PLACE-BASED POLICIES
AND THE GEOGRAPHY OF CORPORATE INVESTMENT

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Motivation: corporate tax breaks & spatial inequality

- Sharp increase in spatial inequality in income + prime-age employment since 1970s
  - Ganong & Shoag (2017); Austin, Glaeser, Summers (2018); Gaubert et al. (2021)

- Policy instruments used to combat this problem:
  - Tax subsidies: governments compete to attract companies
  - Opportunity Zones (2017 TCJA): deferred capital gains taxes + capital lock-in
  - **Bonus depreciation:** focus on long-lasting investment + immediate cash flows

- Two main issues these policies try to address:
  1. Targeting: directing resources where needed the most
  2. Retention: prevent (large) firms from capturing benefits then exiting
Recent failures: the Wisconsin-Foxconn deal

- Gov. Scott Walker and Pres. Donald Trump brokered 2017 deal with Foxconn to bring 13k jobs and $10 bil. to area around Racine, WI

- In exchange, pledged $4 bil. in subsidies to Foxconn (mostly refundable tax credits)

- **Toe-dipping:** by end of 2019 Foxconn hired only 281 workers and invested 2.8% of its promise into an empty facility

Major govt. subsidy for TSMC and Sony in Japan

- TSMC to build by 2024 its first Japanese chip plant in **Kumamoto** with Denso and Sony taking an equity stake

- New Energy and Industrial Technology Development Organization (NEDO) Law offering capital subsidies and low-interest financing

- METI-approved funding for 400 bil. JPY (≈ $3.4 bil.) towards TSMC plant ➞ 50% subsidy
This paper: role of corporate geography in spatial policy

- Place-based policies in 1980s/1990s Japan aimed at strengthening industry clusters
  - Bonus depreciation lowers relative cost of physical capital at certain locations
  - Firm level: eligibility $\implies$ 0.29 s.d. $\uparrow$ in construction, 0.40 s.d. $\uparrow$ in non-RE CAPX
  - Plant level: biggest job gains accrue to untreated plants in major cities (leakage)

- Heterogeneity: larger effects if firms rely on long-lived capital (e.g. buildings)
  - Or if face financial constraints (e.g. Giroud & Mueller 2015, 2019)
  - Or if already have plants close to treated areas (transport + span of control costs)

- Overall no evidence of within or cross-region trade spillovers

- $10k – $15k cost per job when we use observed cash flows from bonus claims
**Related work**

- Empirical studies of place-based policies (PBPs)
- Firm internal capital markets
- Macro-trade literature on firm sorting

**What we contribute...**

1. Insert balance sheets and corporate geography into the analysis of PBPs.
2. Show tax breaks for local investment may ultimately flow to other areas within the firm’s network $\Rightarrow$ difficult to target big companies.

Full literature
Policy Background & Data
Tax incentives to promote industry clusters in Japan

- Staggered rollout of two policies aimed at jump-starting high-tech industrial clusters
  - **Technopolis (1984-89):** parent firms in 55 mfg JSICs eligible
  - **Intelligent Location (1989-94):** eligibility extended to firms in high-tech services

- Both policies offered bonus depreciation rates for CAPX in eligible areas

- Catchment area selection criteria:
  - Already home to a well-developed high-tech mfg sector
  - Near major research university with a strong engineering department
  - Contains regional hub with 200k-300k population

- Eligible munis economically similar to ineligible munis except more mfg employment

Balance table

Intelligent Location (1989 – 1994)

- IL locations chosen to expand on existing Technopolis clusters
## Technopolis bonus rate schedule

<table>
<thead>
<tr>
<th>Time from start date</th>
<th>Non-RE Bonus Rate</th>
<th>RE Bonus Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within 5 years</td>
<td>30%</td>
<td>15%</td>
</tr>
<tr>
<td>Between 5 and 7 years</td>
<td>25%</td>
<td>13%</td>
</tr>
<tr>
<td>Between 7 and 8 years</td>
<td>20%</td>
<td>10%</td>
</tr>
<tr>
<td>Between 8 and 10 years</td>
<td>15%</td>
<td>8%</td>
</tr>
<tr>
<td>Between 10 and 12 years</td>
<td>14%</td>
<td>7%</td>
</tr>
<tr>
<td>&gt; 12 years</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

- Kink points: maximize rate by investing *within 5 years* of implementation
- Big incentives for real estate investment
  - Buildings have depreciation lives ranging from 23 years (cold storage facilities) to 65 years (concrete office buildings)
Consider a firm which invests $1 million in construction of a new site in a Technopolis area, plus $1 million in computers to be installed at the new plant when it is finished in 2 years (e.g. concrete office building).

<table>
<thead>
<tr>
<th>Year</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>...</th>
<th>Total</th>
<th>PDV ( (r = 7%) )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Straight-line (linear)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash flow (PCs)</td>
<td>90</td>
<td>90</td>
<td>90</td>
<td>90</td>
<td>0</td>
<td>...</td>
<td>360</td>
<td>326</td>
</tr>
<tr>
<td>Cash flow (CRE)</td>
<td>0</td>
<td>0</td>
<td>5.5</td>
<td>5.5</td>
<td>5.5</td>
<td>...</td>
<td>360</td>
<td>73</td>
</tr>
<tr>
<td><strong>Declining balance (default)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash flow (PCs)</td>
<td>175</td>
<td>98.5</td>
<td>55.5</td>
<td>31</td>
<td>0</td>
<td>...</td>
<td>360</td>
<td>341</td>
</tr>
<tr>
<td>Cash flow (CRE)</td>
<td>0</td>
<td>0</td>
<td>14</td>
<td>13.5</td>
<td>13</td>
<td>...</td>
<td>360</td>
<td>124.5</td>
</tr>
<tr>
<td><strong>Bonus (Technopolis) + default</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash flow (PCs)</td>
<td>242.5</td>
<td>69</td>
<td>39</td>
<td>10</td>
<td>0</td>
<td>...</td>
<td>360</td>
<td>349</td>
</tr>
<tr>
<td>Cash flow (CRE)</td>
<td>0</td>
<td>0</td>
<td>72</td>
<td>11.5</td>
<td>11</td>
<td>...</td>
<td>360</td>
<td>158</td>
</tr>
</tbody>
</table>
Corporate balance sheet data for listed firms from Development Bank of Japan (DBJ)
- Firms report total bonus depreciation claims $\rightarrow$ first stage effects
- Physical capital investment recorded by type (construction, machines, buildings, land, tools, vehicles) $\rightarrow$ input structure

Plant-level information from two sources:
1. Census of Manufacturers (COM): all plants with $\geq 4$ employees
2. For listed firms, digitize facility itemizations from Form 10-K equivalent (LaPoint 2021)

Value-added shares and I-O tables $\rightarrow$ regional trade links and upstream measures

Historical stock prices and shares outstanding from Nikkei NEEDS
Main Empirical Results
Summary of our main findings

1. First stage: 7-9 p.p. increase in bonus claims for firms operating in eligible areas
   - Distance matters: 10 km ↑ \( \Rightarrow \) 1% less likely to claim bonus

2. Firm level: economically large effects on new construction, non-RE CAPX, hiring
   - Pos. hiring response \( \Rightarrow \) long-lived capital complements labor

