PLACE-BASED POLICIES
AND THE GEOGRAPHY OF CORPORATE INVESTMENT

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NBER Business Taxation in a Federal System

Stanford GSB

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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) `Evidence`

- Policy instruments used to combat this problem:

  - Targeted tax subsidies: governments compete to attract companies
  - Opportunity Zones (2017 TCJA): deferred capital gains taxes + capital lock-in
  - **Bonus depreciation: focus on <u>long-lasting investment</u> + immediate cash flows**

- Two main issues place-based policies [PBPs] try to address:

  1. Targeting: directing resources where needed the most
  2. Retention: prevent firms from capturing benefits then exiting **(Okun's "leaky bucket")**

Imaginary Jobs, Bulldozed Homes & the Sacking of Local Government

Foxconned

LAWRENCE TABAK

- 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

- Revised 2021 deal: $672 mil. in inv. and 1,500 jobs in exchange for $80 mil. subsidy

More than $15 billion has been raised by funds that invest in opportunity zones. The 2017 tax law created capital gains tax breaks for investments in designated zones, like this Chicago neighborhood.

Photographer: Daniel Acker/Bloomberg

Opportunity Zones Keep Drawing Billions During Pandemic

Source: Bloomberg Tax, February 3, 2021

- Governors designate qualifying Census tracts as OZs where CGT deferred, basis step-up after 5 years, and eliminated if investors stay $\geq$ 10 years

- Mixed evidence of effectiveness $+$ no info on long-run effects yet

THIS PAPER: ROLE OF CORPORATE GEOGRAPHY IN SPATIAL POLICY

- <u>National</u> PBP 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. ↑ in construction, 0.40 s.d. ↑ 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 younger/smaller $\longrightarrow$ financing constraints (e.g. Hadlock & Pierce 2010)
  - ▶ Or if already have plants close to treated areas (transport + span of control costs)

- Overall, no evidence of within or cross-region trade spillovers among large firms

- **\$15k – \$20k cost per job** when we use <u>observed</u> cash flows from bonus claims
  - ▶ Firms reallocate labor to productive areas $\longrightarrow$ PDV total surplus of \$56.7 bil.

Related work

- Empirical studies of place-based policies (PBPs)
  - Broad PBPs (e.g. "zones") vs. targeted subsidies/credits
  - We extend Zwick & Mahon (2017) by examining bonus depreciation as a PBP

- Firm internal capital markets
  - Local shocks propagate via plant networks (e.g. Giroud & Mueller 2019; Giroud et al. 2021)
  - Our paper: intra-firm spillovers of local corporate CAPX subsidies

- Macro-trade literature on firm sorting
  - Typically no dynamic investment problem in these models (intermediate inputs)
  - We show evidence for mechanisms such as transport/span of control costs (Oberfield et al. 2020) but emphasize role of internal resource movement

Full literature

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 $\implies$ 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
  1. **Technopolis (1984-89):** <u>parent</u> firms in 55 mfg. JSICs eligible
  2. 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 city with 200k-300k population

- Eligible munis generally have more non-heavy mfg. capacity, but quantitatively small differences in economic fundamentals `Summary stats`

Technopolis (1984 – 1989)

Intelligent Location (1989 – 1994)

	Ineligible
	1984
	1985
	1986
	1987
	1988
	1989
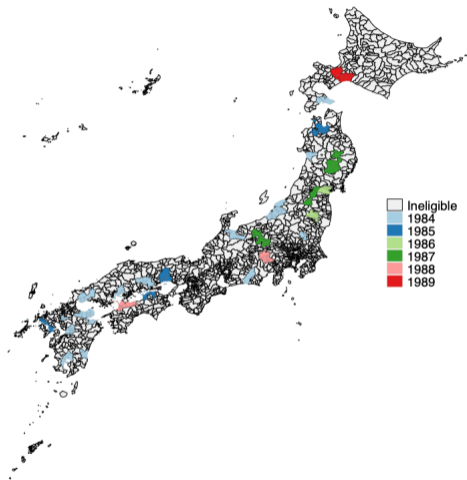
	Ineligible
	1989
	1990
	1991
	1992
	1994
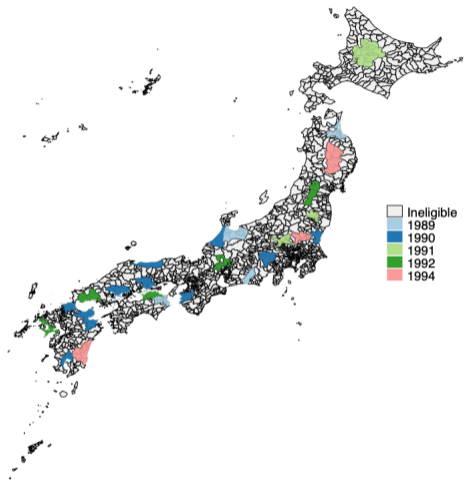
- IL locations chosen to expand on existing Technopolis clusters

Technopolis bonus rate schedule

Time from start date	Non-RE Bonus Rate	RE Bonus Rate
Within 5 years	30%	15%
Between 5 and 7 years	25%	13%
Between 7 and 8 years	20%	10%
Between 8 and 10 years	15%	8%
Between 10 and 12 years	14%	7%
> 12 years	0%	0%

- Kink points: maximize rate by investing within 5 years of implementation

- Big incentives for real estate investment IL schedule   Detailed example
  - Buildings have depreciation lives ranging from 23 years (cold storage facilities) to 65 years (concrete office buildings)

EXAMPLES OF ELIGIBLE INDUSTRIES WITHIN 1-DIGIT SECTORS

Heavy Manufacturing

Carbonaceous electrodes
Miscellaneous carbon and graphite products
Miscellaneous primary smelting and refining of non-ferrous metals
Rolling and drawing of copper and copper alloys
Rolling of aluminum and aluminum alloys, including drawing and extruding
Miscellaneous rolling of non-ferrous metals and alloys, including drawing and extruding
Electric wire and cable, except optical fiber cable
Non-ferrous metal products, n.e.c.
Mechanical power transmission equipment, except ball and roller bearings
Valves and fittings
Ball and roller bearings
Foundry equipment
Machinery for fabrication of plastic and its equipment
Metal machine tools
Metalworking machinery and its equipment, except metal machine tools
Parts and accessories for metal working machines and machine tools, except machinists' precision tools, molds and dyes
Machinists' precision tools, except powder metallurgy products

Electronics

Office machinery and equipment
Manometers, flow meters and quantity gauges
Precision measuring machines and instruments
Analytical instruments
Testing machines
Miscellaneous measuring instruments, analytical instruments, testing machines, surveying instruments and physical and chemical instruments
Medical instruments and apparatus
Microscopes and telescopes
Cameras, motion picture equipment and their parts
Movie machines and their pats
Optical lenses and prisms
Electron tubes
Semiconductor element
Integrated circuits
Miscellaneous electronic components
Generators, motors and other rotating electrical machinery
Electrical relay switches
Auxiliary equipment for internal combustion engines
X-ray equipment

- $\implies$ these are mostly upstream firms in machine mfg. sectors

Geocoded database of corporate investment

- Corporate balance sheet data for listed firms from Development Bank of Japan (DBJ)

  - ▸ Firms report total bonus depreciation claims $\longrightarrow$ **first stage effects**

  - ▸ Physical capital investment recorded by type (construction, machines, buildings, land, tools, vehicles) $\longrightarrow$ input structure (Details) (Example) (Sampling) (Sectors) (Stats)

- Plant-level information from two sources:

  1. Census of Manufacturers (COM): all plants with ≥ 4 employees
  2. For listed firms, digitize facility itemizations from Form 10-K equivalent (LaPoint 2021)

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

- Historical stock prices and shares outstanding from Nikkei NEEDS

Main Empirical Results

STAGGERED DIFF-IN-DIFF (DD) WITH THREE-DIMENSIONAL TREATMENT

- Consider standard firm-level staggered DD event study specification:

$$y_{j,k,t} = \gamma_j + \delta_t + \sum_{t=1, t \neq t_0}^{T} \beta_t \cdot Treatment_{j,k,t} + \eta' \cdot \mathbf{X}_{j,k,t} + \varepsilon_{j,k,t} \quad (1)$$

- $Treatment$ 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

        ★ We show later that multi-plant firm entry is on intensive margin

    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 <u>first</u> 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 $\longrightarrow$ tie breaker if firm has plants in several Technopolises

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 (2022)** [*BJS*]: two-step imputation which uses never-treated and not-yet treated firms, allows for anticipatory leads
  - de Chaisemartin & D'Haultfœuille (2020): uses not-yet treated as control group
  - Sun & Abraham (2021): 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

First stage effect: bonus claiming peaks at initial kink point
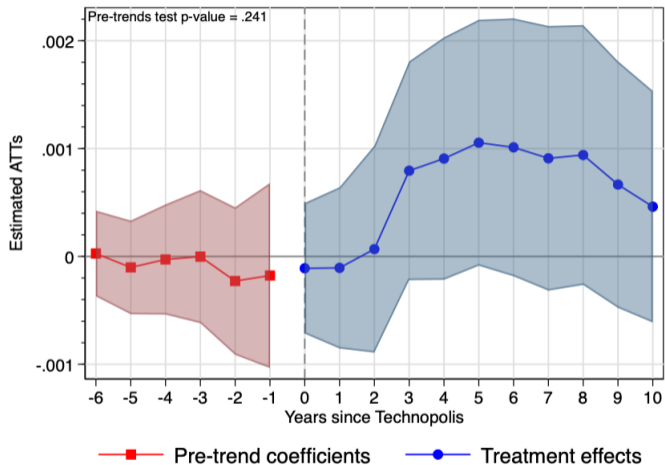
- 0.18 s.d. increase in $ value of bonus claims

- Big spike in claims around policy year 2 $\implies$ time to build in construction

- First stage effect $\implies$ not just identifying ITT effects

- Pre-trend testing: 0.24 p-value on joint significance of leads

Cash flows

Note: We do not use a one-year anticipatory lead to perform the pre-trend test.

$$\mathbb{1}\{bonus > 0\}_{j,k,t} = \gamma_j + \delta_t + \beta \cdot Treatment_{j,k,t} + \eta' \cdot \mathbf{X}_{j,k,t} + \varepsilon_{j,k,t}$$

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

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.

