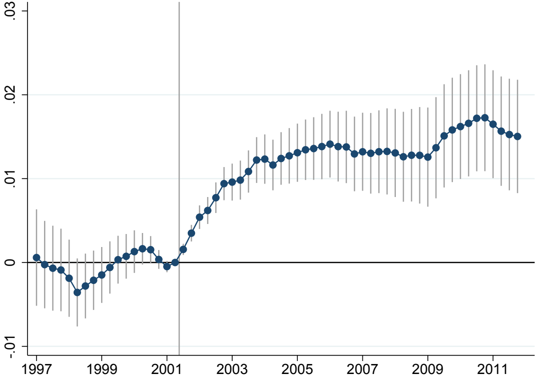


$DiD = 0.0026^{***}(0.001)$

2001 mean = 0.25

$\implies$ 1% increase

Fraction 35 Years of Age and Younger



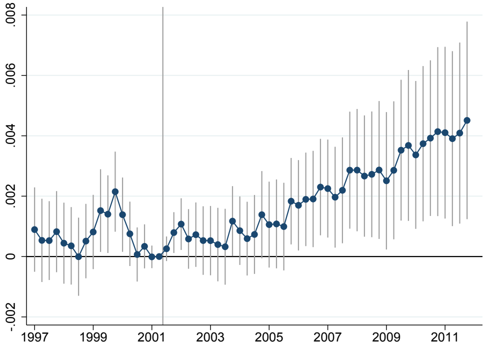
$DiD = 0.0129^{***}(0.0025)$

2001 mean = 0.30

$\implies$ 3.8% increase More

Employment Effects by Race and Ethnicity

Fraction Black

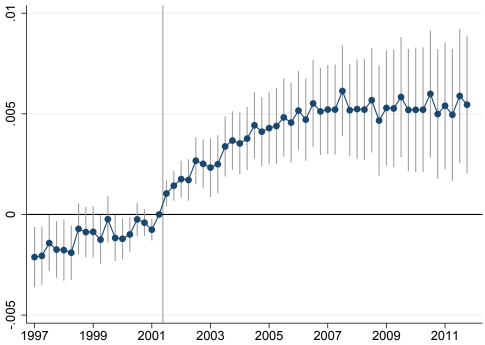


$DiD = 0.0012(0.0007)$

2001 mean $= 0.07$

$\Longrightarrow$ 1.6% increase

Fraction Hispanic



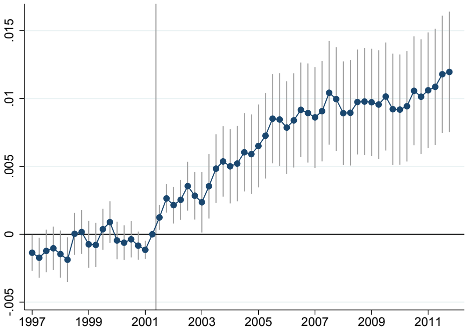
$DiD = 0.0054^{***}(0.0010)$

2001 mean $= 0.06$

$\Longrightarrow$ 8.5% increase More

Employment Effects by Gender

Fraction Female



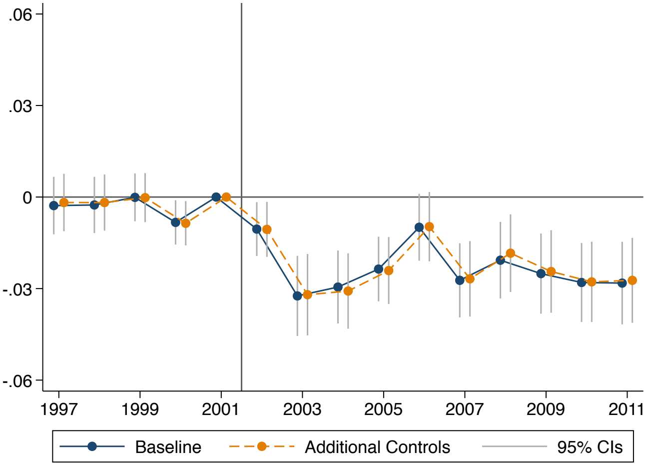
$$DiD = 0.0082^{***}(0.0015)$$

2001 mean $= 0.26 \implies 3.2\%$ increase More

Bonus depreciation has larger employment effects on younger, non-college, female, Black, and Hispanic workers!

Effects of Bonus Depreciation on Mean Earnings and Productivity

Log Mean Earnings



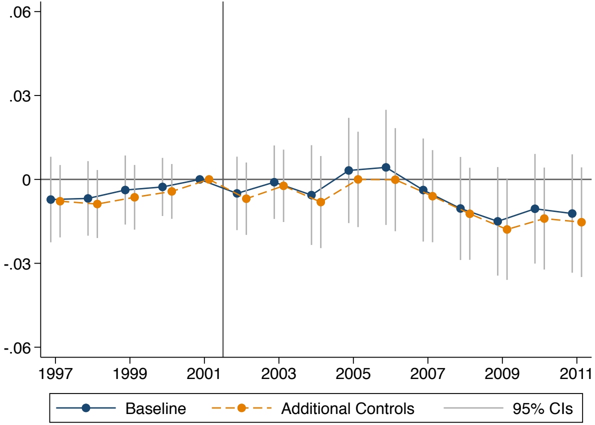
Change in Workforce Composition Explains Wage Effect

	(1)	(2)	(3)	(4)	(5)
	Difference-in-Differences				
Bonus	-0.031***	-0.028***	-0.003	-0.003	0.007
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
	[0.000]	[0.000]	[0.495]	[0.549]	[0.126]
Industry × State FE	✓	✓	✓	✓	✓
State × Year FE	✓	✓	✓	✓	✓
Age Shares		✓	✓	✓	✓
Education Shares			✓	✓	✓
Race Shares				✓	✓
Sex Shares					✓

- Obtain similar results using a regression decomposition

More

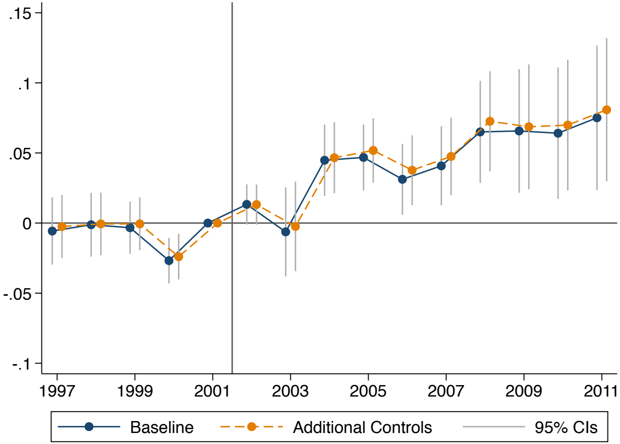
Effects on Log Plant Productivity



$$\text{DiD 95\% CI} = (-0.014, 0.008)$$

DD Estimates

Effects on Log Plant Output



$$LD = 0.081^{***}(0.027)$$

Tax Policy in a Transforming Manufacturing Sector

Tax Policy in a Transforming Manufacturing Sector

- US manufacturing saw significant changes between 2001–2011 more
- Charles, Hurst, and Schwartz (2019): transformation driven by four main factors
  - **Skill Intensity**
  - **Capital Intensity**
  - **Trade Exposure**
  - **Robotization**

Tax Policy in a Transforming Manufacturing Sector

- US manufacturing saw significant changes between 2001–2011 more
- Charles, Hurst, and Schwartz (2019): transformation driven by four main factors
  - **Skill Intensity:** Non-production share of employment in 2001
  - **Capital Intensity:** Asset-to-employee ratio in 2001
  - **Trade Exposure:** Exposure imports from China (2000–2007) (AADHP, 2013)
  - **Robotization:** Change in robotization 3-digit NAICS (1993–2007) (AR, 2020)
- Controls: quartile bins for each factor $\times$ Year FE
- Heterogeneous effects: does bonus prop-up "20th century production"?