3. No effect of offering additional bonus incentives to non-mfg firms in catchment areas
   - Further evidence that firms’ phys. capital structure matters for PBPs

4. Plant level: biggest job gains accrue to untreated plants in major cities (leakage)
Staggered diff-in-diff (DD) with three-dimensional treatment

Consider standard firm-level staggered DD event study specification:

\[
y_{j,k,t} = \gamma_j + \delta_t + \sum_{t=1, t\neq t_0}^T \beta_t \cdot Treatment_{j,k,t} + \eta' \cdot X_{j,k,t} + \epsilon_{j,k,t} \tag{1}
\]

Treatment dummy equal to 1 if all three sequential criteria satisfied:

1. **Firm j level**: “eligible” if firm has plant located in a Technopolis area as of 1980
2. **Industry k level**: firm is in one of the targeted 4-digit JSICs
3. **Timing t**: if first two criteria apply, set dummy to 1 if \(t\) after first possible eligibility year

Or, \(Treatment_{j,k,t} = Treated_{j,k} \times Post_{j,t}\), and \(Post_{j,t}\) stacks up several potential within-firm treatment events \(\rightarrow\) tie breaker if firm has plants in several Technopolises

Details
First stage effect: bonus claiming peaks at initial kink point

- 0.18 s.d. increase in $ value of bonus claims
- Big spike in claims around policy year 2 \(\rightarrow\) time to build in construction
- First stage effect \(\rightarrow\) not just identifying ITT effects
- Pre-trend testing: 0.15 p-value on joint significance of leads

Note: We do not use a one-year anticipatory lead to perform the pre-trend test.
Dynamic effects on cash flows, employment, CIP, non-RE CAPX

- Clear spikes in OCF which correspond to first two kink points in bonus schedule

- Big effects on employment, new construction (0.3 s.d.), non-RE asset purchases (0.4 s.d.) capping out around 8-10 years after reform

- Pre-trend testing: p-value of 0.73 for OCF, 0.31 for employment, 0.10 for CIP, and 0.20 for non-RE purchases
Defining treated plants

- How do firms move resources around within their internal network?

- Same definition of treatment as before, except now plant is eligible if located in Technopolis muni
  - Eligibility along industry dimension still based on JSIC of parent firm

- Backfill the panel: digitize the 10-K PDFs and take out non-mfg plants
  - Plant identifiers only available in Census starting in 1985

- Simple exercise: compare change in # plants, %Δ emp., %Δ real land value between 1980–2000 among eligible/ineligible plants
  - Rank parent firms based on “exposure” to reform: financing constraints, LL asset share
CONSTRUCTION RESPONSE INVOLVES EXPANSION OF EXISTING PLANTS

- Very limited growth in # of plants, concentrated in ineligible areas
- Flat relationship between LL asset share and total establishment growth ($\beta = 0.33$, s.e. = 1.14)
- Same patterns if look at 1980-95 to cut out Asian Financial Crisis

Notes: Each point on the graph corresponds to plant totals among either Technopolis ineligible (red) or eligible (blue) locations within a listed mfg firm.
Leakage of tax breaks to untreated areas within firm

- Much larger employment–LL share gradient for ineligible areas ($\beta = 9.1$) compared to eligible areas ($\beta = 1.9$) $\implies$ cash flows financing hires outside targeted areas

- Real land inv.: neg. relationship for eligible, pos. relationship for ineligible plants
  - Deflate using the local commercial price indexes from LaPoint (2021)
Heterogeneity: Input Composition & Spillovers
Sources of heterogeneous responses

1. Effects driven by financially constrained firms
   - Consistent w/corporate literature (e.g. Giroud & Mueller 2015)

2. Capital inputs matter: effects driven by firms relying on longer-lived assets
   - Q theory-based approach to recover capital input shares (Hayashi & Inoue 1991)

3. No pos. spillovers to ineligible firms in treated areas

4. Span of control and transport costs: take-up greater for firms with more plants proximate to treated areas

5. No evidence of cross-regional spillovers due to trade networks
**Dynamic effects driven by small/young firms**

- Use standard size-age (SA) index of Hadlock & Pierce (2010)
- LaPoint (2021) shows that this measure predicts debt sensitivity to collateral value
- Other index measures are uncorrelated or negatively correlated with SA

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Notes: Bars indicate 95% confidence intervals. We bin the dummies at the end of the effect windows for $t = -6$ and $t = 10$. 

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Policy take-up declines with driving distance

- 10 km ↑ in commuting distance to nearest Technopolis area ⇒ eligible firm 1% less likely to claim bonus
- Otherwise, no effect of distance to treated areas
- Conditional on claiming bonus, no difference in employment or CAPX responses

Notes: Bars indicate 95% confidence intervals. We bin the dummies at the end of the effect windows for \( t = -6 \) and \( t = 10 \).
**Bonus claims driven by high long-lived asset share firms**

- Define LL firms as those with $\omega_{\text{build}}$ above firm median
- Machines relatively long-lived but big range (3-25 yrs.) in usable life depending on use
- Wide confidence intervals on the SL asset firms → more industry heterogeneity

*Notes:* Bars indicate 95% confidence intervals. We bin the dummies at the end of the effect windows for $t = -6$ and $t = 10$. 

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No sectoral trade spillovers from Technopolis

- Technopolis exposure through sectoral trade flows has no clear effect (huge CIs)
- Similar null results when separate import and export shocks

Notes: Bars indicate 95% confidence intervals. We bin the dummies at the end of the effect windows for $t = -6$ and $t = 10$. 

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Cost-per-job estimates

- Fiscal cost = PDV of forgone tax revenues from offering bonus depreciation:

\[
\text{Fiscal cost} = \sum_{t=1984}^{1995} \frac{\tau_t}{(1 + r)^t} \times \left( D_t^{\text{bonus}} - D_t^{\text{normal}} \right) \times \text{Take-up}_t
\]

- We compute the \textit{ex post} benefit $D^{\text{bonus}} - D^{\text{normal}}$ then scale by take-up = Treatment $\times 1 \{\text{bonus} > 0\} \implies$ fiscal cost $\approx 3\%$ per qualifying CAPX dollar

- Applying this rate to total eligible CAPX during policy and our DD estimate of 5-7\% gain in employment $\implies$ \$10k-$15k cost per job

- Caveat: partial equilibrium measure does not take into account spillovers through reallocation across locations within the firm
  - \textbullet{} Local and inter-regional trade spillovers appear to be minimal to non-existent in our setting
We study a spatial policy which subsidizes the cost of long-lived capital and find large effects on new construction and non-real estate CAPX, but limited spillovers.

