Spillovers Through the Supply Chains: How Large Plant Openings Affect Local Supplier Plants

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Opening of TSMC's Plant in Kumamoto

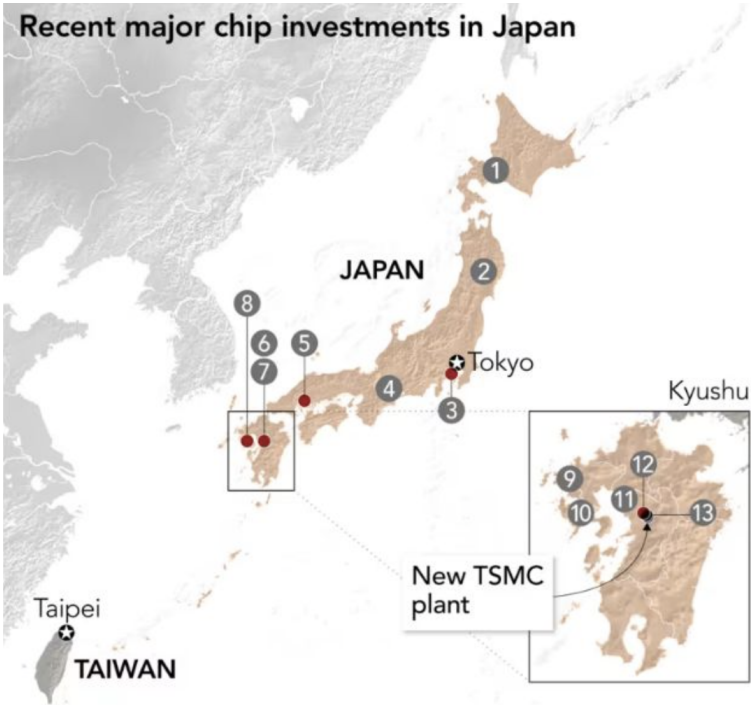
TSMC's first Japan fab on track for mass production by year-end

Taiwan chip giant to start building 2nd Kumamoto plant in early 2025, unit chief says

TSMC opened its first Kumamoto plant back in February. (Photo by Arisa Moriyama)

RYO MUKANO, Nikkei staff writer
December 14, 2024 02:19 JST

Source: The Nikkei Asia. December 14, 2024.



Foreign		Company *(Announced)*	Sector	Investment
Chipmakers	1	Rapidus *(2022)*	Logic	$33 billion*
	6	TSMC *(2021)*	Logic	$20 billion**
	7 8	Sony Group *(2021)*	Sensors	Undisclosed
	2 4	Kioxia†/ Western Digital *(2024)*	Memory	$4.9 billion *(Combined)*
	5	Micron *(2023)*	Memory	$3.7 billion
	3	Samsung *(2023)*	R&D	$280 million

Source: The Nikkei Asia. February 28, 2024.

Relocation of Large Plants

American Factories Are Making Stuff Again as CEOs Take Production Out of China

- The pandemic forced companies to rethink their supply chains
- "This is just economics," says one executive who made the move

Intel's manufacturing facility in Arizona. *Source: Intel Corp.*

Source: The Bloomberg. July 5, 2022.

Trump's Speech in 2019

"We want to build, create, and grow more products in our country using American labor, American goods, and American grit. When we purchase products made in the USA, the profits stay here, the revenue stays here, and the jobs — maybe most importantly of all — they stay right here in the USA."

President Donald J. Trump (July 15, 2019)

Motivation

- How to attract large plants has recently been heavily discussed
  - E.g., TSMC's new plants in Kikuyo-cho, Kumamoto
  - There are also geopolitical reasons behind large plant relocation
- We quantify the spillover effects of the large plant openings
  - The existing literature on the spillover effects has two angles
    1. the geographical proximity
    2. buyer-supplier relationships
  - This paper aims to incorporate both angles to disentangle the effects
    - Winner and loser plants
    - Derive policy implications

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Research Question

- What is the impact of large plant openings on local plants?
  - First-time supplier plants
  - Never-supplier plants
  - Local vs. distant plants

This Paper

1. Identify the large plant openings in Japan from "Survey of Factory Location Trends (METI)"
   - Focus on plant openings with initial investment $\geq$ 5 billion yen
2. Identify plant locations from Census of Manufacture (METI)
   - Local vs. distant plants around the large plants newly opened
3. Merge with the info. of buyer-supplier relationships from TSR data
   - First-time suppliers vs. never-suppliers of large newly opened plants

- Compare these groups of plants to examine the causal effects

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Contribution

- Large Plant Openings
  1. Geographical proximity
     - Greenstone, Hornbeck, and Moretti (2010 JPE)
       → Compare winner vs. loser districts
  2. Supplier relationships
     - Alfaro-Urena, Manelici, and Vasquez (2022 QJE)
     - Amiti, Duprez, Konings, and Van Reenen (2024 JIE)
       → Compare first-time supplier vs. never-supplier firms
  3. **This paper** focuses on large plant openings in Japan and studies the spillover effects among local supplier plants
     → Even inside the "winner" district, there are winner & loser plants
     → The difference comes from supplier relationships