Baseline Results are Robust to Shock Controls

	(1)	(2)	(3)	(4)	(5)	(6)
	Log Investment		Log Employment		Log Mean Earnings	
Bonus	0.158***	0.157***	0.079***	0.069***	-0.021***	0.0001
(SE)	(0.029)	(0.032)	(0.010)	(0.010)	(0.004)	(0.005)
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.983]
Plant FE	✓	✓	✓	✓	✓	✓
State×Year FE	✓	✓	✓	✓	✓	✓
Plant Controls	✓		✓		✓	
Year FE Interactions:						
Skill Intensity		✓		✓		✓
Capital Intensity		✓		✓		✓
Trade Exposure		✓		✓		✓
Robot Exposure		✓		✓		✓

Heterogeneous Effects of Bonus: Log Investment

Interaction Term	(1) Skill Intensity	(2) Capital Intensity	(3) Trade Exposure	(4) Robot Exposure
Bonus	0.180***	0.157***	0.125***	0.158***
(SE)	(0.034)	(0.031)	(0.031)	(0.031)
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]
Bonus×Interaction	0.098*	0.032**	-0.086***	0.0158
(SE)	(0.055)	(0.015)	(0.028)	(0.012)
[p-value]	[0.075]	[0.038]	[0.003]	[0.188]
Plant FE	✓	✓	✓	✓
Year FE Interactions:				
State	✓	✓	✓	✓
Skill Intensity	✓	✓	✓	✓
Capital Intensity	✓	✓	✓	✓
Trade Exposure	✓	✓	✓	✓
Robot Exposure	✓	✓	✓	✓

Heterogeneous Effects of Bonus: Log Employment

Interaction Term	(1) Skill Intensity	(2) Capital Intensity	(3) Trade Exposure	(4) Robot Exposure
Bonus	0.074***	0.069***	0.054***	0.070***
(SE)	(0.011)	(0.010)	(0.011)	(0.010)
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]
Bonus×Interaction	0.0215	0.005*	-0.041***	0.013***
(SE)	(0.018)	(0.003)	(0.011)	(0.004)
[p-value]	[0.232]	[0.091]	[0.000]	[0.001]
Plant FE	✓	✓	✓	✓
Year FE Interactions:				
State	✓	✓	✓	✓
Skill Intensity	✓	✓	✓	✓
Capital Intensity	✓	✓	✓	✓
Trade Exposure	✓	✓	✓	✓
Robot Exposure	✓	✓	✓	✓

Structural Model of

Factor Demands

Scale vs. Substitution Effects

- Marshall (1890) & Hicks (1932) note labor demand depends on:
  - Scale effect: firm expands production and hires more workers
  - Substitution/complementarity between labor and capital

Scale vs. Substitution Effects

- Marshall (1890) & Hicks (1932) note labor demand depends on:
  - Scale effect: firm expands production and hires more workers
  - Substitution/complementarity between labor and capital
- To separates these effects model assumes

1. Bonus lowers cost of capital — $\phi = \frac{\partial \ln(\text{Cost of Capital})}{\partial \text{Bonus}} < 0$
2. Product demand elasticity (CES) — $\eta > 1$
3. Production function has CRTS with inputs K, L, J — s_K, s_L, s_J: Cost shares
   σ_{KL}: Allen elasticity of substitution
   Substitutes $\sigma_{KL} > 0$
   Complements $\sigma_{KL} < 0$

Reduced-Form Effects in Model

- Model predictions for reduced-form effects:

$$\text{Capital}: \qquad \beta^{K} = (\underbrace{s_K \eta}_{\text{Scale}} + \underbrace{s_J \sigma_{KJ} + s_L \sigma_{KL}}_{\text{Substitution}}) \times \underbrace{-\phi}_{\text{Cost of Capital} > 0}$$

Reduced-Form Effects in Model

- Model predictions for reduced-form effects:

$$\text{Capital}: \quad \beta^K = (\underbrace{s_K \eta}_{\text{Scale}} + \underbrace{s_J \sigma_{KJ} + s_L \sigma_{KL}}_{\text{Substitution}}) \times \underbrace{-\phi}_{\text{Cost of Capital} > 0}$$

$$\text{Labor}: \quad \beta^L = s_K(\eta - \sigma_{KL}) \times -\phi$$

$$\text{Revenue}: \quad \beta^R = s_K(\eta - 1) \times -\phi$$

- Labor demand increases if:
  1. K-L are complements: $\sigma_{KL} < 0$
  2. Scale effect dominates: $\eta > \sigma_{KL} > 0$

Reduced-Form Effects in Model

- Model predictions for reduced-form effects:

$$
\begin{aligned}
\text{Capital}: \quad \beta^K &= (\underbrace{s_K\eta}_{\text{Scale}} + \underbrace{s_J\sigma_{KJ} + s_L\sigma_{KL}}_{\text{Substitution}}) \times \underbrace{-\phi}_{\text{Cost of Capital} > 0} \\
\text{Labor}: \quad \beta^L &= s_K(\eta - \sigma_{KL}) \times -\phi \\
\text{Revenue}: \quad \beta^R &= s_K(\eta - 1) \times -\phi
\end{aligned}
$$

- Reduced-form estimate of scale effect, $s_K\eta \times -\phi$:

$$\bar{\beta} \equiv s_J\beta^J + s_K\beta^K + s_L\beta^L = s_K\eta \times -\phi > 0$$

Scale vs. Substitution in Reduced Form Effects

- Compare labor and scale effects:

$$\begin{aligned} \text{Labor}: \quad \beta^L &= s_K(\eta - \sigma_{KL}) \times -\phi \\ \text{Scale effect}: \quad \bar{\beta} &= s_K\eta \times -\phi \end{aligned}$$

Scale vs. Substitution in Reduced Form Effects

- Compare labor and scale effects:

$$\left.\begin{aligned} \text{Labor}: \quad \beta^L &= s_K(\eta - \sigma_{KL}) \times -\phi \\ \text{Scale effect}: \quad \bar{\beta} &= s_K \eta \times -\phi \end{aligned}\right\} \Longrightarrow \quad \frac{\beta^L}{\bar{\beta}} = 1 - \frac{\sigma_{KL}}{\eta}$$

Scale vs. Substitution in Reduced Form Effects

- Compare labor and scale effects:

$$\left.\begin{array}{lrcl} \text{Labor :} & \beta^L & = & s_K(\eta - \sigma_{KL}) \times -\phi \\ \text{Scale effect :} & \bar{\beta} & = & s_K\eta \times -\phi \end{array}\right\} \Longrightarrow \begin{array}{c} \frac{\beta^L}{\bar{\beta}} = 1 - \frac{\sigma_{KL}}{\eta} \\ \bar{\beta} > \beta^L \Longleftrightarrow \sigma_{KL} > 0 \end{array}$$

Scale vs. Substitution in Reduced Form Effects

- Compare labor and scale effects:

$$\left.\begin{array}{lcc} \text{Labor :} & \beta^L = & s_K(\eta - \sigma_{KL}) \times -\phi \\ \text{Scale effect :} & \bar{\beta} = & s_K \eta \times -\phi \end{array}\right\} \implies \begin{array}{c} \frac{\beta^L}{\bar{\beta}} = 1 - \frac{\sigma_{KL}}{\eta} \\ \bar{\beta} > \beta^L \iff \sigma_{KL} > 0 \end{array}$$

- Let $\begin{cases} L = & \text{Production Labor} & \beta^L = 11.5\% & s_L = 50\% \\ J = & \text{Non} - \text{Prod Labor} & \beta^J = 8.1\% & s_J = 30\% \\ K = & \text{Capital} & \beta^K = 7.9\% & s_K = 20\% \end{cases}$