**Internal capital network matters for PBPs to help peripheral economies**

- Incentives providing immediate cash flows generate large investments
- Retention: tying tax breaks to long-lived assets helps mitigate toe-dipping

Some problems on the targeting side, at least with large firms

- **Leakage**: multi-plant firms can redirect cash flows elsewhere
- Welfare effects may be negative since effectively subsidizing low marginal productivity areas

Future: multi-sector firm sorting model with capital lifespan to study welfare

- Complement partial equilibrium cost-per-job numbers
THANK YOU!
Appendix
INCOME DIVERGENCE AND INCREASING DIRECTED MIGRATION (JAPAN)

**1975−1995 annual income growth**

- \[ \beta = -0.19 \]
- \[ \text{s.e.} = 0.10 \]
- \[ N = 1710 \]
- \[ R^2 = 0.00 \]

**1995−2015 annual income growth**

- \[ \beta = 1.06 \]
- \[ \text{s.e.} = 0.13 \]
- \[ N = 1710 \]
- \[ R^2 = 0.06 \]

**1975−1995 annual population growth**

- \[ \beta = 1.69 \]
- \[ \text{s.e.} = 0.07 \]
- \[ N = 1710 \]
- \[ R^2 = 0.20 \]

**1995−2015 annual population growth**

- \[ \beta = 1.95 \]
- \[ \text{s.e.} = 0.09 \]
- \[ N = 1710 \]
- \[ R^2 = 0.29 \]
Related work

- **Empirical studies of place-based policies (PBPs)**
  - Devereux, Griffith, Simpson (2007); Greenstone, Hornbeck, Moretti (2010); Okubo & Tomiura (2012); Kline & Moretti (2014); Criscuolo et al. (2019); Arefeva et al. (2021); Freedman, Khanna, Neumark (2021); Siegloch, Wehrhöfer, Etzel (2021); Kennedy & Wheeler (2021)

- **Firm internal capital markets**
  - Spatial: Chaney, Sraer, Thesmar (2012); Giroud & Mueller (2015, 2019); Dougal, Parsons, Titman (2015); van Straelen (2018); Ma, Murfin, Pratt (2020); LaPoint (2021)
  - Tax incentives: House & Shapiro (2008); Edgerton (2010); Yagan (2015); Zwick & Mahon (2017); Moon (2020); Boissel & Matray (2020); Garrett, Ohrn, & Suárez Serrato (2020); Curtis et al. (2021)

- **Macro-trade literature on firm sorting**
  - Holmes (2005, 2011); Jia (2008); Kerr & Kominers (2015); Gaubert (2018); Fajgelbaum et al. (2018); Walsh (2019); Ziv (2019); Oberfield et al. (2020); Giroud et al. (2021)
  - **Most of these papers only have extensive margin sorting and no phys. capital**
### Comparing eligible vs. ineligible Technopolis locations

<table>
<thead>
<tr>
<th></th>
<th>Eligible</th>
<th>Ineligible</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (s.d.) [min, max]</td>
<td>Mean (s.d.) [min, max]</td>
</tr>
<tr>
<td>Total mfg. employment</td>
<td>9,524 (13,887) [136, 109,649]</td>
<td>5,706 (23,648) [0, 723,990]</td>
</tr>
<tr>
<td>Heavy industry employment share</td>
<td>0.175 (0.128) [0.025, 0.516]</td>
<td>0.212 (0.150) [0.013, 0.875]</td>
</tr>
<tr>
<td>Establishments w/&gt; 4 employees</td>
<td>370 (576) [10, 4,769]</td>
<td>241 (1,389) [1, 47,196]</td>
</tr>
<tr>
<td>Mfg. plant capital stock</td>
<td>3,527 (7,190) [0, 5,961]</td>
<td>1,620 (4,605) [0, 7,570]</td>
</tr>
<tr>
<td>Per capita income</td>
<td>556 (104) [292, 764]</td>
<td>553 (158) [196, 1,446]</td>
</tr>
<tr>
<td>Census population</td>
<td>119,885 (186,727) [4,824, 1,401,757]</td>
<td>64,110 (279,303) [225, 8,351,856]</td>
</tr>
<tr>
<td>Population &gt; 65 y.o.</td>
<td>11,439 (14,653) [568, 87,440]</td>
<td>5,783 (22,151) [27, 686,436]</td>
</tr>
<tr>
<td>Median price/m$^2$ for CRE</td>
<td>63.93 (35.83) [6.60, 180.00]</td>
<td>100.91 (95.33) [6.35, 571.00]</td>
</tr>
<tr>
<td>Housing expenditure share</td>
<td>0.091 (0.024) [0.027, 0.141]</td>
<td>0.096 (0.036) [0.028, 0.241]</td>
</tr>
<tr>
<td>$%\Delta^{1980-83}$ mfg. employment</td>
<td>9.8 (20.7) [−32.0, 136.6]</td>
<td>6.3 (20.8) [−100, 219.1]</td>
</tr>
<tr>
<td>$%\Delta^{1980-83}$ establishments</td>
<td>7.1 (12.0) [−12.5, 72.7]</td>
<td>6.4 (18.6) [−72.7, 200.0]</td>
</tr>
<tr>
<td>$%\Delta^{1980-83}$ CRE price/m$^2$</td>
<td>57.7 (40.1) [10.3, 203.0]</td>
<td>69.8 (64.1) [−37.1, 722.5]</td>
</tr>
<tr>
<td># of municipalities</td>
<td>141</td>
<td>1,568</td>
</tr>
</tbody>
</table>

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### Comparing eligible vs. ineligible IL locations

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Mean (s.d.) [min, max]</td>
<td>Mean (s.d.) [min, max]</td>
</tr>
<tr>
<td>Total mfg. employment</td>
<td>6,466 (11,999) [34, 109,649]</td>
<td>5,919 (24,873) [0, 723,990]</td>
</tr>
<tr>
<td>Heavy industry employment share</td>
<td>0.178 (0.127) [0.025, 0.516]</td>
<td>0.214 (0.152) [0.013, 0.875]</td>
</tr>
<tr>
<td>Establishments w/&gt; 4 employees</td>
<td>246 (445) [3, 4,769]</td>
<td>252 (1,472) [1, 47,196]</td>
</tr>
<tr>
<td>Mfg. plant capital stock</td>
<td>2,334 (6,571) [0, 7,570]</td>
<td>1,650 (4,416) [0, 5,687]</td>
</tr>
<tr>
<td>Per capita income</td>
<td>536 (115) [229, 803]</td>
<td>557 (162) [196, 1,446]</td>
</tr>
<tr>
<td>Census population</td>
<td>75,536 (159,918) [1,360, 2,153,666]</td>
<td>67,122 (293,185) [225, 8,351,856]</td>
</tr>
<tr>
<td>Population &gt; 65 y.o.</td>
<td>7,339 (13,063) [178, 167,476]</td>
<td>5,997 (23,213) [27, 686,436]</td>
</tr>
<tr>
<td>Median price/m(^2) CRE</td>
<td>66.22 (41.65) [6.60, 180.00]</td>
<td>103.16 (97.50) [6.35, 571.00]</td>
</tr>
<tr>
<td>Housing expenditure share</td>
<td>0.084 (0.023) [0.027, 0.141]</td>
<td>0.100 (0.037) [0.028, 0.241]</td>
</tr>
<tr>
<td>(%\Delta^{1980-83}) mfg. employment</td>
<td>6.8 (19.2) [−100, 136.6]</td>
<td>6.5 (21.2) [−100, 219.1]</td>
</tr>
<tr>
<td>(%\Delta^{1980-83}) establishments</td>
<td>6.1 (13.8) [−66.7, 87.5]</td>
<td>6.5 (19.0) [−72.7, 200.0]</td>
</tr>
<tr>
<td>(%\Delta^{1980-83}) CRE price/m(^2)</td>
<td>62.9 (46.0) [−9.2, 276.1]</td>
<td>69.5 (64.7) [−37.1, 722.5]</td>
</tr>
<tr>
<td># of municipalities</td>
<td>319</td>
<td>1,390</td>
</tr>
</tbody>
</table>
Rate schedule similar to Technopolis, but with shorter clock and Tokyo-specific provision