- Supply chains
  - Formation: Adao et al. '20; Alfaro-Ureña et al. '22; Atalay et al. '11; Bernard et al. '18; Bernard et al. '19; Bernard et al. '22; Demir et al. '21; Dhyne et al. '20; Furusawa et al. '19; Gadenne et al. '20; Lim '18; Sugita et al. '21
  - Disruptions: Elliott and Golub '22; Elliott et al. '14; Elliott et al. '22; Grossman et al. '21; Khanna '22; Ksoll et al. '22
  - **This paper:** Firms newly obtain suppliers after opening plants

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Outline

1. Introduction
2. Data
3. Treatment
4. Empirical Strategy
5. Findings
   - Treatment Effects
   - Local Vs. Distant Non-Supplier Plants
6. Additional Findings

Data 1/2

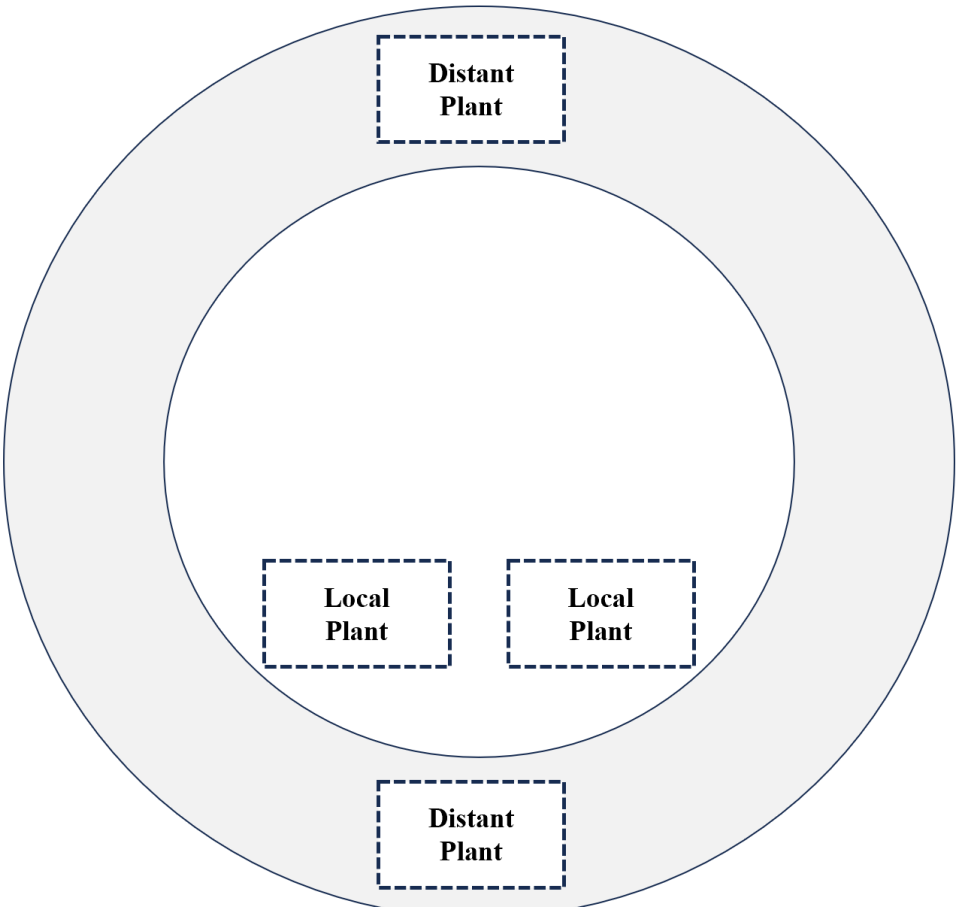
1. Census of Manufacture (METI)
   - Annual survey of manufacturing plants with 4+ employees ($\approx 95\%$ response rate).
   - Key variables: sales, employment, wage bills, and expenditures on intermediate inputs and capital stock.
   - Capital stock is reported only for plants with 30+ workers, so the sample is limited to these when estimating the TFPs.
2. Buyer-Supplier Relationships Data (Tokyo Shoko Research; TSR)
   - Annual records of buyer-supplier relationships.
   - Merge with CoM at the firm-level
   - Identifies plants that become suppliers of large newly opened plants for the "first time".
3. Survey of Factory Location Trends (METI)
   - Target business operators who acquire $\geq 1,000\text{m}^2$ of land annually for new factories/research facilities.
   - Collect the information on firm name, address, investment amount, industry code (70–80% response rate).

Data 2/2

- Sample construction
  - *Large plant openings* are defined as those plants newly opened with initial investment $\geq$ ¥5 billion.
  - Our sample consists of the ***plants surrounding*** them.
    - Exclude the plants that buy inputs from the newly opened plants
    - Exclude the plants which have prior (2007–2009) buyer-supplier relationships with the large newly opened plants
    - $\rightarrow$ Investigate treatment effects (2010–2016)
  - We have about 560, 000 observations in total (80, 000 per year), covering 100,000 unique plants.

- Productivity measures
  - TFPs are estimated by using the following methods: OP (1996), LP (2003), ACF (2015), Wooldridge (2009).
  - Deflators are based on the JIP Database. Winsorize at 0.5% tails.
  - Labor productivity $\equiv$ value added / number of employees.