Dynamic effects on cash flows, employment, CIP, non-RE CAPX
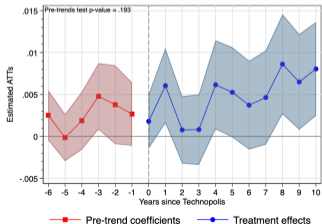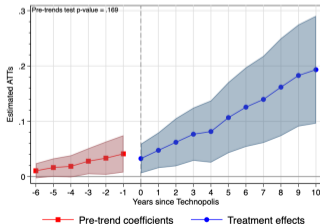

Operating cash flow
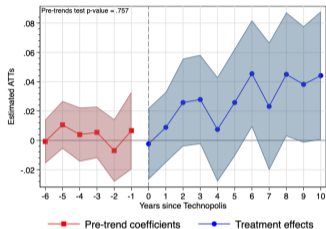
Employment
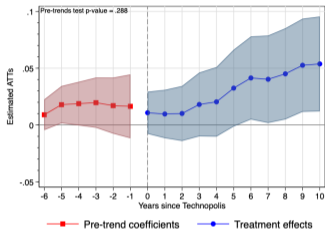
Construction in progress

Non-RE purchases

- 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 0.76 for OCF, 0.29 for employment, 0.19 for CIP, and 0.17 for non-RE purchases
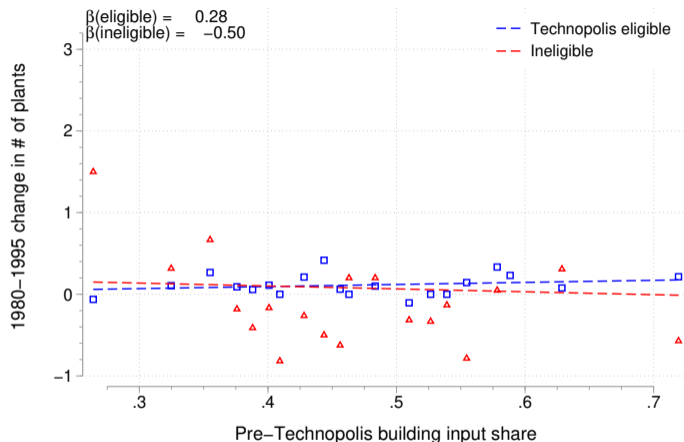
Old geo Estimators Linear trends Logs

City level Other outcomes

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, $\%\Delta$ emp., $\%\Delta$ real land value between 1980–1995 among eligible/ineligible plants
    - Rank parent firms based on "exposure" to reform: financing constraints, **LL asset share**
    - LL asset share $\propto$ capital subsidy rate

CONSTRUCTION RESPONSE INVOLVES EXPANSION OF <u>EXISTING</u> PLANTS

β(eligible) = 0.28
β(ineligible) = −0.50

- - - Technopolis eligible
- - - Ineligible

y-axis: 1980–1995 change in # of plants
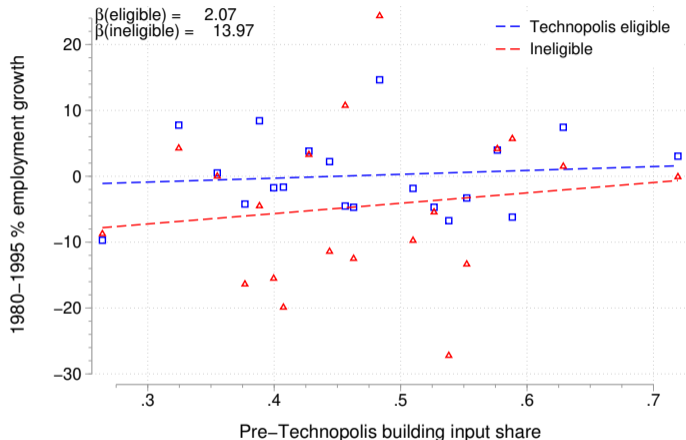x-axis: Pre–Technopolis building input share

Notes: Each point on the graph corresponds to plant totals among either Technopolis ineligible (red) or eligible (blue) locations within a listed mfg. firm. Points reflect 20 quantile bins.

- Flat relationship between LL asset share and establishment growth
  - ▶ But slightly negative in ineligible areas

- Corroborates construction data showing CIP response coming from expansion of existing plants

- x-axis $\omega_{build} \in [0, 1]$ corresponds to subsidy rate ranging from 0.9% to 3.6%

  Simulation

Leakage of tax breaks to untreated areas within firm

β(eligible) = 2.07
β(ineligible) = 13.97

Technopolis eligible
Ineligible

1980–1995 % employment growth

Pre–Technopolis building input share

- Much larger ΔL to LL share gradient for ineligible areas vs. eligible areas
  - $\implies$ cash flows financing hires outside targeted areas

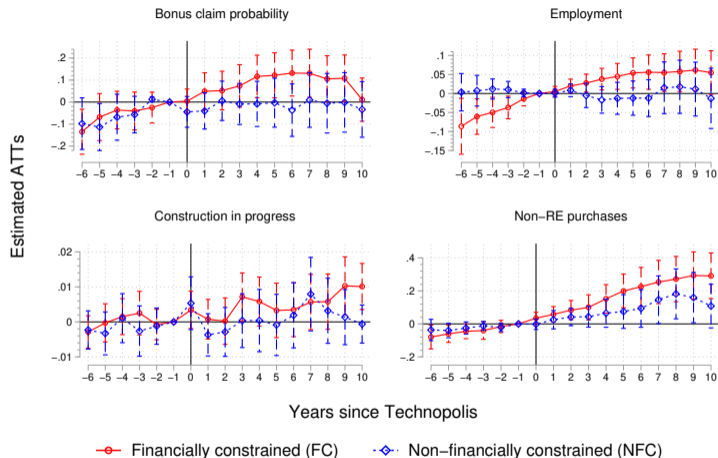- This implies a large **semi-elasticity** w.r.t. subsidy rate of $\varepsilon = \beta/\Delta\tau$
  - In ineligible areas $\varepsilon = 14.0/(3.6\% - 0.9\%) = 5.2$
  - $\varepsilon = 0.8$ in eligible areas (statistically insignificant)

Notes: Each point on the graph corresponds to plant totals among either Technopolis ineligible (red) or eligible (blue) locations within a listed mfg. firm. Points reflect 20 quantile bins.

Heterogeneity: Take-up Determinants & Spillovers

1. Effects driven by financially constrained firms   Jump
   - Consistent with younger/smaller firms valuing future cash flows with high discount rates

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

3. **Capital inputs matter:** effects driven by firms relying on longer-lived assets   Jump
   - Q theory-based structural approach to recover capital input shares

4. No pos. spillovers to ineligible firms in treated areas   Jump

5. No evidence of cross-regional spillovers due to trade networks   Jump

Bonus claim probability · Employment · Construction in progress · Non–RE purchases

Estimated ATTs

Years since Technopolis

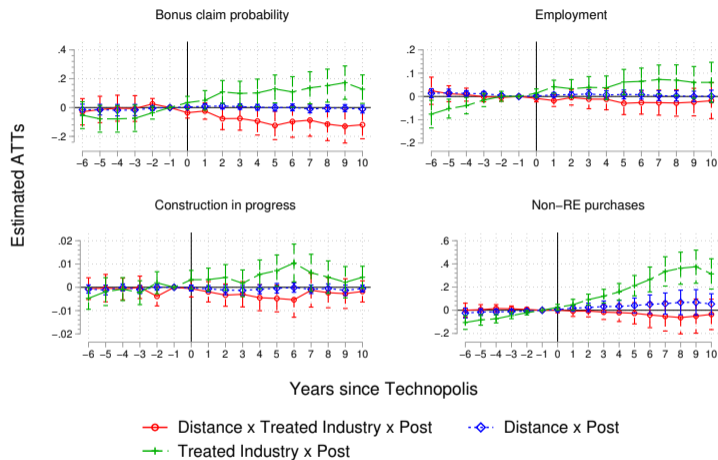—○— Financially constrained (FC) ··◇·· Non–financially constrained (NFC)

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

- 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
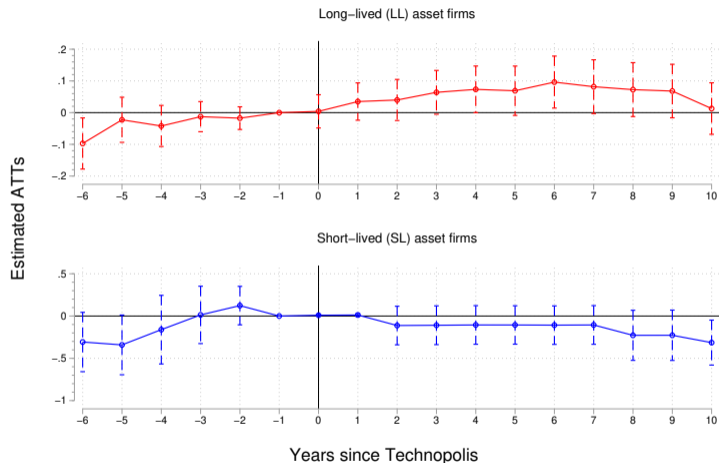
POLICY TAKE-UP DECLINES WITH DRIVING DISTANCE