Scale vs. Substitution in Reduced Form Effects

- Compare labor and scale effects:

$$\left.\begin{array}{lcl} \text{Labor :} & \beta^L = & s_K(\eta - \sigma_{KL}) \times -\phi \\ \text{Scale effect :} & \bar{\beta} = & s_K\eta \times -\phi \end{array}\right\} \Longrightarrow \begin{array}{c} \frac{\beta^L}{\bar{\beta}} = 1 - \frac{\sigma_{KL}}{\eta} \\ \bar{\beta} > \beta^L \Longleftrightarrow \sigma_{KL} > 0 \end{array}$$

- Let $\begin{cases} L = & \text{Production Labor} & \beta^L = 11.5\% & s_L = 50\% \\ J = & \text{Non} - \text{Prod Labor} & \beta^J = 8.1\% & s_J = 30\% \\ K = & \text{Capital} & \beta^K = 7.9\% & s_K = 20\% \end{cases}$

$$\Longrightarrow \text{Scale Effect} \quad \bar{\beta} = 10\% \quad (SE = 1\%)$$

- Absent substitution, bonus $\uparrow$ all inputs by 10%

Scale vs. Substitution in Reduced Form Effects

- Compare labor and scale effects:

$$\left.\begin{array}{lcc} \text{Labor}: & \beta^L = & s_K(\eta - \sigma_{KL}) \times -\phi \\ \text{Scale effect}: & \bar{\beta} = & s_K \eta \times -\phi \end{array}\right\} \Longrightarrow \begin{array}{c} \frac{\beta^L}{\bar{\beta}} = 1 - \frac{\sigma_{KL}}{\eta} \\ \bar{\beta} > \beta^L \Longleftrightarrow \sigma_{KL} > 0 \end{array}$$

- Let $\begin{cases} L = & \text{Production Labor} & \beta^L = 11.5\% & s_L = 50\% \\ J = & \text{Non} - \text{Prod Labor} & \beta^J = 8.1\% & s_J = 30\% \\ K = & \text{Capital} & \beta^K = 7.9\% & s_K = 20\% \end{cases}$

$$\Longrightarrow \text{Scale Effect} \quad \bar{\beta} = 10\% \quad (SE = 1\%)$$

- Absent substitution, bonus $\uparrow$ all inputs by 10%
- Non-production workers substitute for capital: $\bar{\beta} > \beta^J \Longrightarrow \sigma_{KJ} > 0$
- Production workers complementary with capital: $\bar{\beta} < \beta^L \Longrightarrow \sigma_{KL} < 0$

Identification and Estimation

- Previous expression $\frac{\beta^L}{\bar{\beta}} = 1 - \frac{\sigma_{KL}}{\eta}$ implies $\sigma_{KL} = \eta \left(1 - \frac{\beta^L}{\bar{\beta}}\right)$

Identification and Estimation

- Previous expression $\frac{\beta^L}{\bar{\beta}} = 1 - \frac{\sigma_{KL}}{\eta}$ implies $\sigma_{KL} = \eta \left(1 - \frac{\beta^L}{\bar{\beta}}\right)$
- Revenue and scale effects identify η and ϕ:

$$\begin{aligned} \text{Revenue :} \quad \beta^R &= s_K(\eta - 1) \times -\phi \\ \text{Scale effect :} \quad \bar{\beta} &= s_K \eta \times -\phi \end{aligned}$$

Identification and Estimation

- Previous expression $\frac{\beta^L}{\bar{\beta}} = 1 - \frac{\sigma_{KL}}{\eta}$ implies $\sigma_{KL} = \eta\left(1 - \frac{\beta^L}{\bar{\beta}}\right)$

- Revenue and scale effects identify η and ϕ:

$$\left.\begin{array}{lrcl} \text{Revenue :} & \beta^R & = & s_K(\eta - 1) \times -\phi \\ \text{Scale effect :} & \bar{\beta} & = & s_K \eta \times -\phi \end{array}\right\} \Longrightarrow \begin{array}{rcl} \eta & = & \frac{\bar{\beta}}{\bar{\beta} - \beta^R} > 1 \\ \phi & = & -\frac{\bar{\beta} - \beta^R}{s_K} < 0 \end{array}$$

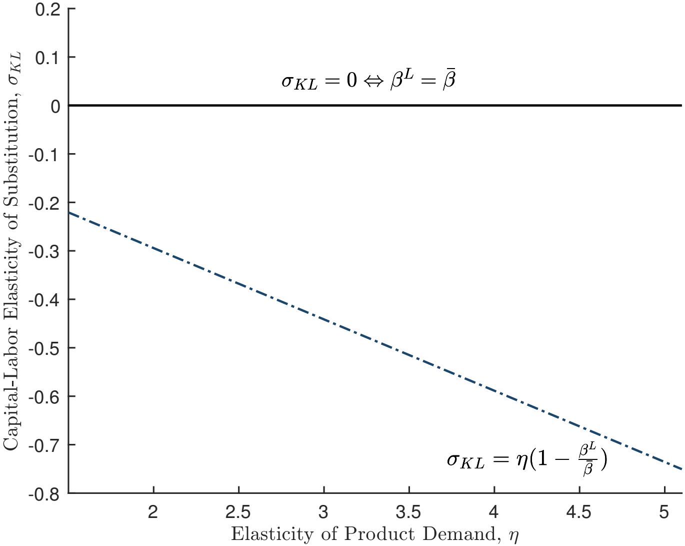
Identification and Estimation

- Previous expression $\frac{\beta^L}{\bar{\beta}} = 1 - \frac{\sigma_{KL}}{\eta}$ implies $\sigma_{KL} = \eta \left(1 - \frac{\beta^L}{\bar{\beta}}\right)$
- Revenue and scale effects identify η and ϕ:

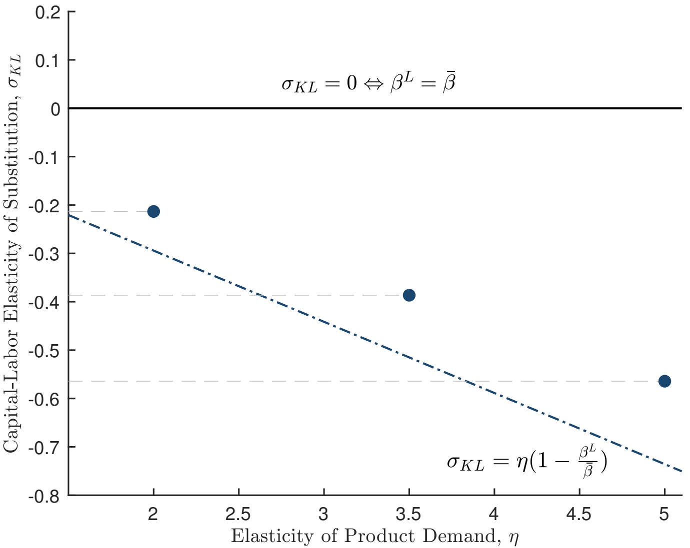
$$\left.\begin{array}{lrcl} \text{Revenue}: & \beta^R & = & s_K(\eta - 1) \times -\phi \\ \text{Scale effect}: & \bar{\beta} & = & s_K \eta \times -\phi \end{array}\right\} \Longrightarrow \begin{array}{rcl} \eta & = & \frac{\bar{\beta}}{\bar{\beta} - \beta^R} > 1 \\ \phi & = & -\frac{\bar{\beta} - \beta^R}{s_K} < 0 \end{array}$$

- Estimate model parameters via Classical Minimum Distance
  - Calibrate $\eta \in [2, 5]$ (Shapiro and Walker, 2020) or estimate it
  - Impose cost minimization $s_J \sigma_{KJ} + s_L \sigma_{KL} > 0$ (Allen, 1938)