Setting



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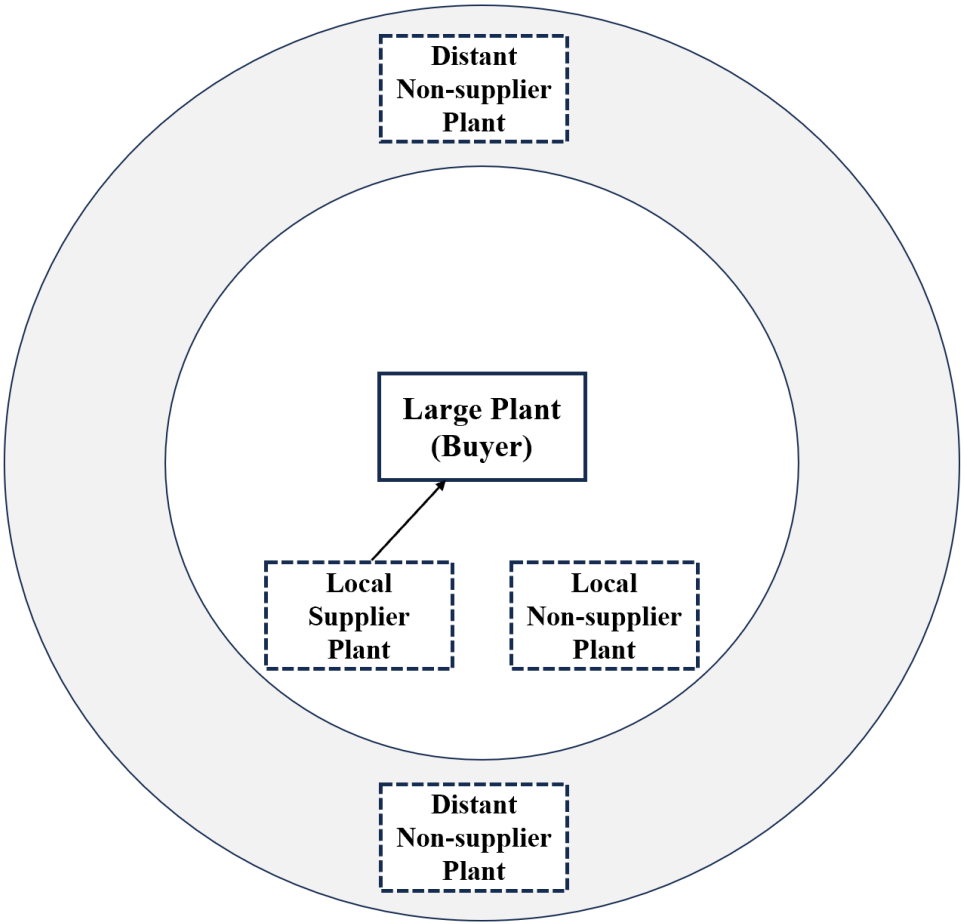
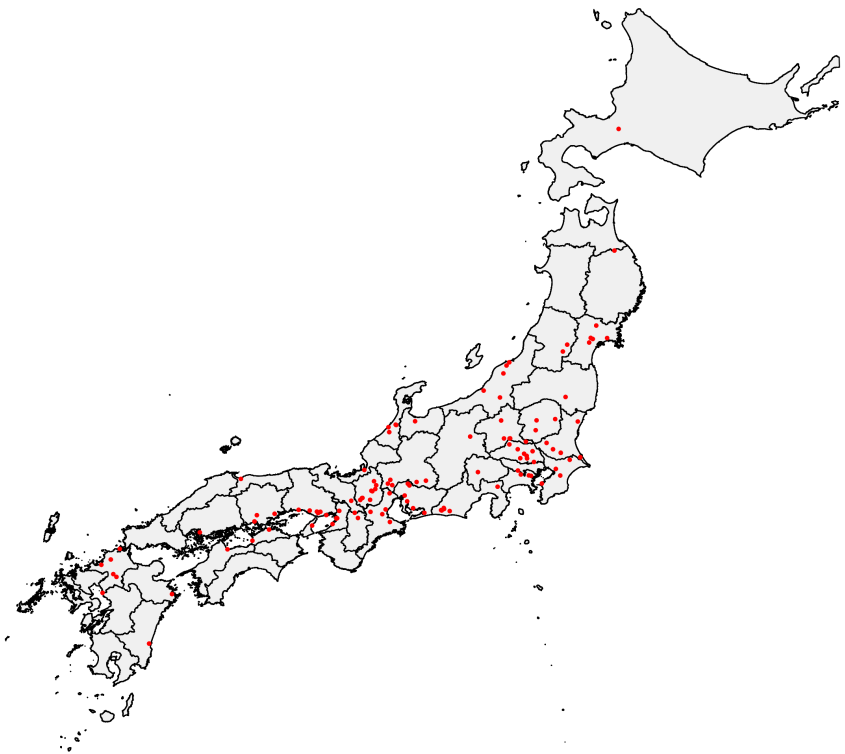

Distant
Non-supplier
Plant
Large Plant
(Buyer)
Local
Supplier
Plant
Local
Non-supplier
Plant
Distant
Non-supplier
Plant

Spatial Distribution of Large Plant Openings

- The figure only shows the cases with capital investment $\geq$ ¥5 billion.
- There were 116 large plant openings during 2010–2016, mostly in the suburbs of major cities such as Tokyo, Osaka, and Nagoya.