Estimated ATTs — Years since Technopolis

Legend:
- Distance x Treated Industry x Post
- Treated Industry x Post
- Distance x Post

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

- 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

Specification   Distribution

Long–lived (LL) asset firms

Short–lived (SL) asset firms

Estimated ATTs

Years since Technopolis

- Define **LL firms** as those with ω_{build} above firm median

- Machines relatively long-lived but big range (3-25 yrs.) in usable life depending on use

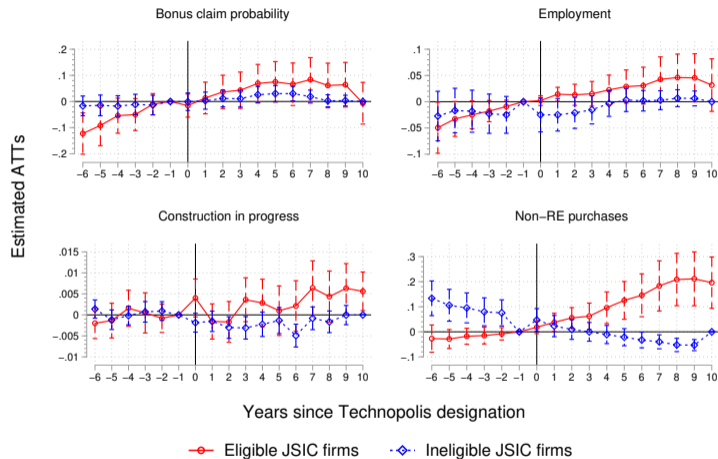- Wide confidence intervals on the **SL asset** firms → more industry heterogeneity

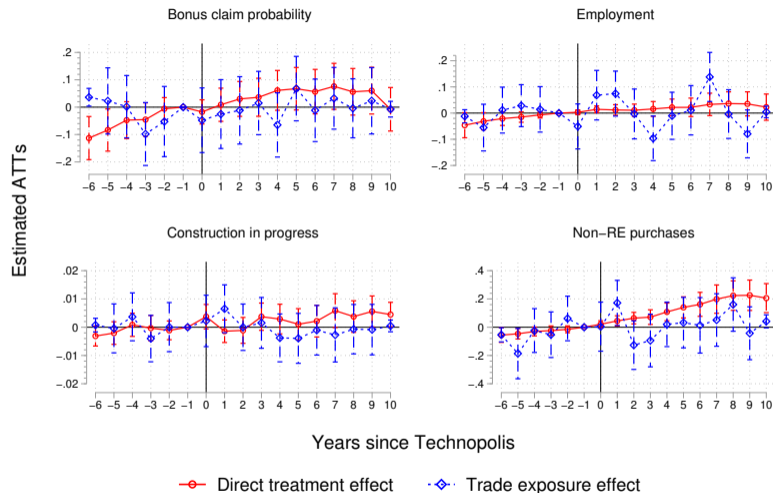Pooled OLS   Details   PSM

Stats   Distribution

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

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

- Add $TreatedCity$ dummy: 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

Full results

No sectoral trade spillovers from Technopolis

Bonus claim probability · Employment · Construction in progress · Non–RE purchases

Estimated ATTs

Years since Technopolis

—●— Direct treatment effect   ··◆·· Trade exposure effect

- Technopolis exposure through sectoral trade flows has no clear effect (huge CIs)

- Similar null results when separate import and export shocks

Specification   Separate shocks

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

Policy Cost-Benefit Analysis

COST-PER-JOB (CPJ) ESTIMATES

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

$$\text{Fiscal cost} = \sum_{t=1984}^{1995} \frac{\tau_t}{(1+r)^t} \times \left(D_t^{bonus} - D_t^{normal} \right) \times \text{Take-up}_t \qquad (2)$$

- Compute the *ex post* benefit $D^{bonus} - D^{normal}$ then scale by take-up = $Treatment \times \mathbb{1}\{bonus > 0\} \implies$ fiscal cost $\approx 2\%$ per <u>qualifying</u> CAPX dollar
  - $\implies$ avg. user cost elasticity of $\epsilon_{K,1-\tau_c} \approx 2.1$ (large, but real estate is subsidized!)

- Applying this rate to total eligible CAPX during policy and our DD estimate of 5-7% gain in employment $\implies$ **\$15k-\$20k cost per job** [CIT rates] [Definitions] [Other methods]

- Caveat: partial equilibrium measure does not take into account spillovers through reallocation across locations within the firm
  - Local and inter-regional trade spillovers minimal to non-existent in our setting
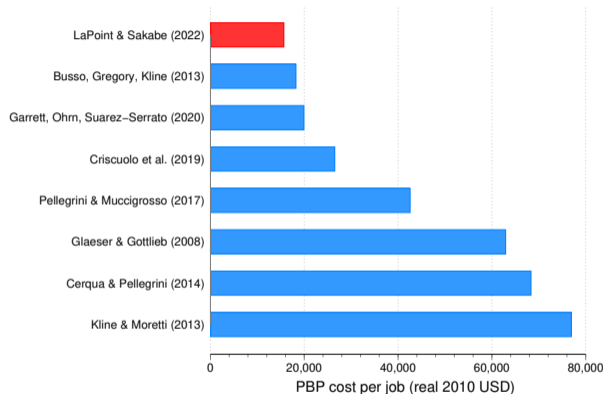
Notes: Estimates from studies reporting CPJ estimates for PBPs featuring investment subsidies. Following Criscuolo et al. (2019), we converted all estimates to real 2010 USD using historical annual average exchange rates from OFX and UBC Saunder Pacific Exchange Rate Service.

- **Finer nature of DiD in our setting + firm-level first stage**
  - ▶ Exception: Cerqua & Pellegrini (2014) observe take up

- CPJ for large listed vs. general sample of firms may be different
  - ▶ Benefit from <u>scale effects</u> in hiring

- Separation of admin from production
  - ▶ Jobs created outside policy regions are at office/sales sites
  - ▶ Likely to be part-time, less specialized

BACK-OF-THE-ENVELOPE ESTIMATES OF WELFARE CHANGE

- **Idea:** compare forgone CIT revenue to profits and wage bills generated
  - ▸ Building on approach of Busso, Gregory, & Kline (2013), among others
  - ▸ Similar to fiscal cost per job, but also take into account *changes in size of tax base*
  - ▸ Fiscal cost measure only computes spending on investment subsidy

- Compute gap for actual vs. counterfactual profits $\widetilde{\pi}$ and wage bill $\widetilde{w}$:
  - ▸ Gain in corporate profits $= \pi - \widetilde{\pi} = \pi \cdot \widehat{\beta}^{profits}/(1 + \widehat{\beta}^{profits})$
  - ▸ Gain in wage bill $= w - \widetilde{w} = w \cdot \widehat{\beta}^{wages}/(1 + \widehat{\beta}^{wages})$

- Then compare actual taxes paid to counterfactual taxes $= \tau \cdot \widetilde{\gamma} = \tau \cdot \gamma/(1 + \widehat{\beta}^{base})$
  - ▸ γ is a measure of π that already **nets out depreciation** write-offs (e.g. net income $+$ taxes)

	Actual value	$\widehat{\beta}$	Counterfactual value	Benefits
Wage bill	591.0	0.063	556.0	35.0
Corporate profits	380.3	0.025	370.0	9.3
Tax revenue	106.3	0.132	93.9	12.4

- **PDV total surplus** $= 35.0 + 9.3 + 12.4 = 56.7$ billion (real 2010 USD) `Regressions`
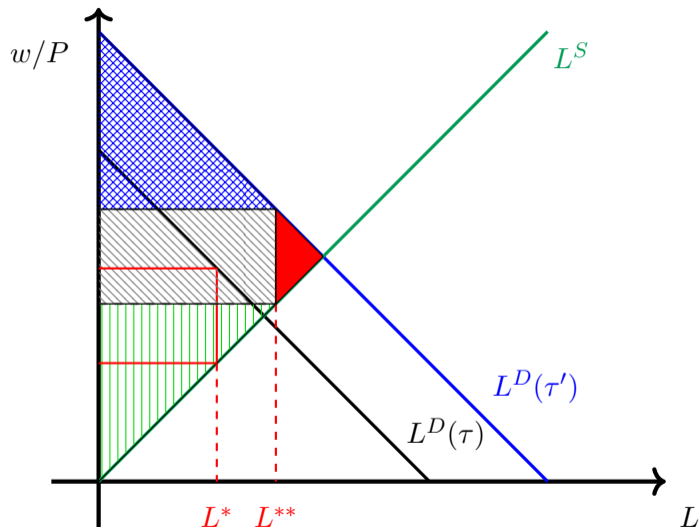 - About 40% of annual avg. total listed firms' profits `PDV flows`
- Caveat: only includes pie generated by activities of listed firms
  - Effects might be bigger for small firms (direct + spillovers)
  - **Evidence:** for city $\times$ industry-level data covering all mfg. firms, $\widehat{\beta}^{wage} = 9\%$

- Labor market when effective tax rate firms pay goes down to $\tau' < \tau$ due to Technopolis

- Simple case w/100% pass-through of CIT to real wages w/P
    - Either through $w \downarrow$ or $P \uparrow$

- Assume no spillovers, so L^s curve does not shift
    - Matches empirical evidence

- Worker surplus, profits, revenue all grow due to L^D shift

Conclusion

- 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 networks matter 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

- On targeting side, multi-plant firms mitigate spatial misallocation of PBPs
  - ▶ **Leakage:** multi-plant firms can redirect cash flows elsewhere
  - ▶ Welfare change $(+)$ but attenuated by subsidies to low marginal productivity areas

- Future: apply structural trade model to quantify region $\times$ 2-digit industry TFP growth
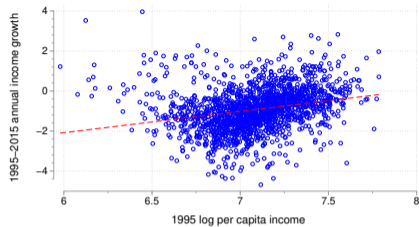 - ▶ Improve upon standard measures of productivity such as mfg. value-added
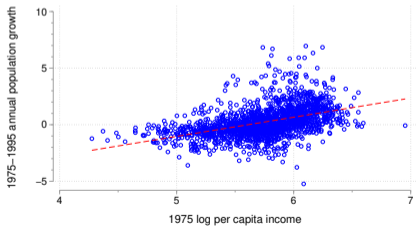
THANK YOU!