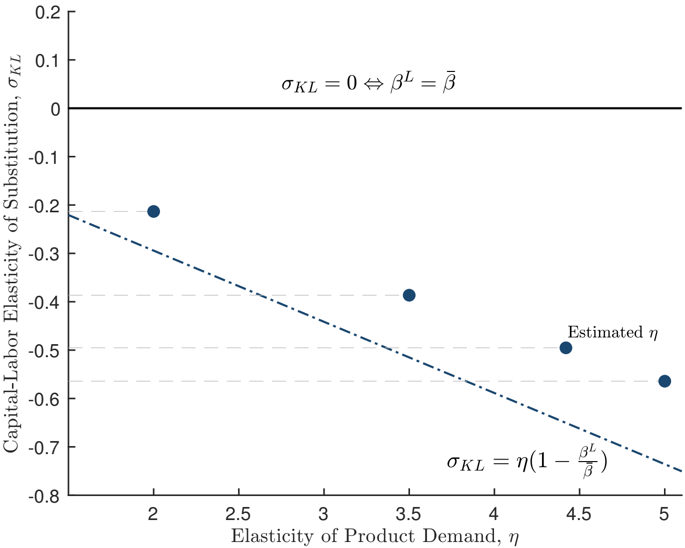
Classical Minimum Distance Estimates of σ_{KL}



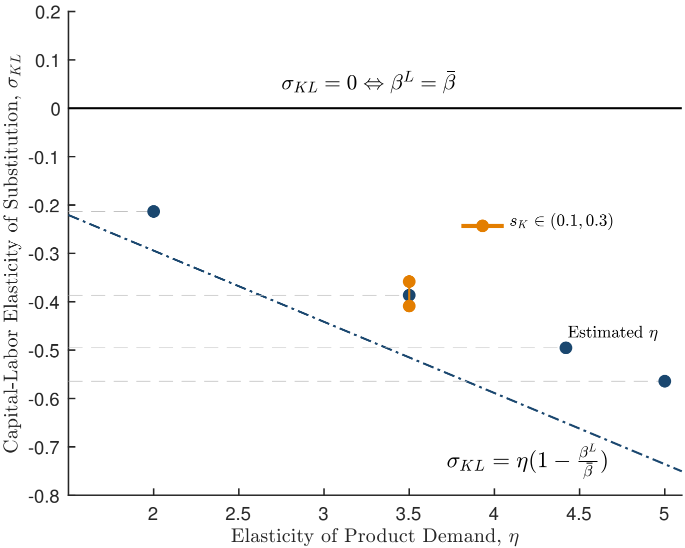
Classical Minimum Distance Estimates of σ_{KL}



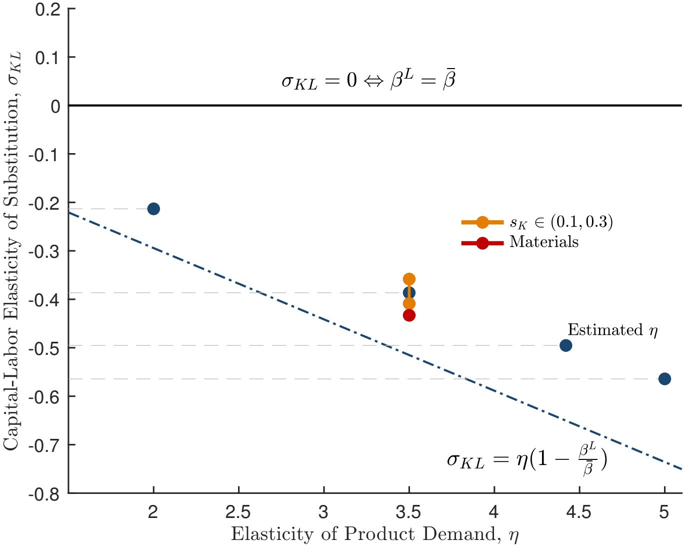
Classical Minimum Distance Estimates of σ_{KL}



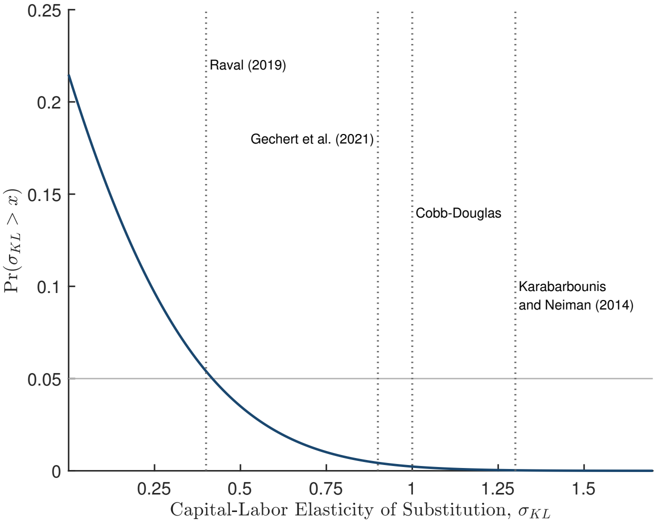
Classical Minimum Distance Estimates of σ_{KL}



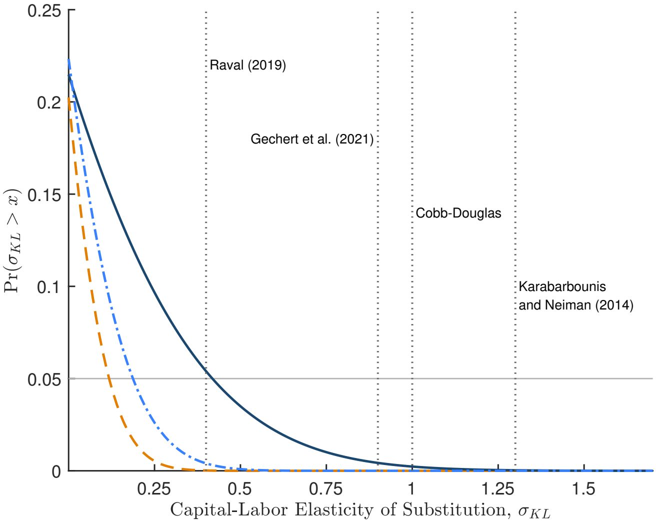
Classical Minimum Distance Estimates of σ_{KL}



Classical Minimum Distance Estimates of σ_{KL}



Classical Minimum Distance Estimates of σ_{KL}



Empirical Implications of Complementarity

- K-L compelementarity $\Longrightarrow$ larger investment effect when wages are low a.k.a. “Marshall’s Second Law of Derived Demand”

Empirical Implications of Complementarity

- K-L compelementarity $\Longrightarrow$ larger investment effect when wages are low a.k.a. "Marshall's Second Law of Derived Demand"

- Test for heterogeneous effects by labor market characteristics:
  1. Union status
     - Unions raise cost of labor
     - Plant-level data (MOPS, 2005): $\mathbb{I}$[unionization$>$ 60%]
  2. Right-to-Work States (as of 2001)
     - Lower wages due to anti-union sentiment, low bargaining power
  3. Labor market concentration
     - Monopsony power $\Longrightarrow$ lower wages (Robinson, 1933)
     - Compute Log HHI at NAICS 3-digit by CZ using LBD

Heterogeneity by Labor Costs: Investment

	(1) Union	(2) RTW	(3) ln(HHI)
Bonus	0.197***	0.062*	0.150***
(SE)	(0.034)	(0.036)	(0.028)
[p-value]	[0.000]	[0.087]	[0.000]
Bonus×Interact	-0.085**	0.200***	0.038**
(SE)	(0.039)	(0.055)	(0.018)
[p-value]	[0.027]	[0.000]	[0.037]
Plant FE	✓	✓	✓
State×Year FE	✓	✓	✓

Investment is higher when labor costs are lower!