We do not find any additional effects of imposing an IL on a Technopolis site

- For this reason, we focus on Technopolis in our main analysis
- IL policy offered bonus depreciation for CAPX to mostly intangible capital firms
Corporate income tax (CIT) bill for income $I$, asset book value $P$, and dep. rate $\theta$ is

$$\tau^{CIT} \cdot (I - \theta \cdot P)$$

Total immediate cash flow benefit with bonus claims is then:

$$\tau^{CIT} \cdot P_{i,0} \times \left( \theta_{i,c}^{\text{bonus}} + (1 - \theta_{i,c}^{\text{bonus}}) \cdot \theta_{0}^{\text{normal}} \right)$$

Normal methods: straight-line (linear) and declining-balance depreciation (default)

- Accounting method chosen by parent firm rather than by plants
- 93% of our firms use declining balance for some capital types
- Remaining 7% use a combination of linear and other accounting methods
Parent firms choose between straight-line [SL] and declining balance [DB] accounting for amortizing asset acquisition costs

- Can use separate methods for different capital types
- Can then exercise bonus claims on top of normal method
- Default is declining balance, which 80% of firms use exclusively

1. **SL (linear) method:** for lifespan $x$ years, $\theta_t = 1/x, \forall t$

2. **DB (recursive) method:** $P_t = P_0 - \sum_{k=1}^{t} \theta_{t-k} \cdot P_{t-k}$, given $\theta_0$ set by tax authority

3. With bonus claims: $\theta_t = \begin{cases} \theta^{\text{bonus}} + (1 - \theta^{\text{bonus}}) \cdot \theta_t^{\text{normal}} & \text{if } t = 0 \\ (1 - \theta^{\text{bonus}}) \cdot \theta_t^{\text{normal}} & \text{if } 0 < t \leq x \end{cases}$

DB method strictly dominates SL in terms of PDV of cash flows for vast majority of capital types and discount rate combos
- Average firm has 3 ongoing projects in filing year (median 3.3)
- 1% increase in project duration associated with 1.44% increase in budget
Example: Full sequence of tax benefit flows

- Clear jump in immediate cash flows with bonus rates
- SL method strictly dominated by DB method
- DB method also shortens amortization schedule by 2 years
Possible effective tax rates (including local): $\tau \in [36.5\%, 50.3\%]$
Form 10-K equivalent for Japan requires firms to itemize their facility locations and construction projects in progress

- Prior to 1991 locations known up to municipality level
- Typically includes (net) book values of land, buildings, structures, vehicles, employees, and rent/own status by facility site
- More comprehensive than Schedule III for real estate firms and locations in U.S. 10-K filings
- CIP tables include project purpose, start/projected end date, budgeted amount, current outlays, and financing method (internal financing vs. ST/LT bank debt)

Using layout parser tool to fill in rest of the plant-level panel [in progress]
Columns are locations, rows are units/book values

Parentheses indicate rented real estate areas

Transcription/geocoding follows methods outlined in LaPoint (2021)

We do not distinguish between owned vs. partially owned or rented locations (makes no difference for treatment status)
<table>
<thead>
<tr>
<th>Location</th>
<th>Land (m²)</th>
<th>Buildings (m²)</th>
<th>Construction (m²)</th>
<th>Employees</th>
<th>Ownership</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hamamatsu (Shizuoka)</td>
<td>173,106</td>
<td>115,849</td>
<td>2,616,000</td>
<td>3,168</td>
<td>Partial</td>
<td>HQ/factory</td>
</tr>
<tr>
<td>Iwata (Shizuoka)</td>
<td>246,301</td>
<td>38,911</td>
<td>1,082,000</td>
<td>1,160</td>
<td>Partial</td>
<td>Factory</td>
</tr>
<tr>
<td>Kosai (Shizuoka)</td>
<td>561,460</td>
<td>82,155</td>
<td>1,328,000</td>
<td>896</td>
<td>Partial</td>
<td>Factory</td>
</tr>
<tr>
<td>Ōsuka (Shizuoka)</td>
<td>104,548</td>
<td>24,098</td>
<td>593,000</td>
<td>312</td>
<td>Full</td>
<td>Factory</td>
</tr>
<tr>
<td>Toyokawa (Aichi)</td>
<td>213,427</td>
<td>71,938</td>
<td>975,000</td>
<td>731</td>
<td>Partial</td>
<td>Factory</td>
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<tr>
<td>Oyabe (Toyama)</td>
<td>84,495</td>
<td>42,986</td>
<td>592,000</td>
<td>711</td>
<td>Full</td>
<td>Factory</td>
</tr>
<tr>
<td>Tokyo</td>
<td>1,071,049</td>
<td>157,239</td>
<td>3,068,000</td>
<td>1,469</td>
<td>Partial</td>
<td>Branch office/agency</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2,454,386</td>
<td>533,176</td>
<td>10,254,000</td>
<td>8,447</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Sample restrictions & scaling variables

- **Standard sample restrictions**
  - Firms must have non-missing total assets for at least 5 consecutive years spanning 1980-87 (covers pre/post first Technopolis start date)
  - Drop firms with fiscal year end dates in middle of year (May, June, July) or which change timing of reports within panel
  - Winsorize at median $\pm 5 \times IQR$, or at 2nd/98th pct. for mean zero variables

- **Several methods to deal with skewness of outcomes**
  1. Preferred method: scale monetary outcomes by total assets in year prior to sample start
     - Addresses econometric critiques of running regressions with $I_t/K_{t-1}$ (Welch 2020)
  2. Take logs: isolates the intensive margin response, but more of a pre-trend due to selection of firms who always invest/hire
  3. $\log(1 + x)$ or $IHS(x)$ transform for spending variables
Firms eligible for tax breaks under Technopolis mostly in the heavy industry and light mfg. categories

Intelligent Location targets services + electronics + some light mfg

COM plant data covers the heavy industry + light mfg + electronics sectors
### Summary Statistics for Multi-Plant Firms

<table>
<thead>
<tr>
<th></th>
<th>Full DBJ Sample</th>
<th>Matched DBJ-COM Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
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<tr>
<td>Construction in progress</td>
<td>0.02</td>
<td>0.01</td>
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<tr>
<td>Non-real estate assets</td>
<td>0.83</td>
<td>0.44</td>
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<tr>
<td>Real estate assets</td>
<td>0.64</td>
<td>0.33</td>
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<tr>
<td>PPE</td>
<td>1.61</td>
<td>0.93</td>
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<tr>
<td>CAPX</td>
<td>0.11</td>
<td>0.06</td>
</tr>
<tr>
<td>Employment</td>
<td>2,572</td>
<td>991</td>
</tr>
<tr>
<td>Long-term debt issues</td>
<td>0.01</td>
<td>0.00</td>
</tr>
<tr>
<td>Cash flow</td>
<td>0.03</td>
<td>0.01</td>
</tr>
<tr>
<td>EBITDA</td>
<td>0.22</td>
<td>0.13</td>
</tr>
<tr>
<td>OCF</td>
<td>0.31</td>
<td>0.18</td>
</tr>
<tr>
<td>Bonus depreciation</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>1_{bonus &gt; 0}</td>
<td>0.23</td>
<td>0.00</td>
</tr>
<tr>
<td># of firm-years</td>
<td>38,374</td>
<td></td>
</tr>
<tr>
<td># of 1980 plants</td>
<td>3,470</td>
<td></td>
</tr>
<tr>
<td># of firms</td>
<td>1,508</td>
<td></td>
</tr>
</tbody>
</table>
Comment on staggered DD estimators in this setting