Appendix

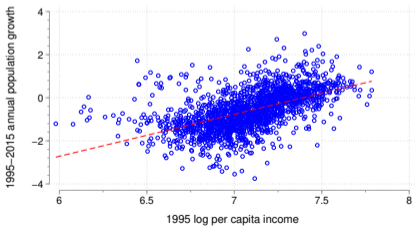# INCOME DIVERGENCE AND INCREASING DIRECTED MIGRATION (JAPAN)
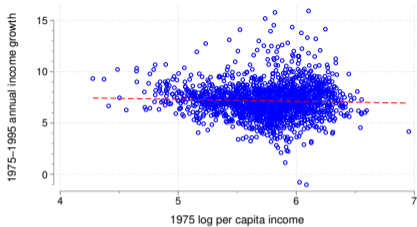
β = −0.19
s.e. = 0.10
N = 1710
R−squared = 0.00

β = 1.06
s.e. = 0.13
N = 1710
R−squared = 0.06

β = 1.69
s.e. = 0.07
N = 1710
R−squared = 0.20

β = 1.95
s.e. = 0.09
N = 1710
R−squared = 0.29

- Empirical studies of place-based policies (PBPs) [non-exhaustive list!]

  - Devereux, Griffith, Simpson (2007); Neumark & Kolko (2010); Busso, Gregory, Kline (2013); Kline & Moretti (2014); Criscuolo et al. (2019); Lu, Wang, Zhu (2019); Bartik (2020); Arefeva et al. (2021); Siegloch, Wehrhöfer, Etzel (2021); Corinth & Feldman (2022); Kennedy & Wheeler (2022)

- Firm internal capital markets

  - Spatial: Desai, Foley, Hines (2004); Chaney, Sraer, Thesmar (2012); Giroud & Mueller (2015, 2019); Dougal, Parsons, Titman (2015); van Straelen (2018); Ma, Murfin, Pratt (2021); LaPoint (2021)

  - Tax incentives: House & Shapiro (2008); Edgerton (2010); Zwick & Mahon (2017); Giroud & Rauh (2019); Garrett, Ohrn, Suárez Serrato (2020); Curtis et al. (2021); Basu, Kim, Singh (2022)

- 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**

	Eligible	Ineligible	Difference	p-value
Log mfg. employment	8.79	8.37	0.42	0.00
Log mfg. establishments	5.44	5.12	0.32	0.01
Log mfg. plant capital stock	14.46	13.91	0.55	0.00
Log per capita income	6.36	6.42	−0.06	0.02
Log Census population	11.27	10.85	0.42	0.00
Log median price/m^2 for CRE	10.87	11.17	−0.30	0.02
Population density (1000s/km^2)	0.47	1.29	−0.82	0.00
Unemployment rate (%)	2.23	2.13	0.10	0.33
Ratio of govt. expenditure to revenue	0.98	0.97	0.01	0.03
Heavy industry employment share	0.18	0.21	−0.03	0.33
Housing expenditure share	0.09	0.10	−0.01	0.59
%$\Delta^{1980-83}$ mfg. employment	9.21	6.21	3.00	0.05
%$\Delta^{1980-83}$ establishments	5.97	7.39	−1.42	0.27
%$\Delta^{1980-83}$ CRE price/m^2	57.74	67.88	−10.14	0.18

Summary Statistics for Intelligent Location Eligible vs. Ineligible Sites

	Eligible	Ineligible	Difference	p-value
Log mfg. employment	8.56	8.38	0.18	0.08
Log mfg. establishments	5.26	5.13	0.13	0.18
Log mfg. plant capital stock	14.15	13.93	0.22	0.07
Log per capita income	6.35	6.43	-0.08	0.00
Log Census population	10.99	10.87	0.12	0.19
Log median price/m^2 for CRE	10.89	11.19	-0.30	0.01
Population density (1000s/km^2)	0.65	1.33	-0.68	0.00
Unemployment rate (%)	2.42	2.07	0.35	0.00
Ratio of govt. expenditure to revenue	0.97	0.97	0.00	0.03
Heavy industry employment share	0.18	0.22	-0.04	0.19
Housing expenditure share	0.09	0.10	-0.01	0.03
%$\Delta^{1980-83}$ mfg. employment	6.86	6.49	0.37	0.76
%$\Delta^{1980-83}$ establishments	5.76	7.60	-1.86	0.07
%$\Delta^{1980-83}$ CRE price/m^2	64.28	66.88	-2.60	0.70

	Eligible		Ineligible	
	Mean (s.d.)	[min,max]	Mean (s.d.)	[min,max]
Total mfg. employment	9,524 (13,887)	[136, 109,649]	5,706 (23,648)	[0, 723,990]
Heavy industry employment share	0.175 (0.128)	[0.025, 0.516]	0.212 (0.150)	[0.013, 0.875]
Establishments w/> 4 employees	370 (576)	[10, 4,769]	241 (1,389)	[1, 47,196]
Mfg. plant capital stock	3,527 (7,190)	[0, 5,961]	1,620 (4,605)	[0, 7,570]
Per capita income	556 (104)	[292, 764]	553 (158)	[196, 1,446]
Census population	119,885 (186,727)	[4,824, 1,401,757]	64,110 (279,303)	[225, 8,351,856]
Population > 65 y.o.	11,439 (14,653)	[568, 87,440]	5,783 (22,151)	[27, 686,436]
Median price/m^2 for CRE	63.93 (35.83)	[6.60, 180.00]	100.91 (95.33)	[6.35, 571.00]
Housing expenditure share	0.091 (0.024)	[0.027, 0.141]	0.096 (0.036)	[0.028, 0.241]
%$\Delta^{1980-83}$ mfg. employment	9.8 (20.7)	[−32.0, 136.6]	6.3 (20.8)	[−100, 219.1]
%$\Delta^{1980-83}$ establishments	7.1 (12.0)	[−12.5, 72,7]	6.4 (18.6)	[−72.7, 200.0]
%$\Delta^{1980-83}$ CRE price/m^2	57.7 (40.1)	[10.3, 203.0]	69.8 (64.1)	[−37.1, 722.5]
# of municipalities	141		1,568	

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

Time from start date	Non-RE Bonus Rate	RE Bonus Rate
Within 2 years + Tokyo HQ	36%	18%
Within 3 years	30%	15%
Between 3 and 5 years	24%	12%
Between 5 and 7 years	20%	10%
> 7 years	0%	0%

- 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

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).

Year	1	2	3	4	5	...	Total	PDV ($r = 7\%$)
Straight-line (linear)								
Cash flow (PCs)	90	90	90	90	0	...	360	326
Cash flow (CRE)	0	0	5.5	5.5	5.5	...	360	73
Declining balance (default)								
Cash flow (PCs)	175	98.5	55.5	31	0	...	360	**341**
Cash flow (CRE)	0	0	14	13.5	13	...	360	**124.5**
Bonus (Technopolis) + default								
Cash flow (PCs)	242.5	69	39	10	0	...	360	**349**
Cash flow (CRE)	0	0	72	11.5	11	...	360	**158**

- Corporate income tax (CIT) bill for income I, asset book value P, and dep. rate θ is

$$\tau^{CIT} \cdot (I - \theta \cdot P) \tag{3}$$

- Total <u>immediate</u> cash flow benefit with bonus claims is then: `Accounting`

$$\tau^{CIT} \cdot P_{i,0} \times \left(\theta_{i,c}^{bonus} + (1 - \theta_{i,c}^{bonus}) \cdot \theta_0^{normal} \right) \tag{4}$$

- Normal methods: straight-line (linear) and declining-balance depreciation (default)
  - Accounting method chosen by <u>parent firm</u> 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 θ_0 set by tax authority

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

- DB method strictly dominates SL in terms of PDV of cash flows for vast majority of capital types and discount rate combos

Mean = 15.43 months
Median = 11.00 months

β = 1.44
s.e. = 0.04
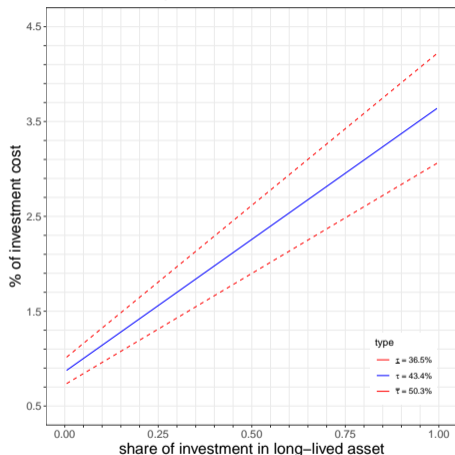N = 3391
R−squared = 0.36
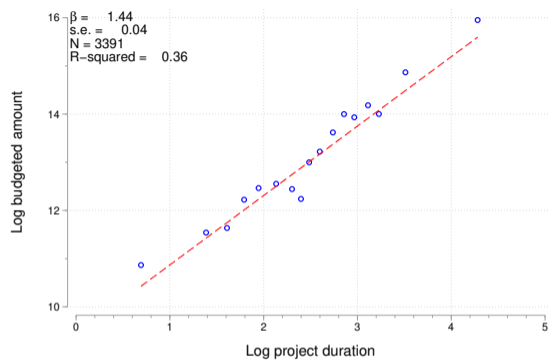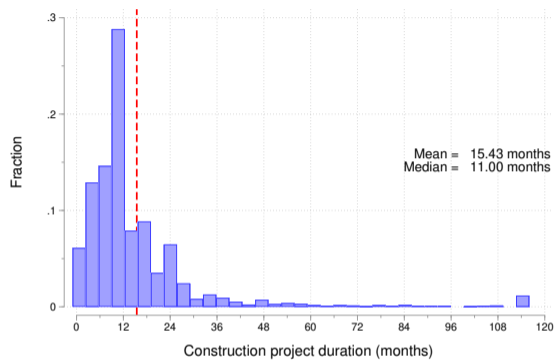
- Average firm has 3 ongoing projects in filing year (median 3.3)