More

Summary of Results

- **Bonus depreciation did not raise mean earnings or productivity**

Summary of Results

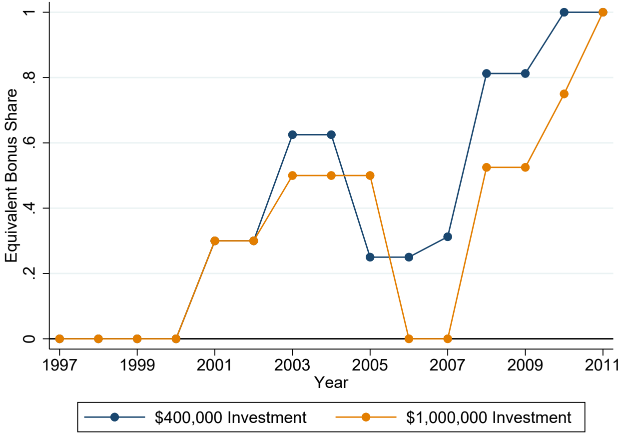
- **Bonus depreciation did not raise mean earnings or productivity**
- **Tax incentives for investment stimulate employment**
  - Estimate larger gains for disadvantaged workers:
    non-college, young, female, Black, and Hispanic
  - Effects larger in manufacturing industries most likely to thrive:
    high skill and capital intensity, comparative advantage, robot adoption

Summary of Results

- **Bonus depreciation did not raise mean earnings or productivity**
- **Tax incentives for investment stimulate employment**
  - Estimate larger gains for disadvantaged workers: non-college, young, female, Black, and Hispanic
  - Effects larger in manufacturing industries most likely to thrive: high skill and capital intensity, comparative advantage, robot adoption
- **Capital and labor are complements in our setting**
  - Scale effect explains 90% of increase in employment
  - Rules out concern that tax incentives for investment eliminate jobs
  - Labor market policy impacts investment decisions

Additional Slides

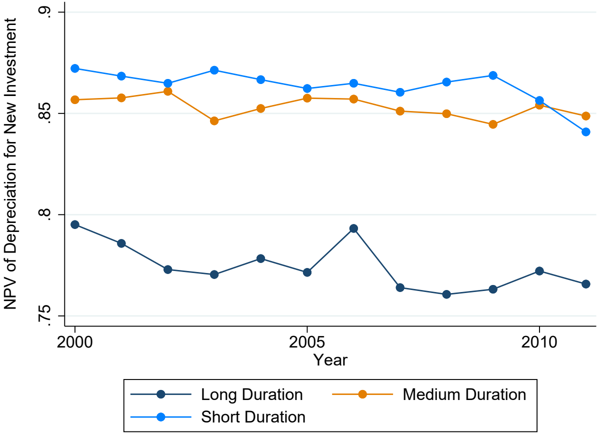
Bonus Depreciation Rate Over Time



- §179 expensing raises average bonus rate for projects $< \$1/2M$, especially in later years
- Includes 2005 extension for long-duration capital projects $> \$1M$
- Extensions, backdating $\Longrightarrow$ expected bonus rate between 25–50%, even in 2006–2007 (House & Shapiro, 2008)

Back

Stability of Bonus Depreciation Treatment Measure



- Potential concern: mix of long / short investment may respond to policy
- Asset classes are often defined by asset *use* not by asset *type*
- Sector-level IRS SOI data on investment by each asset class shows stability of sector-level z_0 2000–2014

Back

Empirical Evaluations of Bonus Depreciation

General Strategy

- Cummins, Hassett & Hubbard (1994) estimated investment effects of accelerated depreciation in the 1986 tax reform by comparing firms that, on average, investment in longer-lived capital to firms that invest in shorter-lived capital

Bonus Depreciation Estimates

- House and Shapiro (2008): effects of bonus depreciation 2001–2004 on investment
- Zwick & Mahon (2017): effects of bonus depreciation on investment, tax return data
- Garrett, Ohrn, & Suárez Serrato (2020): effects of bonus deprecation on local labor markets

Back

Economists' Beliefs about Bonus Depreciation

"Bonus depreciation will subsidize companies to cut even more jobs"

– Robert Reich (2010, former US Secretary of Labor)

"Capital deepening, which brings additional returns to the owners of capital, brings substantial returns to workers as well."

–Trump's CEA (2017)

"The US tax system is biased against labor and in favor of capital, has become more so in recent years, and has promoted levels of automation beyond what is socially desirable"

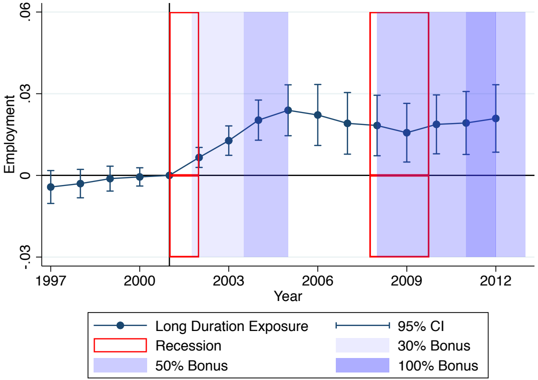
–Acemoglu, Manera, Restrepo (2020)

Back

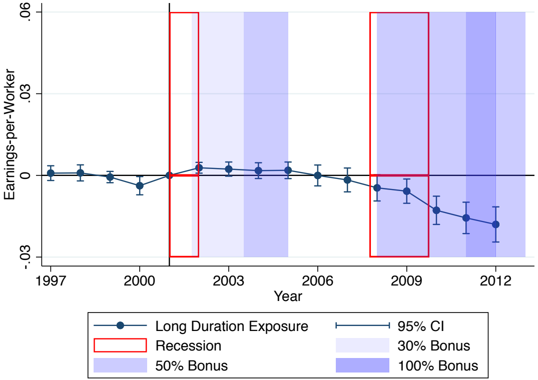
External Validity: Employment and Wages

- Garrett et al. (2020): effect of local exposure to bonus depreciation on local labor markets

Log Employment

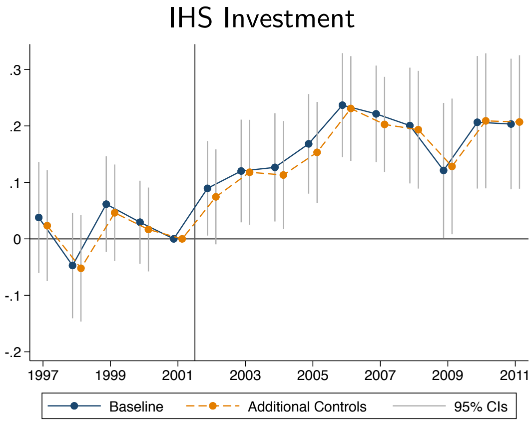


Log Earning Per Worker

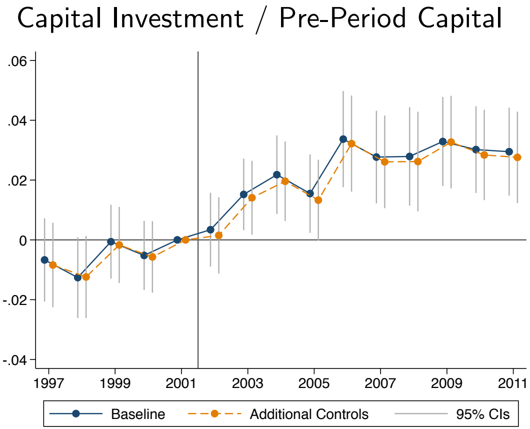


Back

Alternative Measures of Capital Investment



$DiD = 0.168^{***}(0.030)$



$DiD = 0.031 *** (0.004)$

Back

IHS Investment

	(1)	(2)	(3)	(4)	(5)
Bonus	0.168***	0.153***	0.149***	0.150***	0.156***
(SE)	(0.030)	(0.029)	(0.029)	(0.029)	(0.030)
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Plant & Year FE	✓	✓	✓	✓	✓
State $\times$ Year FE		✓	✓	✓	✓
$\text{PlantSize}_{2001} \times$ Year FE			✓	✓	✓
$\text{TFP}_{2001} \times$ Year FE				✓	✓
$\text{FirmSize}_{2001} \times$ Year FE					✓