Definition of Treatment and Control Groups

- Treatment Group
  - We focus on the plants located within a specified range (10–50 km) of large newly opened plants.
  - Also, they are the ones that newly become a supplier to the factory owner *after* the large plant opening, i.e., **first-time supplier plants**.
  - Small or medium-sized enterprises (SMEs) with registered capital $\leq$ 100 million yen.
  - Excludes plants that have prior relationships with the large newly opened plants (2007–2009).

- Control Group
  - Located within the same distance range as the Treatment Group.
  - Never do business with the large newly opened plants (2007–2016), i.e., **never-supplier plants**.
  - Firms of similar size and industry are chosen to control for external factors.

Distribution of Treatment

Year	Frequency	Percent (%)
2010	1,254	12.48
2011	1,093	10.88
2012	1,593	15.82
2013	1,306	13.00
2014	1,464	14.56
2015	1,445	14.38
2016	1,894	18.83

Notes: This table shows the distribution of years in which the treatment group received the treatment, specifically for samples located within a 30km radius.

	Treatment		Control	
Variables	Mean	Obs	Mean	Obs
Sales	64042.811	10049	35006.911	475109
Cost	35064.512	10045	19253.061	474864
Regular Employment	32.415	10049	20.636	475109
Total Wage	12586.856	10049	6963.859	475105
Labor Productivity	849.518	10041	697.950	474593
TFP (OP)	-0.877	2155	-0.469	49057
TFP (LP)	2.470	2155	2.394	49057
TFP (ACF)	-2.261	2155	-2.009	49057
TFP (Wooldridge)	2.296	2155	2.253	49057
Distance to Large Plant	18.811	10049	18.935	475109
Capital	2458.893	10049	1594.413	475109

Notes: The natural logarithm has been taken for TFPs. "Distance to Large Plant" denotes the distance in kilometers to the nearest large plant. Capital indicates the scale of a firm's registered capital. Sales, Cost, Total Wage, Labor Productivity, and TFPs are winsorized at the top and bottom 0.5%.

Empirical Strategy

- Firm's location choice is normally endogenous
  - When a firm newly opens a large plant, it decides where to open it depending on many factors such as the infrastructure, the environment, the existence of suppliers, the access to the market, etc.

- However, it would be quasi-random for local small plants in the area
  - We exclude those firms with prior transaction relationships
  - The firms in our sample did not have any prior transaction relationship with a firm that opened a large plant

- Rather, some firms newly obtained transaction relationships with the large plant while the others did not
  - We apply a difference-in-differences estimation strategy
    - Callaway and Sant'Anna (2021)
    - Compare first-time supplier vs. never supplier plants

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Difference-In-Differences

- **Approach:** Callaway and Sant'Anna (2021)'s DID
  - Multiple time periods & Staggered treatment timing
- **Setup:**
  - G_i: the year in which plant i newly becomes a supplier (∞ if never).
  - **Group-time ATT**: $\tau_{g,t} = \mathbb{E}\left[Y_{i,t}(1) - Y_{i,t}(0) \,\middle|\, G_i = g, X_i \right]$
    - X_i: distance, 2-digit industry, capital size, and multi-plant dummy.
- **Aggregated Group-time ATT:**

$$\hat{\tau}_{ATT} = \sum_g \omega_g \left[\sum_{t \geq g} \hat{\tau}_{g,t} / T_g \right].$$

(T_g: # of post-treatment periods for cohort g; ω_g: its share.)

- **Key Identification Assumption:**
  - Parallel Trends: For each cohort g, pre-treatment outcomes would have evolved similarly to never-treated establishments.
  - No Anticipation: Establishments do not change behavior prior to the actual treatment year.

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Findings

1. We compare local **first-time supplier** vs. **never-supplier** plants
   - This strategy follows Alfaro-Urena et al. (2022) & Amiti et al. (2024)

2. Then, we compare the **local** vs. **distant** never-supplier plants
   - Do local never-supplier plants also enjoy spillover effects?
   - Or, do they actually lose in the competition?
   - Extending Greenstone et al. (2010)

(1) Plant Activities

	Distance to Large Plant				
Outcomes	(1) 10km	(2) 20km	(3) 30km	(4) 40km	(5) 50km
Sales	0.0816***	0.0597***	0.0608***	0.0609***	0.0611***
	(0.0251)	(0.0155)	(0.0141)	(0.0136)	(0.0150)
Cost	0.0630*	0.0422*	0.0560***	0.0560***	0.0563***
	(0.0344)	(0.0223)	(0.0216)	(0.0208)	(0.0168)
Total Wage	0.0312*	0.0404***	0.0377***	0.0378***	0.0381***
	(0.0174)	(0.0113)	(0.00959)	(0.0113)	(0.0120)
Regular Employment	0.0359***	0.0372***	0.0412***	0.0412***	0.0414***
	(0.0132)	(0.00828)	(0.00941)	(0.00933)	(0.0106)

Notes: The sample used for the estimation is selected based on the distance to the large plant. This table reports the estimation results for each case where the distance is restricted to (1) within 10 km, (2) within 20 km, (3) within 30 km, (4) within 40 km, or (5) within 50 km. The natural logarithm is taken for Sales, Cost, Total Wage, and Regular Employment. Standard errors are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