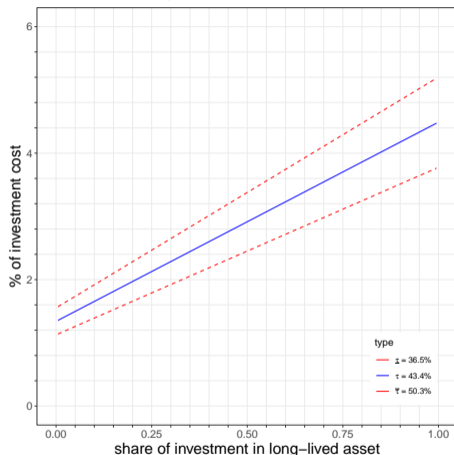- 1% increase in project duration associated with 1.44% increase in budget
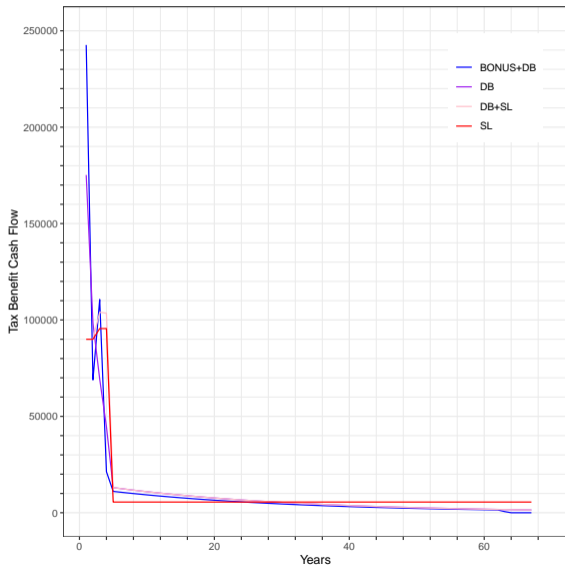
- Clear jump in immediate cash flows with bonus rates

- SL method strictly dominated by DB method

- DB method also shortens amortization schedule by 2 years

Compared to DB benefit · Compared to SL benefit

- 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]**

区　分		本社及び本社工場	磐田工場	富山工場	大須賀工場	湖西工場	豊川工場	部品倉庫	その他	合　計
土　地	所有地 (㎡)	(1,371) 173,106	(976) 246,301	84,495	104,548	(114,920) 561,460	(22,141) 213,427	39,943	(181,610) 1,071,049	(321,018) 2,494,331
	借　地 (㎡)	(1,279) 17,162	36,061	—	—	55,286	18,024	—	(2,774) 559,421	(4,053) 685,959
	金　額 (百万円)	(1) 95	(2) 59	58	151	(144) 730	(64) 705	130	(4,462) 7,895	(4,673) 10,366
建　物	所有建物 (㎡)	115,849	38,911	42,956	24,098	82,155	(17,451) 71,938	29,602	(83,814) 157,239	(101,265) 612,165
	借　家 (㎡)	—	—	—	—	—	—	—	(984) 2,198	(984) 2,198
	金　額 (百万円)	2,616	1,081	592	593	1,328	(101) 975	516	(1,868) 3,068	(1,969) 10,770
構　築　物	金　額 (百万円)	242	141	80	111	364	203	50	(146) 420	(146) 1,633
機械及び装置	台　数 (台)	2,931	1,118	638	553	934	766	24	(399) 528	(399) 7,492
	金　額 (百万円)	9,671	3,347	917	1,969	2,122	1,062	65	(865) 1,110	(865) 20,263
車両運搬具	金　額 (百万円)	97	26	7	14	36	19	7	(49) 91	(49) 297
工具器具備品	金　額 (百万円)	686	526	90	306	665	602	12	(1) 40	(1) 2,927
投下資本合計	(百万円)	13,407	5,736	1,754	3,144	5,245	3,566	780	12,624	46,256
従　業　員　数	(人)	3,168	1,160	711	312	896	731	104	1,469	8,551
取　扱　業　務		本社業務及び部品の製造業務	製品の製造業務	製品の製造業務	部品の製造業務	製品の製造業務	製品の製造業務	完成品の保管及び販売業務	販売業務他	

- 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)

| Location	Land		Buildings		Construction	Employees	Ownership	Usage
Hamamatsu (Shizuoka)	173,106 m^2	95,000	115,849 m^2	2,616,000	242,000	3,168	Partial	HQ/factory
Iwata (Shizuoka)	246,301 m^2	592,000	38,911 m^2	1,082,000	165,000	1,160	Partial	Factory
Kosai (Shizuoka)	561,460 m^2	730,000	82,155 m^2	1,328,000	364,000	896	Partial	Factory
Ōsuka (Shizuoka)	104,548 m^2	151,000	24,098 m^2	593,000	111,000	312	Full	Factory
Toyokawa (Aichi)	213,427 m^2	705,000	71,938 m^2	975,000	203,000	731	Partial	Factory
Oyabe (Toyama)	84,495 m^2	58,000	42,986 m^2	592,000	80,000	711	Full	Factory
Tokyo	1,071,049 m^2	7,895,000	157,239 m^2	3,068,000	420,000	1,469	Partial	Branch office/agency
Total	2,454,386 m^2	10,226,000	533,176 m^2	10,254,000	1,585,000	8,447		

- 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
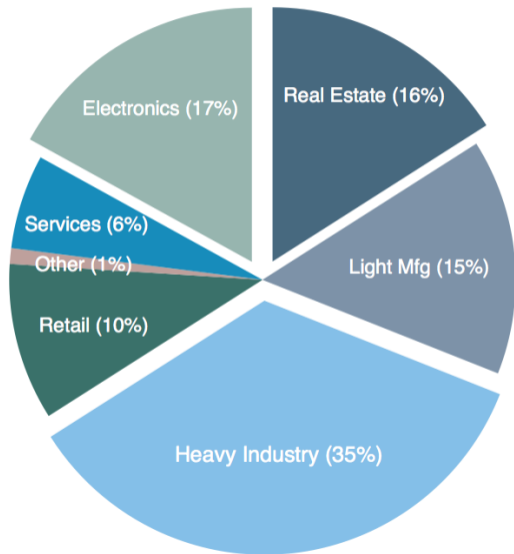
- Firms eligible for tax breaks under Technopolis mostly in the heavy industry and light mfg. categories

- 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

|	Full DBJ Sample				Matched DBJ-COM Sample			
	Mean	Median	10th pct.	90th pct.	Mean	Median	10th pct.	90th pct.
Construction in progress	0.02	0.01	0.00	0.11	0.03	0.01	0.00	0.11
Non-real estate assets	0.83	0.44	0.02	2.26	1.07	0.74	0.07	2.76
Real estate assets	0.64	0.33	0.07	1.91	0.72	0.47	0.11	1.74
PPE	1.61	0.93	0.17	4.18	1.90	1.37	0.28	4.31
CAPX	0.11	0.06	-0.02	0.57	0.09	0.06	-0.05	0.40
Employment	2,572	991	240	5,559	2,516	950	262	5,144
Long-term debt issues	0.01	0.00	-0.10	0.15	0.01	0.00	-0.14	0.19
Cash flow	0.03	0.01	-0.02	0.16	0.03	0.01	-0.04	0.16
EBITDA	0.22	0.13	0.02	0.57	0.24	0.16	0.00	0.64
OCF	0.31	0.18	0.03	1.15	0.30	0.20	0.03	0.82
Bonus depreciation	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
$\mathbb{1}\{bonus > 0\}$	**0.23**	0.00	0.00	1.00	**0.30**	0.00	0.00	1.00
# of firm-years		38,374				13,688		
# of 1980 plants		3,470				2,765		
# of firms		1,508				870		

Log employment
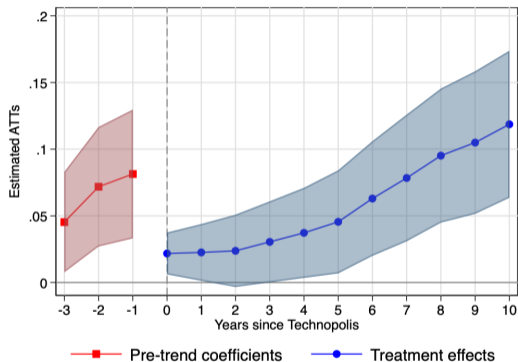
Log number of establishments
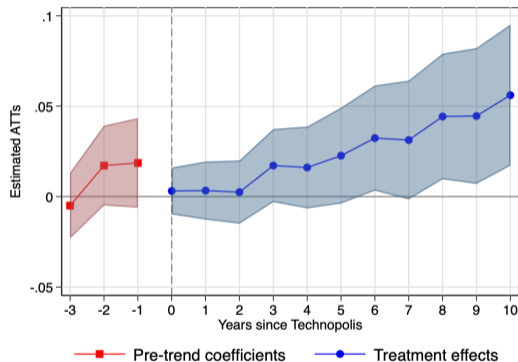
- Pre-trend: we already know that eligible sites chosen with specific criteria in mind