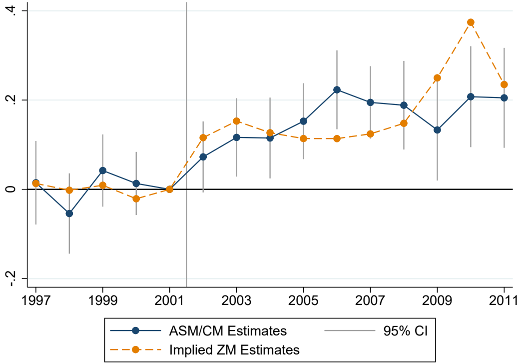
Back

Capital Investment / Pre-Period Capital

	(1)	(2)	(3)	(4)	(5)
Bonus	0.031***	0.029***	0.027***	0.027***	0.028***
(SE)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Plant & Year FE	✓	✓	✓	✓	✓
State $\times$ Year FE		✓	✓	✓	✓
$\text{PlantSize}_{2001} \times$ Year FE			✓	✓	✓
$\text{TFP}_{2001} \times$ Year FE				✓	✓
$\text{FirmSize}_{2001} \times$ Year FE					✓

Back

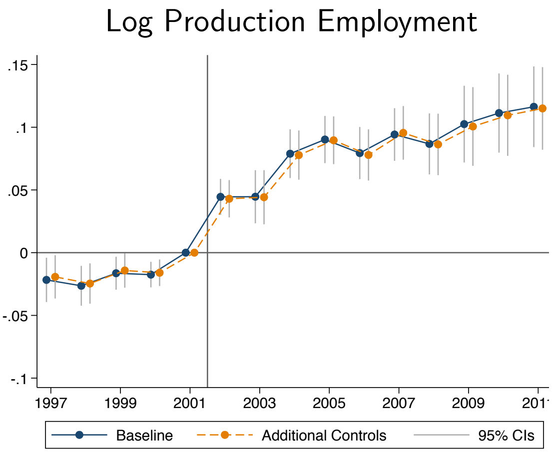
Comparison of Investment Event Study Results with Zwick & Mahon (2017)

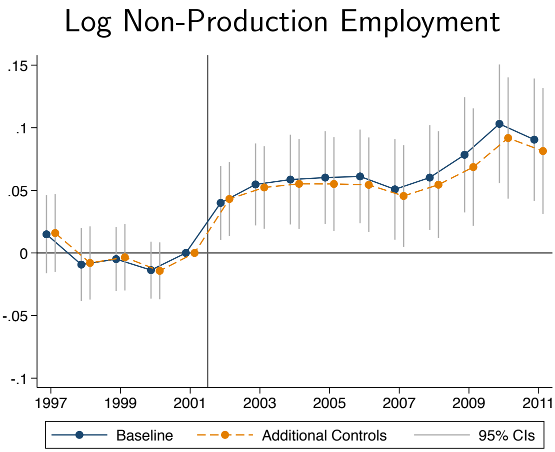


- Similar magnitudes despite differences: firms/plant, tax/survey data, all sectors/manufacturing, unbalanced/balanced, and sets of controls

Back

Effects on Log Plant Employment by Task





Back

Log Mean Earnings

	(1)	(2)	(3)	(4)	(5)
Bonus	-0.018***	-0.021***	-0.021***	-0.020***	-0.021***
(SE)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Plant & Year FE	✓	✓	✓	✓	✓
State$\times$Year FE		✓	✓	✓	✓
PlantSize$_{2001}$$\times$Year FE			✓	✓	✓
TFP$_{2001}$$\times$Year FE				✓	✓
FirmSize$_{2001}$$\times$Year FE					✓

Back

Kitagawa-Oaxaca-Blinder Decomposition

- We now quantify effect of composition changes on mean earnings

- Change in wages for treated firms is:

$$\Delta \ln(\widehat{wage})^{\text{treat}} = \underbrace{\Delta\hat{\alpha}^{\text{treat}} + \Delta\hat{\beta}^{\text{treat}}\overline{X}^{\text{treat, pre}}}_{\text{Wages conditional on observables}} + \underbrace{\hat{\beta}^{\text{treat, pre}}\Delta\overline{X}^{\text{treat}}}_{\text{Composition}}$$

Kitagawa-Oaxaca-Blinder Decomposition

- We now quantify effect of composition changes on mean earnings
- Change in wages for treated firms is:

$$\Delta \ln(\widehat{wage})^{\text{treat}} = \underbrace{\Delta\hat{\alpha}^{\text{treat}} + \Delta\hat{\beta}^{\text{treat}}\overline{X}^{\text{treat, pre}}}_{\text{Wages conditional on observables}} + \underbrace{\hat{\beta}^{\text{treat, pre}}\Delta\overline{X}^{\text{treat}}}_{\text{Composition}}$$

- In the DiD context:

$$\begin{aligned}\Delta \ln(\widehat{wage})^{\text{treat}} - \Delta \ln(\widehat{wage})^{\text{control}} &= \Delta\hat{\alpha}^{\text{treat}} - \Delta\hat{\alpha}^{\text{control}} \\ &+ \Delta\hat{\beta}^{\text{treat}}\overline{X}^{\text{treat, pre}} - \Delta\hat{\beta}^{\text{control}}\overline{X}^{\text{control, pre}} \\ &+ \hat{\beta}^{\text{treat, pre}}\Delta\overline{X}^{\text{treat}} - \hat{\beta}^{\text{control, pre}}\Delta\overline{X}^{\text{control}}\end{aligned}$$

Back

Kitagawa-Oaxaca-Blinder Decomposition

$\Delta\Delta$ Wages Conditional on Observables	$\Delta\Delta\hat{\alpha} + \Delta\hat{\beta}^{\text{treat}}\overline{X}^{\text{treat, pre}} - \Delta\hat{\beta}^{\text{control}}\overline{X}^{\text{control, pre}}$	-0.003
$\Delta\Delta$ Worker Composition	$+\ \hat{\beta}^{\text{treat, pre}}\Delta\overline{X}^{\text{treat}} - \hat{\beta}^{\text{control, pre}}\Delta\overline{X}^{\text{control}}$	-0.028
DiD Estimate	$\Delta \ln(\widehat{wage})^{\text{treat}} - \Delta \ln(\widehat{wage})^{\text{control}}$	-0.031*** (0.011)

- Wage declines are over 90% attributable to shifting composition! Back

Log Total Output

	(1)	(2)	(3)	(4)	(5)
Bonus	0.057***	0.051***	0.051***	0.052***	0.054***
(SE)	(0.015)	(0.014)	(0.014)	(0.014)	(0.014)
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Plant & Year FE	✓	✓	✓	✓	✓
State×Year FE		✓	✓	✓	✓
PlantSize_{2001}×Year FE			✓	✓	✓
TFP_{2001}×Year FE				✓	✓
FirmSize_{2001}×Year FE					✓

Back

Log Total Factor Productivity

	(1)	(2)	(3)	(4)	(5)
Bonus	-0.0007	-0.0015	-0.0011	-0.0017	-0.0028
(SE)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
[p-value]	[0.910]	[0.806]	[0.857]	[0.777]	[0.635]
Plant & Year FE	✓	✓	✓	✓	✓
State$\times$Year FE		✓	✓	✓	✓
$\text{PlantSize}_{2001}\times$Year FE			✓	✓	✓
$\text{TFP}_{2001}\times$Year FE				✓	✓
$\text{FirmSize}_{2001}\times$Year FE					✓