(2) Productivity Measures

	Distance to Large Plant				
Outcomes	(1) 10km	(2) 20km	(3) 30km	(4) 40km	(5) 50km
Labor Productivity	0.00365	0.0112	0.00432	0.00424	0.00433
	(0.0327)	(0.0210)	(0.0175)	(0.0174)	(0.0187)
TFP (OP)	0.187**	0.0963**	0.0693**	0.0693*	0.0708*
	(0.0921)	(0.0414)	(0.0317)	(0.0354)	(0.0395)
TFP (LP)	0.187*	0.104**	0.0760**	0.0759*	0.0773*
	(0.0966)	(0.0431)	(0.0350)	(0.0394)	(0.0427)
TFP (ACF)	0.186**	0.0902**	0.0650**	0.0650*	0.0665*
	(0.0909)	(0.0407)	(0.0327)	(0.0361)	(0.0392)
TFP (Wooldridge)	0.185*	0.104**	0.0766**	0.0765**	0.0780*
	(0.0968)	(0.0430)	(0.0332)	(0.0378)	(0.0419)

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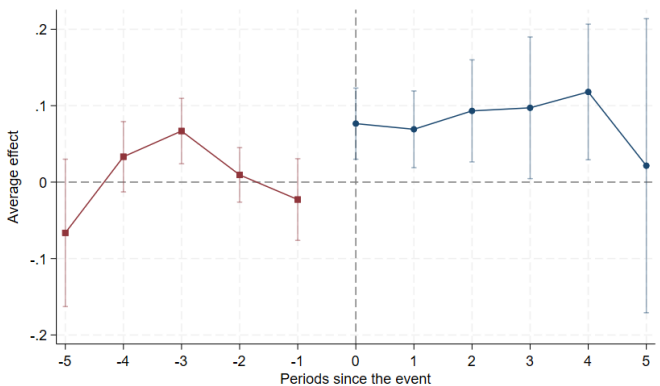
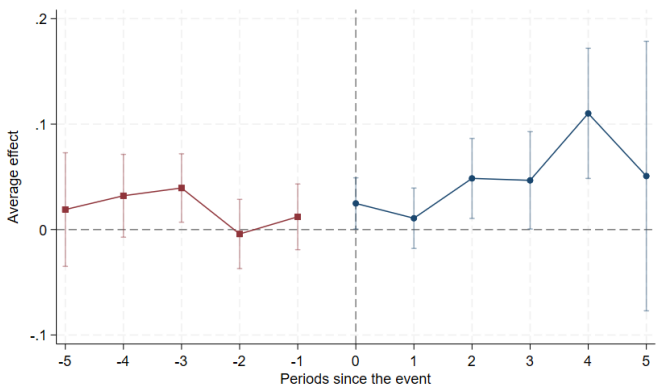
Event Study Figures

Focus on the 10km range from the large plants.



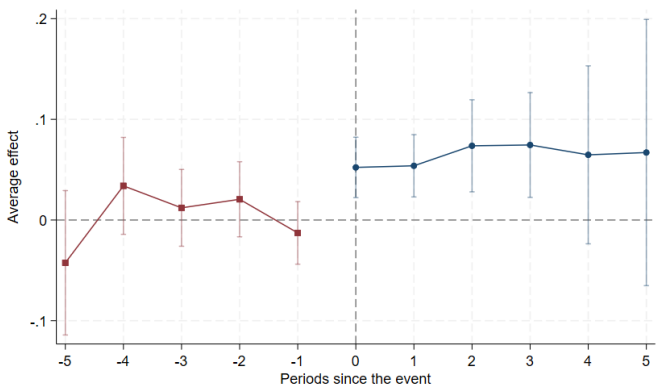
Sales



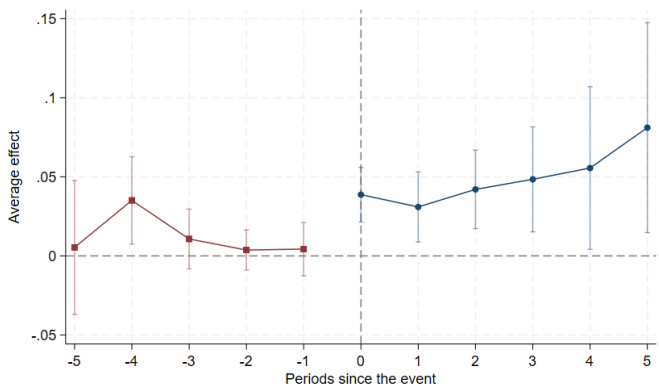
Employment

Event Study Figures

Focus on the 30km range from the large plants.



Sales



Employment

1. Treatment Effect on Local Supplier Plants

- There are sizable impacts on local first-time supplier plants compared to local never-supplier plants
  - Plant sales rises by about 8.2%
  - TFP measures rise by about 19%
  - The impacts are almost monotonically decreasing over space
- We confirm our baseline findings by robustness checks

Robustness Checks

1. Single plants
   - Firms can form buyer-supplier relationships in different places
   - This does not become a concern if we restrict our focus to single-plant firms

2. Continuing plants
   - There are firm entry and exit during the sample period, which could result in survival bias
   - We conduct a similar analysis by restricting the sample to those plants that existed through the entire sample period

3. Plants with the information for TFP estimation
   - We conduct a similar analysis by restricting the sample to those plants with the information for TFP estimation