- Using firm-level eligibility criteria helps difference out local macro trends
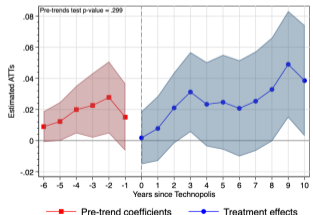
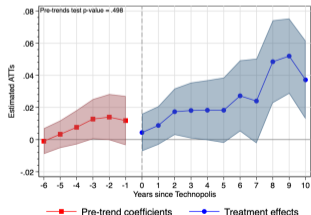# COMPARING TRAJECTORIES OF CASH FLOW MEASURES
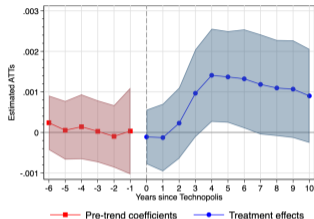
Bonus claim probability
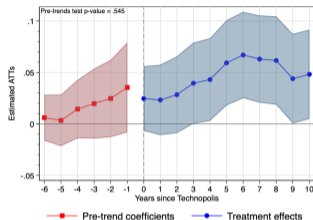
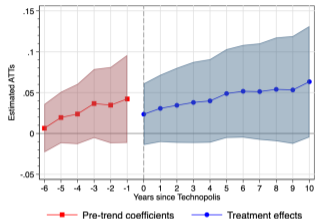Operating cash flow
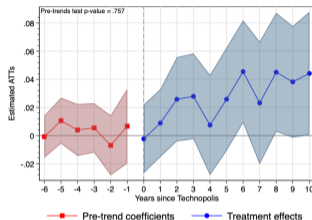
EBITDA

Cash flow

- Extensive margin bonus claim response again peaks around policy year 5

- Bonus claims included in OCF and cash flow but <u>not</u> EBITDA

- Effect on EBITDA coming from output of new investment

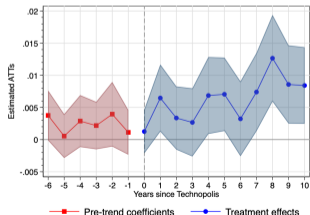- Zwick & Mahon (2017): cash flow = net income before dep. after taxes paid
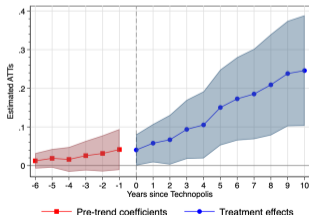
- Upward trend in OCF after reform, but no clear spikes at kink points

- Nearly identical estimates for employment, new construction (0.3 s.d.), non-RE asset purchases (0.4 s.d.)
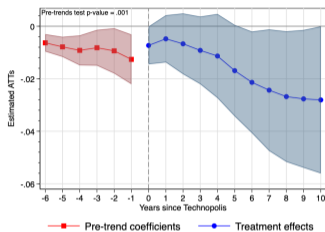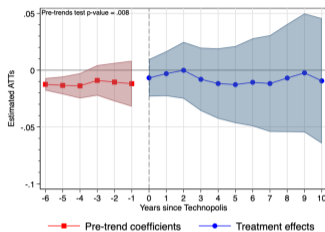
- Pre-trend diminishes, SEs ↑ when we impose 1980 municipal boundaries

Land purchases

Net building purchases

Overall CAPX
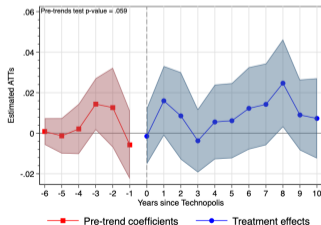
LT loan issues
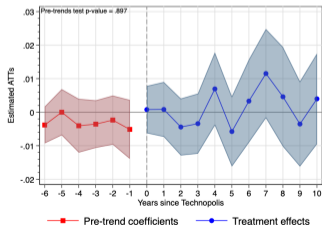
- Substitution away from inv. in land (0.16 s.d.) $\longrightarrow$ doesn't depreciate!

- 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
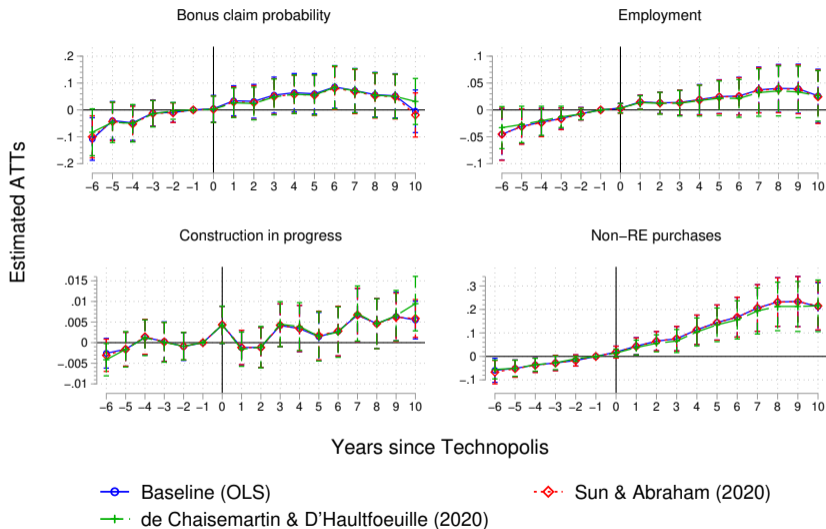
Years since Technopolis

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

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

Estimated ATTs

Bonus claim probability

Employment

Construction in progress

Non–RE purchases

Years since Technopolis

- ○ OLS w/linear trends
- ◇ Sun & Abraham w/linear trends
- + OLS w/o linear trends
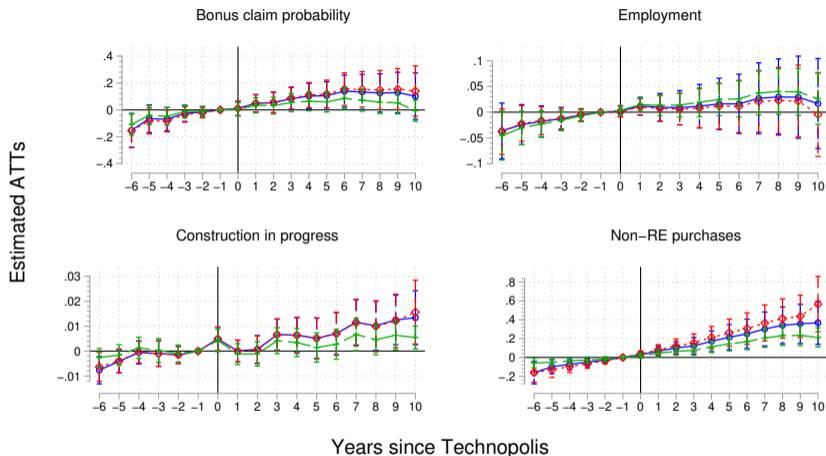
Notes: Bars indicate 95% confidence intervals. We bin the dummies at the end of the effect windows for $t = -6$ and $t = 10$.

$$y_{j,k,t} = \gamma_j + \delta_t + \beta \cdot Treatment_{j,k,t} + \eta' \cdot \mathbf{X}_{j,k,t} + \varepsilon_{j,k,t}$$

	Construction			Non-RE purchases			Employment		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$Treatment$	0.166**	0.111*	0.221***	0.184***	0.145***	0.189***	0.070**	0.035	0.074**
	(0.072)	(0.067)	(0.077)	(0.046)	(0.039)	(0.046)	(0.030)	(0.028)	(0.032)
Estimator	OLS	BJS	BJS	OLS	BJS	BJS	OLS	BJS	BJS
Firm FEs	✓	✓	✓	✓	✓	✓	✓	✓	✓
Financial controls		✓			✓			✓	
Controls × year FEs			✓			✓			✓
N	26,996	24,408	26,985	36,396	32,829	36,383	38,340	34,578	38,326
# Firms	1,416	1,318	1,415	1,499	1,399	1,498	1,508	1,408	1,507
Adj. R^2	0.702	0.723	0.702	0.948	0.957	0.949	0.954	0.964	0.955

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.

- Govt. tried to amplify initial policy via bonuses to upstream, high-tech services firms
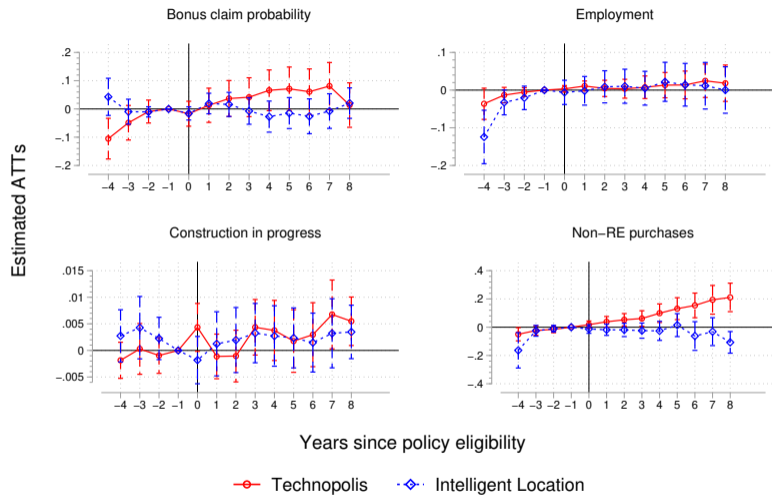
- Consider the multiple treatment regression:

$$y_{j,k,t} = \gamma_j + \delta_t + \beta_1 \cdot Treatment^T_{j,k,t} + \beta_2 \cdot Treatment^{IL}_{j,k,t} + \varepsilon_{j,k,t} \qquad (5)$$