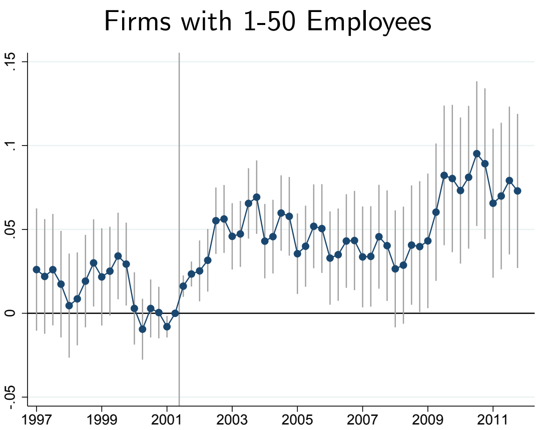
Back

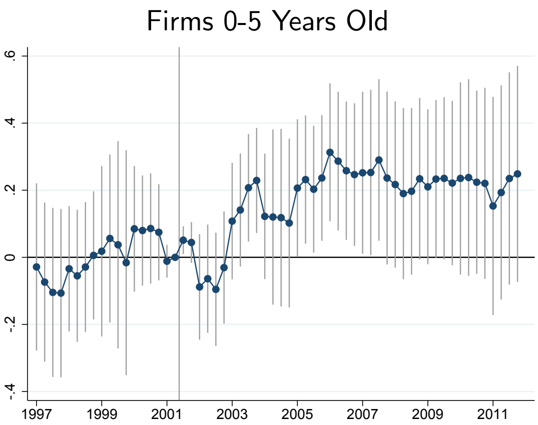
Additional Outcomes

	(1) Log Prod. Hours	(2) Log Nonprod. Hours	(3) Log Materials
Bonus	0.0863*** (0.0181) [0.000]	0.0582* (0.0311) [0.061]	0.0832** (0.0344) [0.016]
Plant FE	✓	✓	✓
State×Year FE	✓	✓	✓

Back

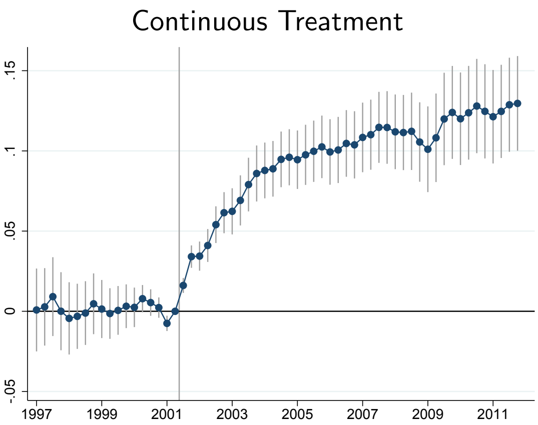
Small and Young Firms

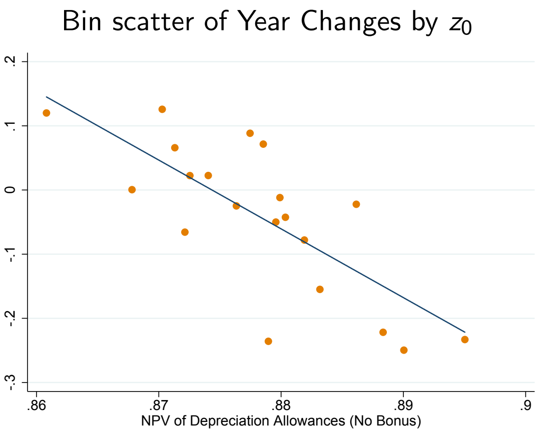




Back

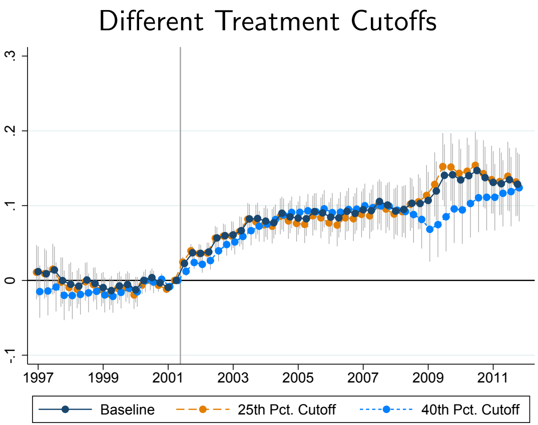
Log Employment (QWI Data) Continuous Treatment

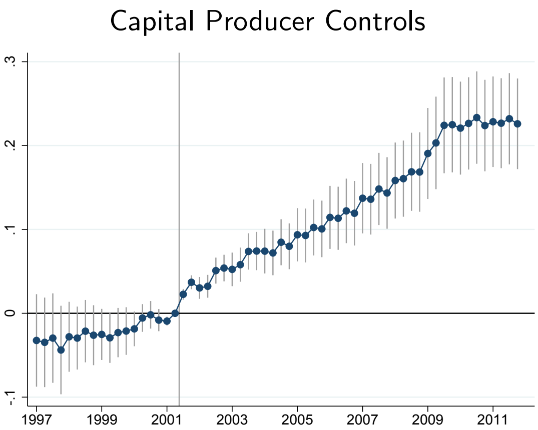




Back

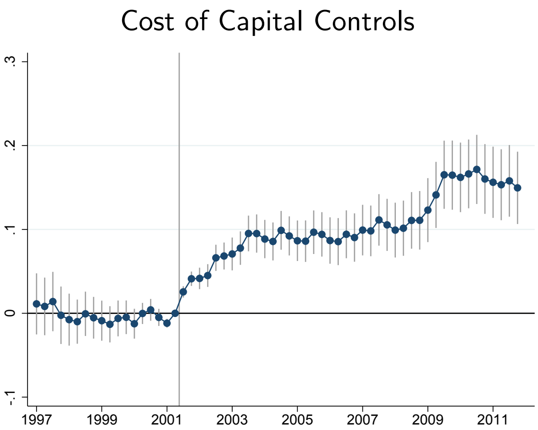
Effects of Bonus on Employment: Robustness (1/2)

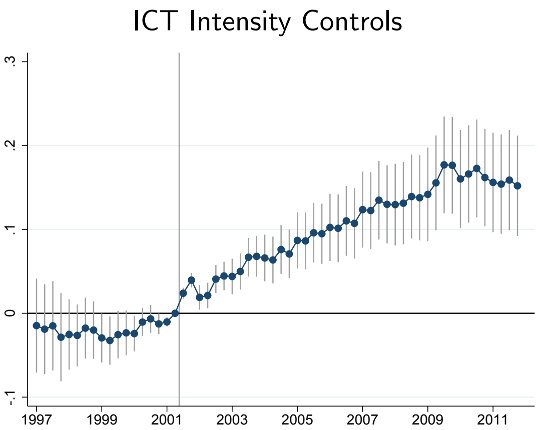




Back

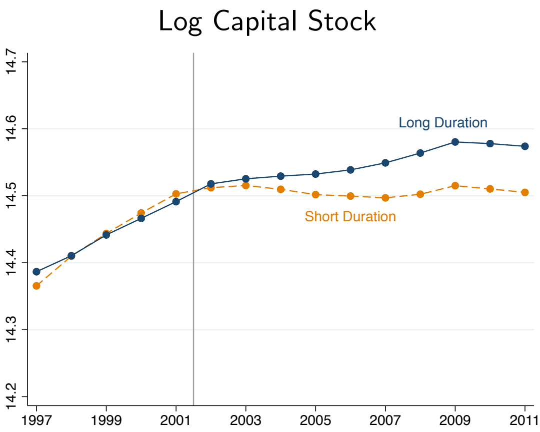
Effects of Bonus on Employment: Robustness (2/2)

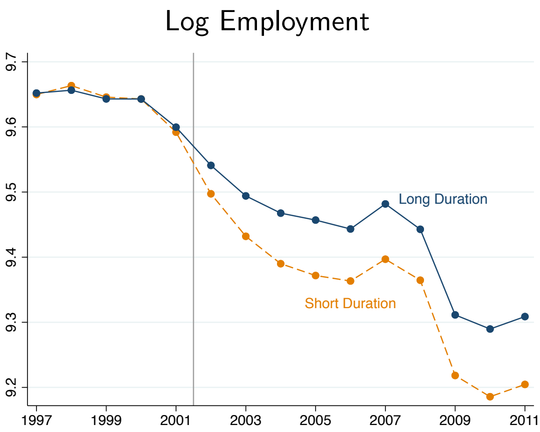




Back

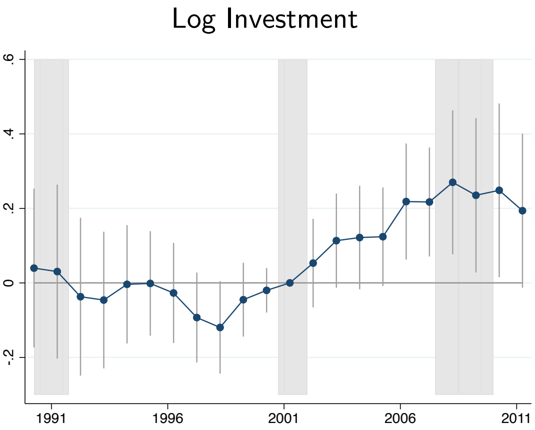
Effects of Bonus Depreciation on Aggregate Trends