4. Factories
   - We conduct a similar analysis only with large factory openings

(1) Single Plants

	Distance to Large Plant			
Outcomes	(1) 10km	(2) 20km	(3) 30km	(4) 40km
Sales	0.082***	0.067***	0.072***	0.066***
	(0.024)	(0.018)	(0.015)	(0.015)
Cost	0.062*	0.049*	0.067***	0.061**
	(0.035)	(0.028)	(0.024)	(0.026)
Total Wage	0.035**	0.050***	0.046***	0.043***
	(0.017)	(0.016)	(0.012)	(0.013)
Regular Employment	0.044***	0.040***	0.043***	0.040***
	(0.013)	(0.009)	(0.009)	(0.008)
Wage	-0.005	0.012	0.006	0.006
	(0.016)	(0.011)	(0.011)	(0.011)

Notes: The sample used for the estimation is selected based on the distance to the large plant. This table reports the estimation results for each case where the distance is restricted to (1) within 10 km, (2) within 20 km, (3) within 30 km, or (4) within 40 km. The natural logarithm is taken for Sales, Cost, Total Wage, Regular Employment, and Wage. Standard errors are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

(2) Continuing Plants

	Distance to Large Plant			
Outcomes	(1) 10km	(2) 20km	(3) 30km	(4) 40km
Sales	0.075***	0.055***	0.057***	0.052***
	(0.024)	(0.016)	(0.017)	(0.016)
Cost	0.030	0.019	0.031	0.026
	(0.037)	(0.028)	(0.023)	(0.023)
Total Wage	0.032*	0.035**	0.028**	0.027*
	(0.019)	(0.015)	(0.012)	(0.014)
Regular Employment	0.032**	0.029***	0.030***	0.029***
	(0.016)	(0.010)	(0.009)	(0.009)
Wage	0.004	0.008	0.001	0.001
	(0.017)	(0.011)	(0.012)	(0.011)

Notes: The sample used for the estimation is selected based on the distance to the large plant. This table reports the estimation results for each case where the distance is restricted to (1) within 10 km, (2) within 20 km, (3) within 30 km, or (4) within 40 km. The natural logarithm is taken for Sales, Cost, Total Wage, Regular Employment, and Wage. Standard errors are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

(3) Plants With TFP Measures

	Distance to Large Plant			
Outcomes	(1) 10km	(2) 20km	(3) 30km	(4) 40km
Sales	0.166**	0.068**	0.059*	0.054*
	(0.071)	(0.034)	(0.034)	(0.031)
Cost	0.120	0.037	0.029	0.034
	(0.087)	(0.048)	(0.047)	(0.046)
Total Wage	0.110**	0.058*	0.057**	0.052**
	(0.046)	(0.030)	(0.026)	(0.021)
Regular Employment	0.018	0.020	0.020	0.017
	(0.037)	(0.022)	(0.021)	(0.017)
Wage	0.094**	0.040*	0.039**	0.036**
	(0.038)	(0.022)	(0.019)	(0.015)

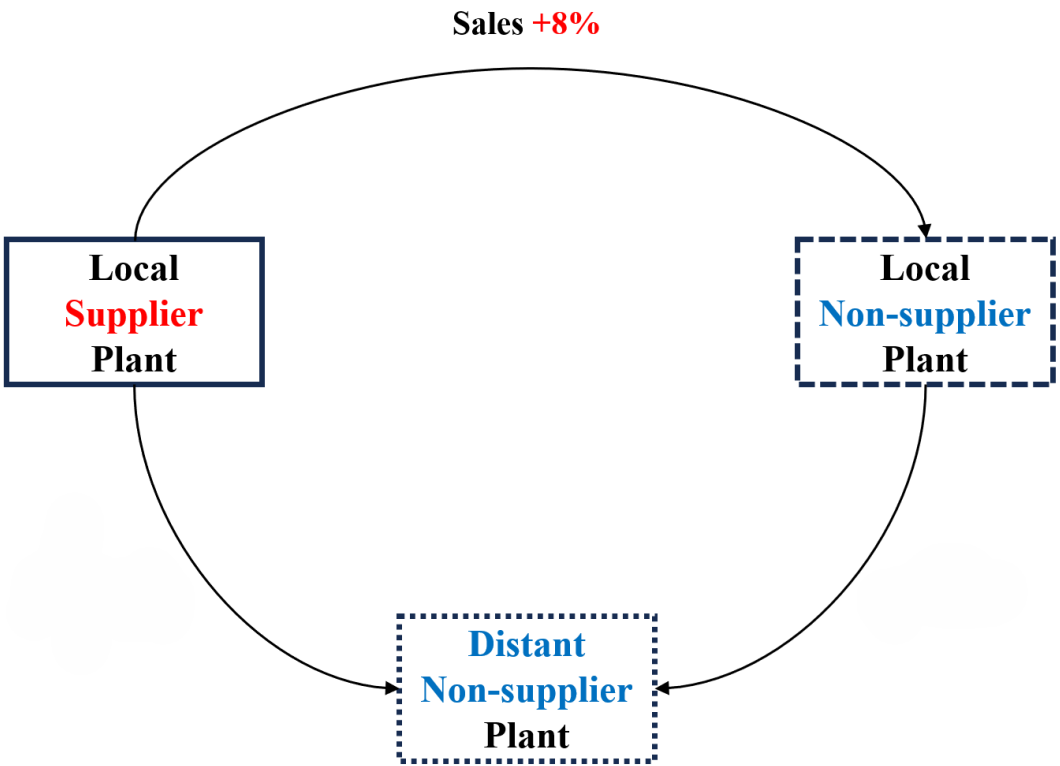
Notes: The sample used for the estimation is selected based on the distance to the large plant. This table reports the estimation results for each case where the distance is restricted to (1) within 10 km, (2) within 20 km, (3) within 30 km, or (4) within 40 km. The natural logarithm is taken for Sales, Cost, Total Wage, Regular Employment, and Wage. Standard errors are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