- 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 $Treatment^T_{j,k,t} = 1$

$$y_{j,k,t} = \gamma_j + \delta_t + \sum_{t=1, t \neq t_0}^{T} \beta_{2,t} \cdot Treatment^{IL}_{j,k,t} + F^T_{j,t} + \varepsilon_{j,k,t} \qquad (6)$$

- $F^T_{j,t}$ non-parametric trends w.r.t. first year where firm j obtains Technopolis eligibility

Bonus claim probability · Employment · Construction in progress · Non–RE purchases

Estimated ATTs

Years since policy eligibility

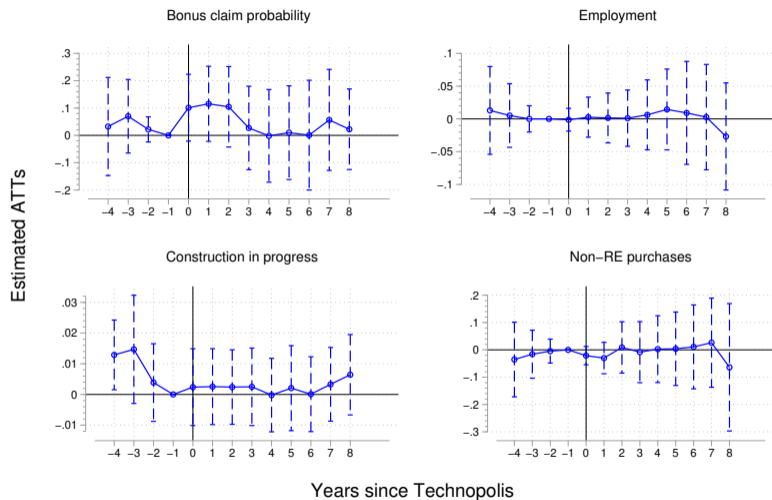—○— Technopolis   ·◇· Intelligent Location

- Controlling for IL policy exposure results in little change in the dynamic effects of Technopolis

- Some evidence of spillover effects on employment

Main deck

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

Estimated ATTs

Bonus claim probability

Employment

Construction in progress

Non–RE purchases

Years since Technopolis

- Suggests poor targeting: high-tech services firms rely more on intangible capital

- Caveat: we lose power by restricting to firm-year obs. with $Treatment^T_{j,k,t} = 1$

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

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

|	Bonus claim		Construction		Non-RE purchases		Employment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Treatment^T$	0.093***	0.087***	0.163**	0.167**	0.172***	0.165***	0.060*	0.062**
	(0.028)	(0.028)	(0.072)	(0.072)	(0.046)	(0.047)	(0.031)	(0.030)
$Treatment^{IL}$	−0.023	−0.018	0.044	0.042	0.143**	0.138**	0.125***	0.119***
	(0.024)	(0.023)	(0.108)	(0.109)	(0.059)	(0.059)	(0.039)	(0.039)
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	0.956

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 × year FEs includes size/age quintiles and Census region of the corporate HQ.

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

$$y_{j,k,t} = \gamma_j + \delta_t + Distance_j \times Post_t + Treated_k \times Post_t \quad (7)$$

$$+ Distance_j \times Treated_k \times Post_t + \eta' \cdot \mathbf{X_{j,k,t}} + \varepsilon_{j,k,t}$$

- 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
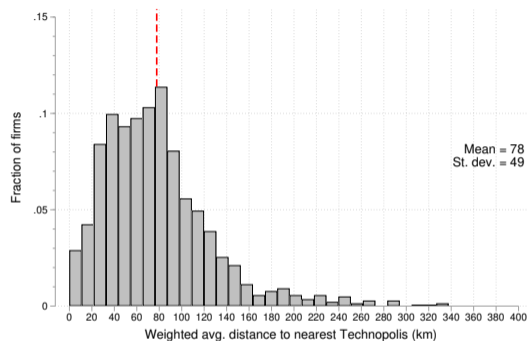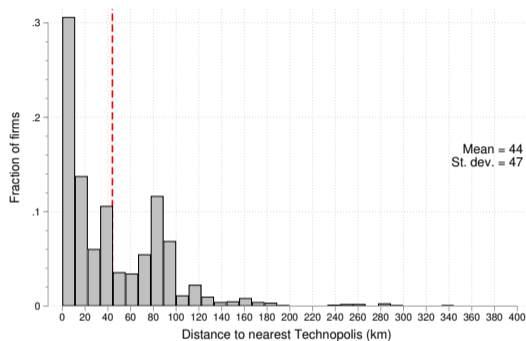
- 43% of firms already operate within a Technopolis border

- 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. Cobb-Douglas capital aggregator for firm j:

$$f(K_j) = \prod_{i=1}^{6} k_i^{\omega_{i,j}} \quad \text{s.t.} \ \sum_{i=1}^{6} \omega_{i,j} = 1, \forall j$$

- **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:

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

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

- User costs depend on depreciation rates δ_i, the discount rate β^R (WACC), PDV of claimed tax breaks $z_{i,t}$ and tax rates τ_t

- Impose Cobb-Douglas production and then solve for the ω_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:

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

- 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 ω_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 τ_t, $z_{i,t}$ based on national + local tax code provisions

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

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 ω_i and set $T_j = 1$ for them to estimate logit:

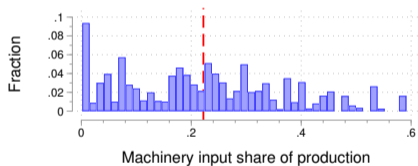$$P\Big(T_j = 1 | X_j\Big) = \frac{\exp\Big(h(X_j)\Big)}{1 + \exp\Big(h(X_j)\Big)}$$

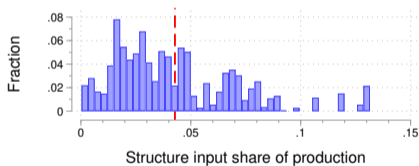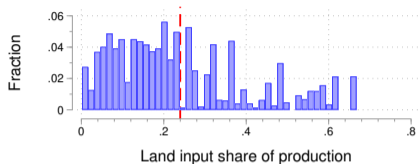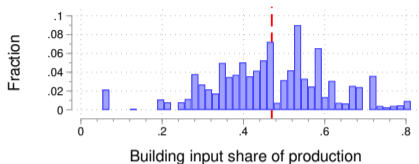- Mfg. firms more likely to have non-missing input shares, but no clear relationship btw size/age and balance sheet completeness

	N	ω_{build}	$\omega_{machine}$	ω_{land}	$\omega_{structure}$	ω_{tools}	$\omega_{vehicle}$
Light manufacturing	237	0.468	0.222	0.243	0.042	0.036	0.037
		(0.131)	(0.153)	(0.163)	(0.027)	(0.035)	(0.031)
Heavy manufacturing	525	0.472	0.240	0.224	0.041	0.038	0.035
		(0.133)	(0.146)	(0.161)	(0.027)	(0.038)	(0.031)
Real estate	30	0.429	0.214	0.286	0.055	0.024	0.036
		(0.173)	(0.183)	(0.193)	(0.035)	(0.026)	(0.032)
Construction	121	0.448	0.224	0.259	0.050	0.022	0.041
		(0.153)	(0.174)	(0.181)	(0.030)	(0.024)	(0.034)
Transportation	88	0.512	0.195	0.210	0.046	0.027	0.049
		(0.160)	(0.160)	(0.160)	(0.031)	(0.024)	(0.035)
Electronics	259	0.467	0.229	0.239	0.033	0.055	0.030
		(0.111)	(0.120)	(0.147)	(0.019)	(0.048)	(0.026)
Non-transportation services	82	0.470	0.196	0.266	0.051	0.024	0.042
		(0.180)	(0.167)	(0.199)	(0.036)	(0.024)	(0.036)
Agriculture	13	0.532	0.177	0.217	0.046	0.029	0.044
		(0.129)	(0.136)	(0.120)	(0.013)	(0.024)	(0.036)
Overall	1,507	0.469	0.222	0.240	0.042	0.036	0.037
		(0.144)	(0.150)	(0.168)	(0.029)	(0.037)	(0.032)

Distribution of physical capital input shares

POOLED OLS RESULTS BY LONG-LIVED ASSET SHARE Main deck
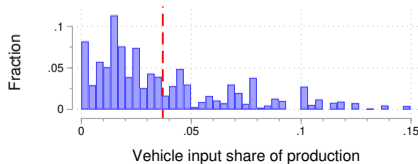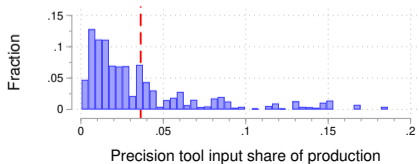
$$y_{j,t} = \gamma_j + \delta_t + \beta_1 \cdot Treatment_{j,t} \times LL-Firm_j + \beta_2 \cdot Treatment_{j,t} \times SL-Firm_j + \eta' \cdot \mathbf{X}_{j,t} + \varepsilon_{j,t}$$

	Bonus claim		Construction		Non-RE purchases		Employment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Treatment \times LL-Firm$	0.096***	0.089***	0.166**	0.170**	0.180***	0.171***	0.077**	0.076**
	(0.029)	(0.028)	(0.074)	(0.074)	(0.048)	(0.049)	(0.031)	(0.031)
$Treatment \times SL-Firm$	−0.011	0.028	0.169	0.160	0.245**	0.265***	−0.037	−0.004
	(0.104)	(0.109)	(0.261)	(0.273)	(0.097)	(0.094)	(0.111)	(0.106)
p-value on difference	0.319	0.586	0.991	0.971	0.542	0.367	0.323	0.465
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.

$$y_{j,c,k,t} = \gamma_j + \delta_t + \beta_1 \cdot Treatment_{j,k,t} + \beta_2 \cdot TreatedCity_{j,c,t} + \eta' \cdot \mathbf{X}_{j,k,t} + \varepsilon_{j,c,k,t} \qquad (8)$$

	Bonus claim		Construction		Non-RE purchases		Employment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Treatment$	0.100***	0.084***	0.139*	0.145*	0.151***	0.136***	0.080**	0.076**
	(0.028)	(0.028)	(0.074)	(0.074)	(0.047)	(0.047)	(0.031)	(0.030)
$TreatedCity$	0.029	−0.004	−0.087	−0.083	−0.105***	−0.129***	0.029	0.014
	(0.016)	(0.017)	(0.065)	(0.068)	(0.033)	(0.036)	(0.021)	(0.022)
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.