- Explosion of recent papers on problems with estimating by OLS
- Basic idea: treatment/control groups are changing over time, so can get negative weights on ATEs for some group-time cells (Goodman-Bacon 2021)
- OLS delivers nearly identical results to other estimators, including:
  - Borusyak, Jaravel, Spiess (2021) [BJS]: two-step imputation which uses never-treated and not-yet treated firms, allows for anticipatory leads
  - de Chaisemartin & D’Haultfoeuille (2020): uses not-yet treated as control group
  - Sun & Abraham (2020): uses never-treated firms as control group
  - Callaway & Sant’Anna (2020): w/o time-varying covariates same as Sun & Abraham
- We use BJS in our main analysis to account for anticipation effects from Technopolis sites being announced 1 year in advance
Clear growth in employment + # of plants at city level

- Pre-trend: we already know that eligible sites chosen with specific criteria in mind
- Using firm-level eligibility criteria helps difference out local macro trends
Comparing trajectories of cash flow measures

- Extensive margin bonus claim response again peaks around policy year 5
- Bonus claims included in OCF and cash flow but not EBITDA
- Effect on EBITDA coming from output of new investment
- Zwick & Mahon (2017): cash flow = net income before dep. after taxes paid
Main results implying old geographic boundaries

- Upward trend in OCF after reform, but no clear spikes at kink points
- Nearly identical estimates for employment, new construction (0.3 s.d.), non-RE asset purchases (0.4 s.d.)
- Pre-trend diminishes, SEs ↑ when we impose 1980 municipal boundaries
Limited response of other outcomes to bonus eligibility

- Substitution away from inv. in land (0.16 s.d.) → doesn’t depreciate!

- Muted bumps in overall CAPX due to decline in land purchases

- Spikes in loan issues around years 3 and 6 of program – subsidized credit from regional banks in Technopolis areas
**Similar results for other staggered DD estimators**

**Main deck**

- **Bonus claim probability**
- **Employment**
- **Construction in progress**
- **Non-RE purchases**

**Estimated ATTs**

- Baseline (OLS)
- Sun & Abraham (2020)
- de Chaisemartin & D'Haultfoeuille (2020)

**Years since Technopolis**

**Notes:** Bars indicate 95% confidence intervals. We bin the dummies at the end of the effect windows for $t = -6$ and $t = 10$. 

**LaPoint (Yale) & Sakabe (Columbia)**

**PBPs & Corporate Investment**

**Japan Economic Seminar 2022**
Similar results with linear firm time trends

Notes: Bars indicate 95% confidence intervals. We bin the dummies at the end of the effect windows for $t = -6$ and $t = 10$. 

LaPoint (Yale) & Sakabe (Columbia)
Robustness of first stage bonus claim results

\[ \mathbb{1}\{bonus > 0\}_{j,k,t} = \gamma_j + \delta_t + \beta \cdot Treatment_{j,k,t} + \eta' \cdot X_{j,k,t} + \varepsilon_{j,k,t} \]

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>0.091***</td>
<td>0.072**</td>
<td>0.086***</td>
<td>0.094***</td>
<td>0.070**</td>
<td>0.090***</td>
</tr>
<tr>
<td></td>
<td>(0.028)</td>
<td>(0.029)</td>
<td>(0.027)</td>
<td>(0.028)</td>
<td>(0.030)</td>
<td>(0.028)</td>
</tr>
<tr>
<td>Estimator</td>
<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
<td>BJS</td>
<td>BJS</td>
<td>BJS</td>
</tr>
<tr>
<td>Firm FEs</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
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<tr>
<td>Financial controls</td>
<td>✔️</td>
<td></td>
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<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Controls × year FEs</td>
<td>✔️</td>
<td></td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>N</td>
<td>38,374</td>
<td>34,578</td>
<td>38,360</td>
<td>38,374</td>
<td>34,578</td>
<td>38,360</td>
</tr>
<tr>
<td># Firms</td>
<td>1,508</td>
<td>1,408</td>
<td>1,507</td>
<td>1,508</td>
<td>1,408</td>
<td>1,507</td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>0.535</td>
<td>0.547</td>
<td>0.551</td>
<td>0.535</td>
<td>0.547</td>
<td>0.551</td>
</tr>
</tbody>
</table>

Notes: Sample time period: 1975 – 2000. Financial controls include OCF, EBITDA, and the Q ratio. We include a one-year lead to account for potential anticipation effects from the announcement of Technopolis sites. Controls × year FEs includes size/age quintiles and Census region of the corporate HQ.
Intensive margin results using log outcomes

\[ y_{j,k,t} = \gamma_j + \delta_t + \beta \cdot Treatment_{j,k,t} + \eta' \cdot X_{j,k,t} + \varepsilon_{j,k,t} \]

<table>
<thead>
<tr>
<th></th>
<th>Construction</th>
<th>Non-RE purchases</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Treatment</strong></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td></td>
<td>0.166**</td>
<td>0.111*</td>
<td>0.221***</td>
</tr>
<tr>
<td></td>
<td>(0.072)</td>
<td>(0.067)</td>
<td>(0.077)</td>
</tr>
<tr>
<td><strong>Estimator</strong></td>
<td>OLS</td>
<td>BJS</td>
<td>BJS</td>
</tr>
<tr>
<td><strong>Firm FEs</strong></td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td><strong>Financial controls</strong></td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td><strong>Controls × year FE</strong></td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>26,996</td>
<td>24,408</td>
<td>26,985</td>
</tr>
<tr>
<td><strong># Firms</strong></td>
<td>1,416</td>
<td>1,318</td>
<td>1,415</td>
</tr>
<tr>
<td><strong>Adj. (R^2)</strong></td>
<td>0.702</td>
<td>0.723</td>
<td>0.702</td>
</tr>
</tbody>
</table>

Notes: Sample time period: 1975 – 2000. Financial controls include OCF, EBITDA, and the Q ratio. We include a one-year lead to account for potential anticipation effects from the announcement of Technopolis sites. Controls \( \times \) year FE includes size/age quintiles and Census region of the corporate HQ.
Isolating ATTs of the second round of bonus incentives

- Govt. tried to amplify initial policy via bonuses to upstream, high-tech services firms

- Consider the multiple treatment regression:

\[ y_{j,k,t} = \gamma_j + \delta_t + \beta_1 \cdot Treatment_{j,k,t}^T + \beta_2 \cdot Treatment_{j,k,t}^{IL} + \epsilon_{j,k,t} \] (5)

- Difficult to interpret due to cross-contamination of treatment and control groups

- de Chaisemartin & D’Haultfœuille (2021) propose an estimator to isolate the second policy which restricts to obs. with \( Treatment_{j,k,t}^T = 1 \)

\[ y_{j,k,t} = \gamma_j + \delta_t + \sum_{t=1, t \neq t_0}^{T} \beta_{2,t} \cdot Treatment_{j,k,t}^{IL} + F_{j,t}^T + \epsilon_{j,k,t} \] (6)

- \( F_{j,t}^T \) non-parametric trends w.r.t. first year where firm \( j \) obtains Technopolis eligibility
Controlling for IL policy exposure results in little change in the dynamic effects of Technopolis

Some evidence of spillover effects on employment

**Notes:** Bars indicate 95% confidence intervals. We bin the dummies at the end of the effect windows for \( t = -4 \) and \( t = 8 \).
No effects of layered bonuses to local upstream firms

- Suggests poor targeting: high-tech services firms rely more on intangible capital
- Caveat: we lose power by restricting to firm-year obs. with $Treatment_{j,k,t}^T = 1$

Notes: Bars indicate 95% confidence intervals. We bin the dummies at the end of the effect windows for $t = -4$ and $t = 8$. 