(4) Factories

	Distance to Large Plant			
Outcomes	(1) 10km	(2) 20km	(3) 30km	(4) 40km
Sales	0.084***	0.056***	0.061***	0.057***
	(0.030)	(0.019)	(0.015)	(0.014)
Cost	0.108***	0.034	0.061***	0.055**
	(0.041)	(0.027)	(0.021)	(0.024)
Total Wage	0.025	0.039***	0.029**	0.027**
	(0.021)	(0.015)	(0.012)	(0.012)
Regular Employment	0.046***	0.039***	0.036***	0.032***
	(0.017)	(0.011)	(0.010)	(0.008)
Wage	-0.018	0.002	-0.006	-0.003
	(0.019)	(0.011)	(0.011)	(0.010)

Notes: The sample used for the estimation is selected based on the distance to the large plant. This table reports the estimation results for each case where the distance is restricted to (1) within 10 km, (2) within 20 km, (3) within 30 km, or (4) within 40 km. The natural logarithm is taken for Sales, Cost, Total Wage, Regular Employment, and Wage. Standard errors are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Effects


Sales +8%
Local Supplier Plant
Local Non-supplier Plant
Distant Non-supplier Plant

2. Local Vs. Distant Non-Supplier Plants

- So far, we compare local first-time supplier vs. never-supplier plants, which ignores the possibility of having both winner and loser plants inside the geographical unit
  - Possibility: Winner plant $\uparrow$ but loser plants $\downarrow$
  - This is because they compete inside a narrow geographical unit
  - This issue exists in Alfaro-Urena et al. (2022) and Amiti et al. (2024)

- Next, we investigate the impact on local never-supplier plants compared to distant never-supplier plants
  - Did they actually lose after large plant openings?
  - This is an empirical question and important for policy perspectives

(1) Plant Activities

	Distance to Large Plant			
Outcomes	(1) 10km	(2) 20km	(3) 30km	(4) 40km
Sales	-0.0192**	-0.0108	-0.00691	-0.00806
	(0.00825)	(0.00666)	(0.00648)	(0.00594)
Cost	-0.0175**	-0.00945	-0.00693	-0.00766
	(0.00735)	(0.00582)	(0.00525)	(0.00469)
Regular Employment	-0.00140	0.000213	0.00114	0.000628
	(0.00495)	(0.00346)	(0.00318)	(0.00283)
Total Wage	-0.00148	-0.00475	-0.000578	-0.00396
	(0.0101)	(0.00814)	(0.00812)	(0.00797)

Notes: The sample used for the estimation is selected based on the distance to the large plant. This table reports the estimation results for each case where the distance is restricted to (1) within 10 km, (2) within 20 km, (3) within 30 km, or (4) within 40 km. The natural logarithm is taken for Sales, Cost, Total Wage, and Regular Employment. Standard errors are shown in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

(2) Productivity Measures

	Distance to Large Plant			
Outcomes	(1) 10km	(2) 20km	(3) 30km	(4) 40km
Labor Productivity	-0.0274***	-0.0173**	-0.0145*	-0.0140*
	(0.00912)	(0.00825)	(0.00844)	(0.00826)
TFP (OP)	-0.0287	-0.0286**	-0.0240*	-0.0204
	(0.0177)	(0.0145)	(0.0137)	(0.0136)
TFP (LP)	-0.0303**	-0.0303**	-0.0261**	-0.0214*
	(0.0152)	(0.0134)	(0.0127)	(0.0127)
TFP (ACF)	-0.0321*	-0.0326**	-0.0279**	-0.0233*
	(0.0180)	(0.0148)	(0.0141)	(0.0136)
TFP (Wooldridge)	-0.0311**	-0.0313**	-0.0271**	-0.0225*
	(0.0157)	(0.0135)	(0.0129)	(0.0128)

Notes: The sample used for the estimation is selected based on the distance to the large plant. This table reports the estimation results for each case where the distance is restricted to (1) within 10 km, (2) within 20 km, (3) within 30 km, or (4) within 40 km. The natural logarithm is taken for Labor Productivity and TFPs. Standard errors are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

2. Effects on Local Non-Supplier Plants

- There are negative impacts on local never-supplier plants compared to distant never-supplier plants
  - Plant sales declines by about 2%
  - TFP measures decline by about 3%
  - These negative impacts are confirmed by robustness checks

- So, actually local non-supplier plants become losers after large plant opening
  - Large plant openings benefit local supplier plants but damage the other local non-supplier plants
  - This would be because they compete with local supplier plants that grow after the large plant openings

- We also confirm that there exist sizable gains when we compare local supplier plants vs. distant non-supplier plants

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- We also confirm that there exist sizable gains when we compare local supplier plants vs. distant non-supplier plants

Excluding Local Tier 2 Suppliers

- Local Tier 2 supplier plants are included in the group of local non-supplier plants
- However, they might be positively affected through the supply chains
- Thus, we exclude local Tier 2 suppliers from the sample