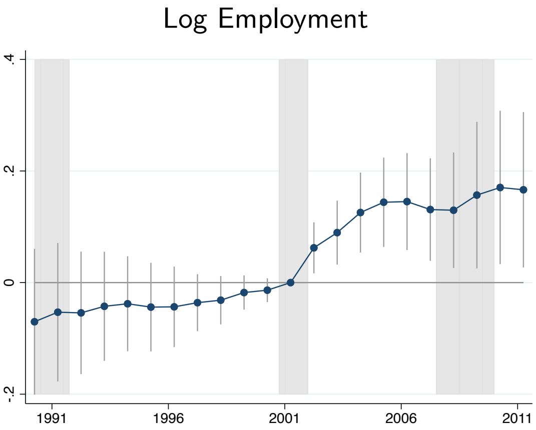




Back

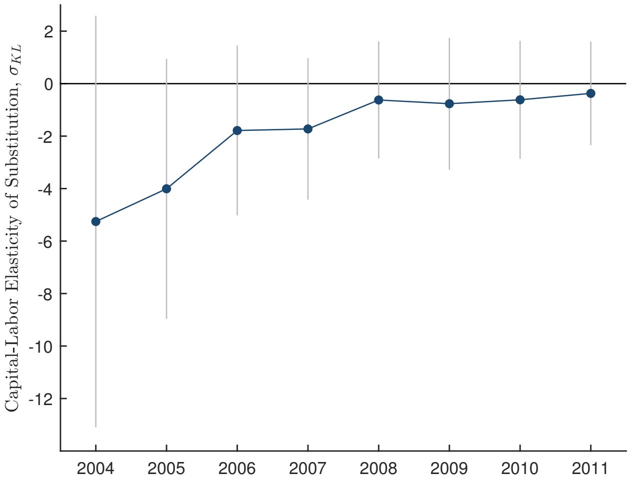
U.S. Manufacturing Over the Business Cycle





Back

Capital-Production Labor Substitution over Time



Back

Estimates of Nested CES Production Function

	(1) Baseline	(2) Low s_K	(3) High s_K	(4) Low η	(5) High η	(6) Est. η
	Panel A: CES Parameter Estimates					
Nonproduction Labor, ρ_1	-0.552	-0.556	-0.551	-1.812	-0.063	-0.211
	(2.152)	(2.155)	(2.156)	(4.863)	(1.330)	(1.564)
Production Labor, ρ_2	3.587	3.446	3.791	5.687	2.772	3.019
	(4.682)	(4.213)	(5.510)	(10.450)	(2.907)	(3.415)
	Panel B: p-values for Skill Complementarity Test					
$H_0 : \sigma_{KL} - \sigma_{KJ} - 1 > 0$	0.052	0.054	0.051	0.003	0.127	0.098
Cost shares:						
Production labor	0.50	0.55	0.45	0.50	0.50	0.50
Nonproduction labor	0.30	0.35	0.25	0.30	0.30	0.30
Capital	0.20	0.10	0.30	0.20	0.20	0.20
Effect on Cost of Capital, ϕ	-0.14	-0.28	-0.09	-0.25	-0.10	-0.11
Demand Elasticity, η	3.50	3.50	3.50	2.00	5.00	4.42

$$F(K,J,L) = \left[\mu_1 J^{\rho_1} + (1-\mu_1)\left(\mu_2 L^{\rho_2} + (1-\mu_2)K^{\rho_2}\right)^{\frac{\rho_1}{\rho_2}}\right]^{\frac{1}{\rho_1}}$$

Employment Effects by Education and Age

	(1) Log(Emp)	(2) Log(Earn)	(3) % $<$ HS	(4) % $<$ 35 years
	Difference-in-Differences			
Bonus	0.097***	-0.031***	0.00259***	0.01285***
	(0.0156)	(0.00547)	(0.000605)	(0.0024862)
	[0.000]	[0.000]	[0.000]	[0.000]
	Long Differences			
Bonus	0.135***	-0.0314***	0.00394***	0.0306***
	(0.0216)	(0.0078)	(0.000724)	(0.00679)
	[0.000]	[0.000]	[0.000]	[0.000]
Share2001			0.25	0.3
State×NAICS FE	✓	✓	✓	✓
State×Quarter FE	✓	✓	✓	✓

Back

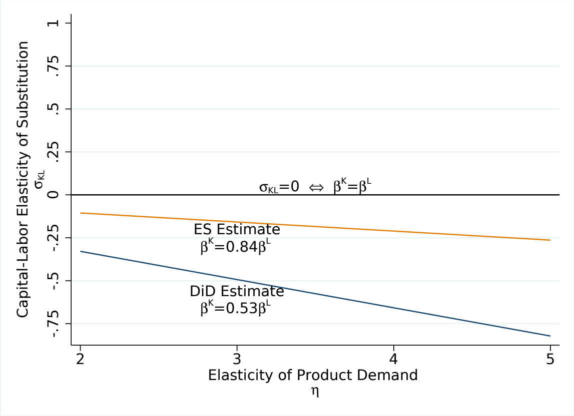
Employment Effects by Gender, Race, and Ethnicity

	(1) % Female	(2) % Nonwhite	(3) % Black	(4) % Hispanic
	Difference-in-Differences			
Bonus	0.00822***	0.000267	0.0012	0.00536***
	(0.00151)	(0.000958)	(0.00074)	(0.000969)
	[0.000]	[0.780]	[0.105]	[0.000]
	Long Differences			
Bonus	0.0118***	0.000678	0.00409***	0.00589***
	(0.0022)	(0.00211)	(0.00153)	(0.0017)
	[0.000]	[0.748]	[0.008]	[0.001]
Share2001	0.25	0.26	0.07	0.06
State×NAICS FE	✓	✓	✓	✓
State×Quarter FE	✓	✓	✓	✓
Pre-Period Growth FE	✓	✓	✓	✓

Back

2 Input Model: Capital-Labor Elasticity of Substitution

$$\sigma_{KL} = \eta \left(1 - \frac{\beta^L}{s_L \beta^L + s_K \beta^K}\right)$$



Back

Heterogeneity by Labor Costs: Employment

	(1) Union	(2) RTW	(3) ln(HHI)
Bonus	0.111***	0.068***	0.082***
(SE)	(0.011)	(0.013)	(0.010)
[p-value]	[0.000]	[0.000]	[0.000]
Bonus×Interact	-0.062***	0.0294	-0.0053
(SE)	(0.012)	(0.019)	(0.005)
[p-value]	[0.000]	[0.124]	[0.308]
Plant FE	✓	✓	✓
State×Year FE	✓	✓	✓

Back

Heterogeneity by Labor Costs: Earnings

	(1) Union	(2) RTW	(3) ln(HHI)
Bonus	-0.016***	-0.023***	-0.022***
(SE)	(0.005)	(0.006)	(0.004)
[p-value]	[0.003]	[0.000]	[0.000]
Bonus×Interact	-0.010*	0.0052	0.008***
(SE)	(0.006)	(0.009)	(0.003)
[p-value]	[0.097]	[0.545]	[0.005]
Plant FE	✓	✓	✓
State×Year FE	✓	✓	✓

Back