LaPoint (Yale) & Sakabe (Columbia)  
PBPs & Corporate Investment  
Japan Economic Seminar 2022
Pooled OLS estimates of multiple treatment regression

\[ y_{j,k,t} = \gamma_j + \delta_t + \beta_1 \cdot \text{Treatment}^T_{j,k,t} + \beta_2 \cdot \text{Treatment}^{IL}_{j,k,t} + \varepsilon_{j,k,t} \]

<table>
<thead>
<tr>
<th></th>
<th>Bonus claim</th>
<th>Construction</th>
<th>Non-RE purchases</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>\text{Treatment}^T</td>
<td>0.093***</td>
<td>0.087***</td>
<td>0.163**</td>
<td>0.172***</td>
</tr>
<tr>
<td></td>
<td>(0.028)</td>
<td>(0.028)</td>
<td>(0.072)</td>
<td>(0.046)</td>
</tr>
<tr>
<td>\text{Treatment}^{IL}</td>
<td>−0.023</td>
<td>−0.018</td>
<td>0.044</td>
<td>0.143**</td>
</tr>
<tr>
<td></td>
<td>(0.024)</td>
<td>(0.023)</td>
<td>(0.108)</td>
<td>(0.059)</td>
</tr>
</tbody>
</table>

Firm FEs          ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔
Controls \times year FEs ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔

N            38,374 38,360 26,996 26,985 36,396 36,383 38,340 38,326
# Firms       1,508 1,507 1,416 1,415 1,499 1,498 1,508 1,507
Adj. \text{R}^2 0.535 0.551 0.702 0.702 0.948 0.949 0.954 0.956

Notes: Sample time period: 1975 – 2000. We include a one-year lead to account for potential anticipation effects from the announcement of Technopolis sites. Controls \times year FEs includes size/age quintiles and Census region of the corporate HQ.
Details: computing corporate distance to policy regions

- Extend baseline DD to include triple interaction with distance measure:

\[ y_{j,k,t} = \gamma_j + \delta_t + Distance_j \times Post_t + Treated_k \times Post_t \]

\[ + Distance_j \times Treated_k \times Post_t + \eta' \cdot X_{j,k,t} + \varepsilon_{j,k,t} \quad (7) \]

- Since we are looking at extensive margin of policy take-up, \( Post_t \) does not vary at the firm \( j \) level (unstaggered)

- Same results if define \( Post_{j,t} \) based on activation of nearest Technopolis (staggered)

- \( Distance_j \) is a function of all pairwise truck driving distances between a plant location within \( j \) and a Technopolis area
43% of firms already operate within a Technopolis border

Typical corporate plant is 100 km from nearest Technopolis

Alternatives: driving time or Haversine distance, employment-weighted averages
Firms benefit more from bonuses if assets they use have longer depreciation lives

- Example with tax breaks from investing in computers vs. real estate

We compute the production input shares and focus on firms which rely on buildings

- Six categories in our data: buildings, land, machines, structures, tools, vehicles
- Depreciation lives vary by asset use but are much longer (up to 65 years) for buildings

Approach is based on Q-theory and relies on two assumptions:

1. Profit function is homogeneous of degree one in $k_i$ inputs
2. Constant returns to scale capital aggregator for firm $j$:

$$f(K_j) = \prod_{i=1}^{6} k_i^{\omega_{i,j}} \quad \text{s.t.} \quad \sum_{i=1}^{6} \omega_{i,j} = 1, \forall j$$
Basic idea: aggregate capital stock can be recovered as function of user costs of inputs $c_{i,t}$ and real inputs $k_{i,t}$ themselves

For CRS capital aggregate and profit-maximizing firms:

$$\frac{\partial f(K_t)}{\partial k_{i,t}} = \frac{\partial f(K_t)}{\partial k_{j,t}} = \frac{\omega_{i,t} \cdot k_{j,t}}{\omega_{j,t} \cdot k_{i,t}} = \frac{c_{i,t}}{c_{j,t}}$$

$$c_{i,t} = \left[1 - (1 - \delta_i) \cdot \mathbb{E}_t \left(\beta_i^{R_{i,t,t+1}}\right)\right] \cdot \frac{(1 - z_{i,t}) \cdot P k_{i,t}}{(1 - \tau_t) \cdot P_t}$$

User costs depend on depreciation rates $\delta_i$, the discount rate $\beta^R$ (WACC), PDV of claimed tax breaks $z_{i,t}$ and tax rates $\tau_t$

Impose Cobb-Douglas production and then solve for the $\omega_i$ shares for each firm
Problem: approach requires many balance sheet items to be non-missing in all years

- Real capital inputs $k_{i,t}$ come from iterating on investment law of motion:

$$P k_{i,t} \cdot k_{i,t+1} = (1 - \delta_i) \cdot P k_{i,t} k_{i,t} + NOMI_{i,t}$$

For roughly half of the sample we cannot fill in the index $f(K_t)$ due to missing variables (i.e. tax bills), so nearest-neighbor match using logit model

- Covariates: dummies for eight broad industrial sectors, total assets, and a quadratic in age
- Take fitted prob. of having non-missing $\omega_i$ as propensity score and then match each firm to nearest (squared difference) donor firm

Similar results if we apply a corporate tax calculator to directly impute $\tau_t, z_{i,t}$ based on national + local tax code provisions
Propensity score model estimates for missing input shares

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assets</td>
<td>−0.022</td>
<td>−0.022</td>
<td>−0.011</td>
<td>−0.012</td>
</tr>
<tr>
<td>Age</td>
<td>−0.001</td>
<td>−0.001</td>
<td>−0.004</td>
<td>0.008</td>
</tr>
<tr>
<td>Age(^2)</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>−0.000</td>
</tr>
<tr>
<td>Mfg dummy</td>
<td>0.836***</td>
<td>0.825***</td>
<td>0.826***</td>
<td>0.709***</td>
</tr>
<tr>
<td>Retail dummy</td>
<td>0.047</td>
<td>0.086</td>
<td>0.418</td>
<td></td>
</tr>
<tr>
<td>Services dummy</td>
<td>−0.224</td>
<td>−0.207</td>
<td>−0.991</td>
<td></td>
</tr>
<tr>
<td>DB method dummy</td>
<td>0.461</td>
<td>0.346</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q ratio</td>
<td>−0.163</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EBITDA</td>
<td></td>
<td>7.715***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>−2.519***</td>
<td>−2.505***</td>
<td>−2.871***</td>
<td>−3.774***</td>
</tr>
<tr>
<td>N</td>
<td>1,507</td>
<td>1,507</td>
<td>1,360</td>
<td>1,334</td>
</tr>
<tr>
<td>Pseudo-(R^2)</td>
<td>0.025</td>
<td>0.025</td>
<td>0.027</td>
<td>0.079</td>
</tr>
</tbody>
</table>

Notes: Assets measured as average pre-Technopolis total assets in millions of yen. Age measured from the TSE listing date. DB method dummy is equal to unity if the firm uses declining balance depreciation accounting methods in the pre-Technopolis period.