- Some evidence of cannibalization on the non-RE CAPX margin (pre-trend)

- Consider augmented regression which captures sectoral exposure to trade flows:

$$y_{j,k,t} = \gamma_j + \delta_t + \beta_1 \cdot Treatment_{j,k,t} + \beta_2 \cdot TradeExposure_{j,k,t} + \varepsilon_{j,k,t} \qquad (9)$$
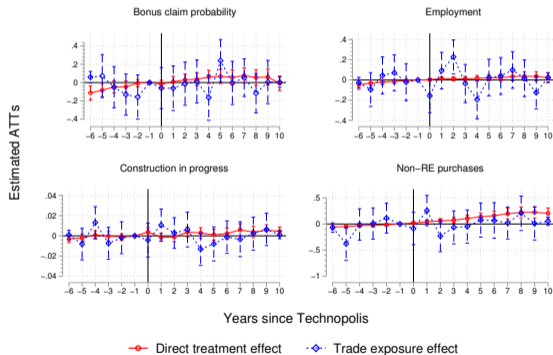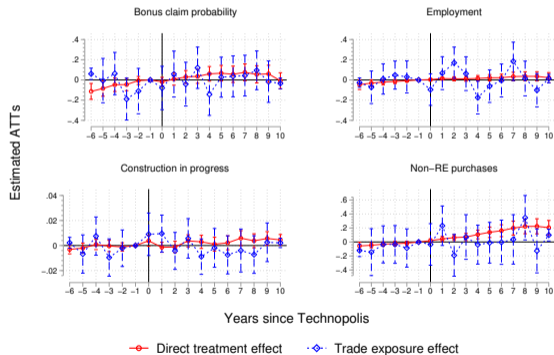
$$TradeExposure_{j,k,t} = \sum_{p \in \mathcal{J}} \omega^j_{p,1980} \cdot TradeExposure^k_{p,t} \quad \text{for } \mathcal{J} = \{j_1, j_2, \ldots, j_n\}$$
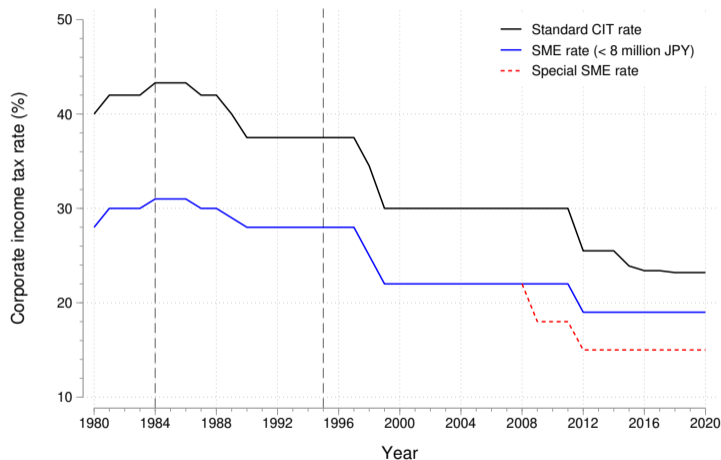
where $\quad \omega^j_{p,1980} = \dfrac{PPE^j_{p,1980}}{\sum_{p \in \mathcal{J}} PPE^j_{p,1980}} \quad$ (each location's <u>net</u> PPE share)

and $\quad TradeExposure^k_{p,t} = \underbrace{\sum_{q \neq p} \dfrac{Imports^k_{p,q}}{TotalImports^k_p} \times Treatment_{q,t}}_{\text{supply}} + \underbrace{\sum_{q \neq p} \dfrac{Exports^k_{p,q}}{TotalExports^k_p} \times Treatment_{q,t}}_{\text{demand}}$

Import exposure (supply)

Export exposure (demand)

- National corporate income tax rates (CIT) are <u>flat</u>

- SME rate applies for firms with annual earnings < 8 million JPY ($\approx$ 80k USD)

- Rates were relatively high during our sample period, and increasing right before spatial bonus policies

- **Qualifying CAPX:** scale down total CAPX by share of eligible investment among manufacturing firms' plants:

$$\frac{\sum_{t=0}^{T} \sum_{i} \Delta PPE_{i,t} \times Treatment_{i,k,t}}{\sum_{t=0}^{T} \sum_{i} \Delta PPE_{i,t}}$$

  - $Treatment_{i,k,t}$: industry eligibility of plant i
  - $\Delta PPE_{i,t}$: YOY change in net book value of <u>non-land</u> physical assets, plus accounting depreciation (i.e. investment in non-land assets)
  - $\implies$ 6.6% eligibility rate, or \$93.65 billion in corporate CAPX

- **Jobs created:** avg. employment during the pre-reform period $\times (1 + \widehat{\beta}^{emp})$

  - $\implies$ between 65,717 [$\widehat{\beta}^{emp} = 5\%$] and 92,004 [$\widehat{\beta}^{emp} = 7\%$] new corporate jobs

1. Feed in <u>observed</u> corporate cash flows

   ▸ Version A (baseline): compare D_t^{total}/I_t of bonus claiming to non-claiming firms

   ▸ Version B: compute $\overline{D_t^{gap}/I_t} - D_{pre}^{gap}/I_{pre}$ accruing only to the eligible firms [1st differences]

   ▸ Version C: $\left(\overline{D_t^{gap}/I_t} - D_{pre}^{gap}/I_{pre}|\ \text{eligible} \right) - \left(\overline{D_t^{gap}/I_t} - D_{pre}^{gap}/I_{pre}|\ \text{ineligible} \right)$ [diff-in-diff]

   ▸ **Version D: residualized diff-in-diff** where feed in $\widehat{\beta}_t$ from regression:

   $$D_{j,k,t}^{gap}/I_{j,k,t} = \gamma_j + \sum_{t=1975}^{1995} \left(\beta_t \cdot Treated_{j,k,t} \times Post_t + \textbf{Controls } \times \delta_t \right) + \varepsilon_{j,k,t}$$

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

	A: Baseline	B: 1st diff in means	C: DD in means	**D: Residualized DD**
$r = 5\%; \quad \widehat{\beta}^{emp} = 5\%$	$55,430 [3.69%]	$52,672 [3.50%]	$37,011 [2.46%]	$26,659 [1.77%]
$r = 7\%; \quad \widehat{\beta}^{emp} = 5\%$	$43,556 [2.90%]	$45,439 [3.02%]	$30,525 [2.03%]	$22,222 [1.48%]
$r = 5\%; \quad \widehat{\beta}^{emp} = 7\%$	$39,135 [3.69%]	$33,931 [3.50%]	$21,584 [2.46%]	$16,781 [1.77%]
$r = 7\%; \quad \widehat{\beta}^{emp} = 7\%$	$30,799 [2.90%]	$32,130 [3.02%]	$18,818 [2.03%]	**$15,714 [1.48%]**

Notes: The table shows cost-per-job estimates (real 2010 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 $\approx$ 2-3% once we take into account capital input shares ω_i

|	Wage bill	Corporate profits	Taxable income
Treatment	0.061**	0.025***	0.124*
	(0.028)	(0.008)	(0.070)
Firm FEs	✓	✓	✓
Controls × year FEs	✓	✓	✓
N	27,567	28,941	27,462
# Firms	1,374	1,406	1,506
Adj. R^2	0.952	0.613	0.585

Notes: The wage bill is the log of the sum of wage and non-wage compensation which includes employer retirement contributions and pensions. Corporate profits is net income before depreciation after taxes, deflated by its firm value at beginning of the panel. Taxable income is the sum total of all gains less allowable losses, left-censored at zero and transformed using the IHS function to accommodate firm-years with no taxable income.

- Tax base **grows** (big CIs) as many firms transition from years of negative taxable income

Actual cash flows
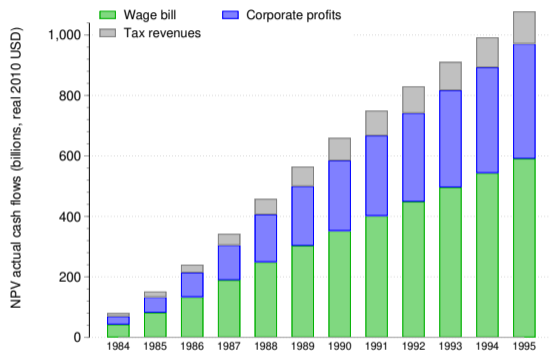
Benefits = actual − counterfactual
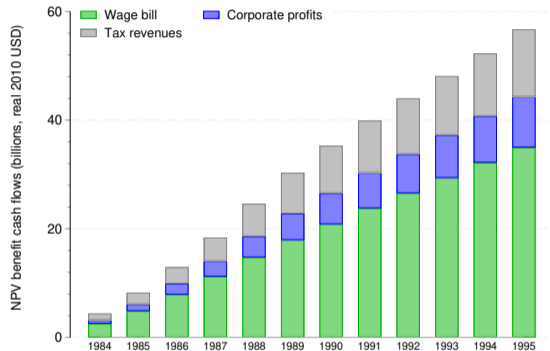
- After-tax corporate profits grow dramatically in early policy years, but only account for ≈ 15% of overall welfare gain