- Collect donor firms \(j\) for which we can estimate all \(\omega_i\) and set \(T_j = 1\) for them to estimate logit:

\[
P(T_j = 1|X_j) = \frac{\exp(h(X_j))}{1 + \exp(h(X_j))}\]

- Mfg firms more likely to have non-missing input shares, but no clear relationship btw size/age and balance sheet completeness
<table>
<thead>
<tr>
<th>Category</th>
<th>N</th>
<th>( \omega_{\text{build}} )</th>
<th>( \omega_{\text{machine}} )</th>
<th>( \omega_{\text{land}} )</th>
<th>( \omega_{\text{structure}} )</th>
<th>( \omega_{\text{tools}} )</th>
<th>( \omega_{\text{vehicle}} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light manufacturing</td>
<td>237</td>
<td>0.468</td>
<td>0.222</td>
<td>0.243</td>
<td>0.042</td>
<td>0.036</td>
<td>0.037</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.131)</td>
<td>(0.153)</td>
<td>(0.163)</td>
<td>(0.027)</td>
<td>(0.035)</td>
<td>(0.031)</td>
</tr>
<tr>
<td>Heavy manufacturing</td>
<td>525</td>
<td>0.472</td>
<td>0.240</td>
<td>0.224</td>
<td>0.041</td>
<td>0.038</td>
<td>0.035</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.133)</td>
<td>(0.146)</td>
<td>(0.161)</td>
<td>(0.027)</td>
<td>(0.038)</td>
<td>(0.031)</td>
</tr>
<tr>
<td>Real estate</td>
<td>30</td>
<td>0.429</td>
<td>0.214</td>
<td>0.286</td>
<td>0.055</td>
<td>0.024</td>
<td>0.036</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.173)</td>
<td>(0.183)</td>
<td>(0.193)</td>
<td>(0.035)</td>
<td>(0.026)</td>
<td>(0.032)</td>
</tr>
<tr>
<td>Construction</td>
<td>121</td>
<td>0.448</td>
<td>0.224</td>
<td>0.259</td>
<td>0.050</td>
<td>0.022</td>
<td>0.041</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.153)</td>
<td>(0.174)</td>
<td>(0.181)</td>
<td>(0.030)</td>
<td>(0.024)</td>
<td>(0.034)</td>
</tr>
<tr>
<td>Transportation</td>
<td>88</td>
<td>0.512</td>
<td>0.195</td>
<td>0.210</td>
<td>0.046</td>
<td>0.027</td>
<td>0.049</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.160)</td>
<td>(0.160)</td>
<td>(0.160)</td>
<td>(0.031)</td>
<td>(0.024)</td>
<td>(0.035)</td>
</tr>
<tr>
<td>Electronics</td>
<td>259</td>
<td>0.467</td>
<td>0.229</td>
<td>0.239</td>
<td>0.033</td>
<td>0.055</td>
<td>0.030</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.111)</td>
<td>(0.120)</td>
<td>(0.147)</td>
<td>(0.019)</td>
<td>(0.048)</td>
<td>(0.026)</td>
</tr>
<tr>
<td>Non-transportation services</td>
<td>82</td>
<td>0.470</td>
<td>0.196</td>
<td>0.266</td>
<td>0.051</td>
<td>0.024</td>
<td>0.042</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.180)</td>
<td>(0.167)</td>
<td>(0.199)</td>
<td>(0.036)</td>
<td>(0.024)</td>
<td>(0.036)</td>
</tr>
<tr>
<td>Agriculture</td>
<td>13</td>
<td>0.532</td>
<td>0.177</td>
<td>0.217</td>
<td>0.046</td>
<td>0.029</td>
<td>0.044</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.129)</td>
<td>(0.136)</td>
<td>(0.120)</td>
<td>(0.013)</td>
<td>(0.024)</td>
<td>(0.036)</td>
</tr>
<tr>
<td>Overall</td>
<td>1,507</td>
<td>0.469</td>
<td>0.222</td>
<td>0.240</td>
<td>0.042</td>
<td>0.036</td>
<td>0.037</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.144)</td>
<td>(0.150)</td>
<td>(0.168)</td>
<td>(0.029)</td>
<td>(0.037)</td>
<td>(0.032)</td>
</tr>
</tbody>
</table>
Pooled OLS results by long-lived asset share

\[ y_{j,t} = \gamma_j + \delta_t + \beta_1 \cdot Treatment_{j,t} \times LL - Firm_j + \beta_2 \cdot Treatment_{j,t} \times SL - Firm_j + \eta' \cdot X_{j,t} + \varepsilon_{j,t} \]

<table>
<thead>
<tr>
<th></th>
<th>Bonus claim</th>
<th>Construction</th>
<th>Non-RE purchases</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Treatment × LL − Firm</td>
<td>0.096***</td>
<td>0.089***</td>
<td>0.166**</td>
<td>0.170**</td>
</tr>
<tr>
<td></td>
<td>(0.029)</td>
<td>(0.028)</td>
<td>(0.074)</td>
<td>(0.074)</td>
</tr>
<tr>
<td>Treatment × SL − Firm</td>
<td>−0.011</td>
<td>0.028</td>
<td>0.169</td>
<td>0.160</td>
</tr>
<tr>
<td></td>
<td>(0.104)</td>
<td>(0.109)</td>
<td>(0.261)</td>
<td>(0.273)</td>
</tr>
<tr>
<td>p-value on difference</td>
<td>0.319</td>
<td>0.586</td>
<td>0.991</td>
<td>0.971</td>
</tr>
</tbody>
</table>

Firm FEs: ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Controls × year FEs: ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓

N | 38,374 | 38,360 | 26,996 | 26,985 | 36,396 | 36,383 | 38,340 | 38,326

# Firms | 1,508 | 1,507 | 1,416 | 1,415 | 1,499 | 1,498 | 1,508 | 1,507

Adj. $R^2$ | 0.535 | 0.551 | 0.702 | 0.702 | 0.948 | 0.949 | 0.954 | 0.955

Notes: Sample time period: 1975 – 2000. We include a one-year lead to account for potential anticipation effects from the announcement of Technopolis sites. Controls × year FEs includes size/age quintiles and Census region of the corporate HQ. We use the pre-Technopolis share of buildings in the firm’s constant returns to scale production function as the basis for classifying firms as using primarily long-lived or short-lived assets. We use the pre-Technopolis share of buildings in the firm’s constant returns to scale production function as the basis for classifying firms as using primarily long-lived or short-lived assets.
No pos. spillovers to untreated firms in treated areas

\[ y_{j,c,k,t} = \gamma_j + \delta_t + \beta_1 \cdot Treatment_{j,k,t} + \beta_2 \cdot TreatedCity_{j,c,t} + \eta' \cdot X_{j,k,t} + \varepsilon_{j,c,k,t} \]  

(8)

<table>
<thead>
<tr>
<th>Bonus claim</th>
<th>Construction</th>
<th>Non-RE purchases</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Treatment</td>
<td>0.100***</td>
<td>0.139*</td>
<td>0.151***</td>
</tr>
<tr>
<td></td>
<td>(0.028)</td>
<td>(0.074)</td>
<td>(0.047)</td>
</tr>
<tr>
<td>TreatedCity</td>
<td>-0.004</td>
<td>-0.087</td>
<td>-0.105***</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td>(0.065)</td>
<td>(0.033)</td>
</tr>
</tbody>
</table>

Firm FEs ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Controls × year FEs ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓

<table>
<thead>
<tr>
<th>N</th>
<th>38,374</th>
<th>38,360</th>
<th>26,996</th>
<th>26,985</th>
<th>36,396</th>
<th>36,383</th>
<th>38,340</th>
<th>38,326</th>
</tr>
</thead>
<tbody>
<tr>
<td># Firms</td>
<td>1,508</td>
<td>1,507</td>
<td>1,416</td>
<td>1,415</td>
<td>1,499</td>
<td>1,498</td>
<td>1,508</td>
<td>1,507</td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>0.535</td>
<td>0.551</td>
<td>0.702</td>
<td>0.702</td>
<td>0.948</td>
<td>0.949</td>
<td>0.954</td>
<td>0.955</td>
</tr>
</tbody>
</table>

Notes: Sample time period: 1975 – 2000. We include a one-year lead to account for potential anticipation effects from the announcement of Technopolis sites. Controls × year FEs includes size/age quintiles and Census region of the corporate HQ.

- Some evidence of cannibalization on the non-RE CAPX margin (pre-trend)
Evolution of (non-) spillovers to local untreated firms

\[ y_{j,t} = \gamma_j + \delta_t + \beta_1 \cdot \text{Treatment}_{j,t} + \beta_2 \cdot \text{TreatedCity}_{j,t} + \varepsilon_{j,t} \]

- \text{TreatedCity}: spillovers to ineligibles located in a Technopolis area
- Placebo (top left): no effect on bonus claiming for ineligible firms
- No evidence of local spillovers for other main outcomes

**Notes:** Bars indicate 95% confidence intervals. We bin the dummies at the end of the effect windows for \( t = -6 \) and \( t = 10 \).
Consider augmented regression which captures sectoral exposure to trade flows:

\[ y_{j,k,t} = \gamma_j + \delta_t + \beta_1 \cdot \text{Treatment}_{j,k,t} + \beta_2 \cdot \text{TradeExposure}_{j,k,t} + \varepsilon_{j,k,t} \] (9)

\[ \text{TradeExposure}_{j,k,t} = \sum_{p \in J} \omega_{j,p,1980} \cdot \text{TradeExposure}_{p,t} \text{ for } J = \{j_1, j_2, \ldots, j_n\} \]

where \( \omega_{j,p,1980} = \frac{\text{PPE}_{j,p,1980}}{\sum_{p \in J} \text{PPE}_{j,p,1980}} \) (each location’s net PPE share)

and \( \text{TradeExposure}_{p,t} = \sum_{q \neq p} \frac{\text{Imports}_{p,q}^k}{\text{TotalImports}_p^k} \times \text{Treatment}_{q,t} + \sum_{q \neq p} \frac{\text{Exports}_{p,q}^k}{\text{TotalExports}_p^k} \times \text{Treatment}_{q,t} \)

supply

demand
No trade exposure through demand or supply

Import exposure (supply)

Export exposure (demand)

LaPoint (Yale) & Sakabe (Columbia)
National corporate income tax rates (CIT) are flat

SME rate applies for firms with annual earnings < 8 million JPY (≈ 80k USD)

Rates were relatively high during our sample period, and increasing right before spatial bonus policies
Alternative cost-per-job measures

Three methods for computing lost cash flows from offering bonus write-offs...

1. Feed in observed corporate cash flows
   - Version A (baseline): compare $D_{t}^{total}/I_{t}$ of bonus claiming to non-claiming firms
   - Version B: compute $D_{t}^{gap}/I_{t} - D_{pre}^{gap}/I_{pre}$ accruing only to the eligible firms [1st differences]
   - Version C: $(D_{t}^{gap}/I_{t} - D_{pre}^{gap}/I_{pre}|\text{eligible}) - (D_{t}^{gap}/I_{t} - D_{pre}^{gap}/I_{pre}|\text{ineligible})$ [diff-in-diff]
   - Version D: residualized diff-in-diff

2. Simulate expected benefits for firms based on capital stock composition

3. Apply expected benefits to CAPX of all eligible firms from public-use files of mfg Census
### Sensitivity Analysis of Cost-per-Job Estimates

<table>
<thead>
<tr>
<th>r = 5%; $\hat{\beta}^{emp} = 5%$</th>
<th>A: Baseline</th>
<th>B: 1st diff in means</th>
<th>C: DD in means</th>
<th>D: Residualized DD</th>
</tr>
</thead>
<tbody>
<tr>
<td>$r = 5%$; $\hat{\beta}^{emp} = 5%$</td>
<td>$18,618$</td>
<td>$17,691$</td>
<td>$12,431$</td>
<td>$8,954$</td>
</tr>
<tr>
<td>Brackets: $3.69%$</td>
<td>$3.50%$</td>
<td>$2.46%$</td>
<td>$1.77%$</td>
<td></td>
</tr>
<tr>
<td>$r = 7%$; $\hat{\beta}^{emp} = 5%$</td>
<td>$14,629$</td>
<td>$15,262$</td>
<td>$10,253$</td>
<td>$7,464$</td>
</tr>
<tr>
<td>Brackets: $2.90%$</td>
<td>$3.02%$</td>
<td>$2.03%$</td>
<td>$1.48%$</td>
<td></td>
</tr>
<tr>
<td>$r = 5%$; $\hat{\beta}^{emp} = 7%$</td>
<td>$13,278$</td>
<td>$11,512$</td>
<td>$7,323$</td>
<td>$5,693$</td>
</tr>
<tr>
<td>Brackets: $3.69%$</td>
<td>$3.50%$</td>
<td>$2.46%$</td>
<td>$1.77%$</td>
<td></td>
</tr>
<tr>
<td>$r = 7%$; $\hat{\beta}^{emp} = 7%$</td>
<td>$10,450$</td>
<td>$10,901$</td>
<td>$6,385$</td>
<td>$5,331$</td>
</tr>
<tr>
<td>Brackets: $2.90%$</td>
<td>$3.02%$</td>
<td>$2.03%$</td>
<td>$1.48%$</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** The table shows cost-per-job estimates (USD) for different parameter estimates using the accounting identity for lost cash flows from offering bonus depreciation. Brackets indicate the fiscal cost as a percentage of a dollar of capital investment that qualifies for bonuses. In each method we compute the denominator of $D_t/I_t$ using the YOY change in the net book value of PPE excluding land, plus accounting depreciation.

- Simulation-based measures also result in fiscal cost of $\approx 3\%$ once we take into account capital input shares $\omega_i$