(1) Plant Activities

Outcomes	Distance to Large Plant			
	10km (1) Excluding Tier 2	20km (2) Excluding Tier 2	30km (3) Excluding Tier 2	40km (4) Excluding Tier 2
Sales	-0.021***	-0.009	-0.006	-0.007
	(0.008)	(0.007)	(0.007)	(0.006)
Cost	-0.005	-0.003	0.000	-0.004
	(0.010)	(0.008)	(0.009)	(0.008)
Total Wage	-0.018**	-0.010	-0.007	-0.008
	(0.007)	(0.006)	(0.006)	(0.005)
Regular Employment	-0.001	-0.000	0.000	0.000
	(0.006)	(0.004)	(0.004)	(0.004)

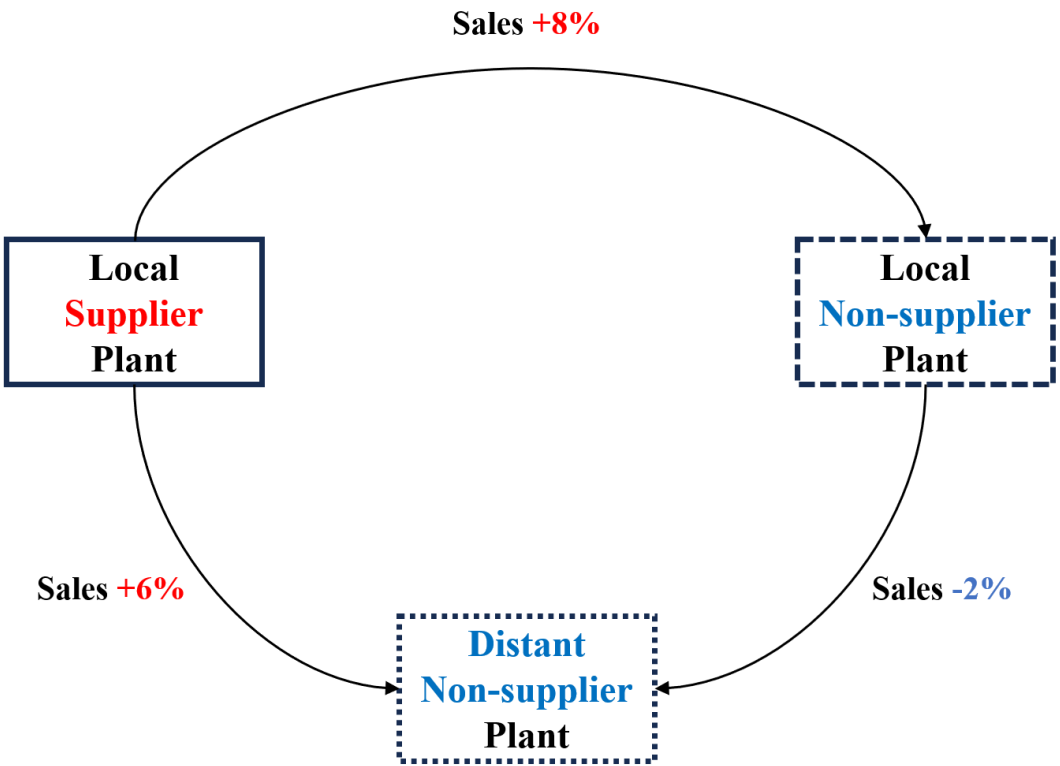
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

(2) Productivity Measures

Outcomes	Distance to Large Plant			
	10km (1) Excluding Tier 2	20km (2) Excluding Tier 2	30km (3) Excluding Tier 2	40km (4) Excluding Tier 2
Labor Productivity	-0.026***	-0.015*	-0.011	-0.012
	(0.010)	(0.008)	(0.008)	(0.008)
TFP (OP)	-0.035*	-0.050***	-0.041***	-0.040***
	(0.019)	(0.017)	(0.014)	(0.015)
TFP (LP)	-0.039**	-0.053***	-0.045***	-0.043***
	(0.016)	(0.017)	(0.014)	(0.014)
TFP (ACF)	-0.041**	-0.055***	-0.046***	-0.044***
	(0.019)	(0.018)	(0.015)	(0.016)
TFP (Wooldridge)	-0.040**	-0.054***	-0.045***	-0.044***
	(0.017)	(0.018)	(0.014)	(0.015)

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Decomposition of Effects



3. Additional Findings

- Supply chain expansion
  - # of buyers & # of suppliers
- Composition of suppliers/buyers
  - Upgrading - signaling effect
- Propagation effects
  - Tier 2 & 3 supplier plants
- Policy
  - Government and municipal support

3-1. Supply Chain Expansion

	Distance to Large Plant			
Outcomes	10km	20km	30km	40km
Panel A: Local Supplier vs. Local Non-supplier plants				
# of Buyers	0.394***	0.332***	0.328***	0.320***
	(0.040)	(0.031)	(0.027)	(0.028)
# of Suppliers	0.130***	0.107***	0.108***	0.106***
	(0.043)	(0.023)	(0.023)	(0.022)
Panel B: Local Non-supplier vs. Distant Non-supplier plants				
# of Buyers	0.013	0.016*	0.014	0.010
	(0.010)	(0.009)	(0.009)	(0.010)
# of Suppliers	0.003	0.009	0.012	0.010
	(0.009)	(0.007)	(0.007)	(0.007)

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

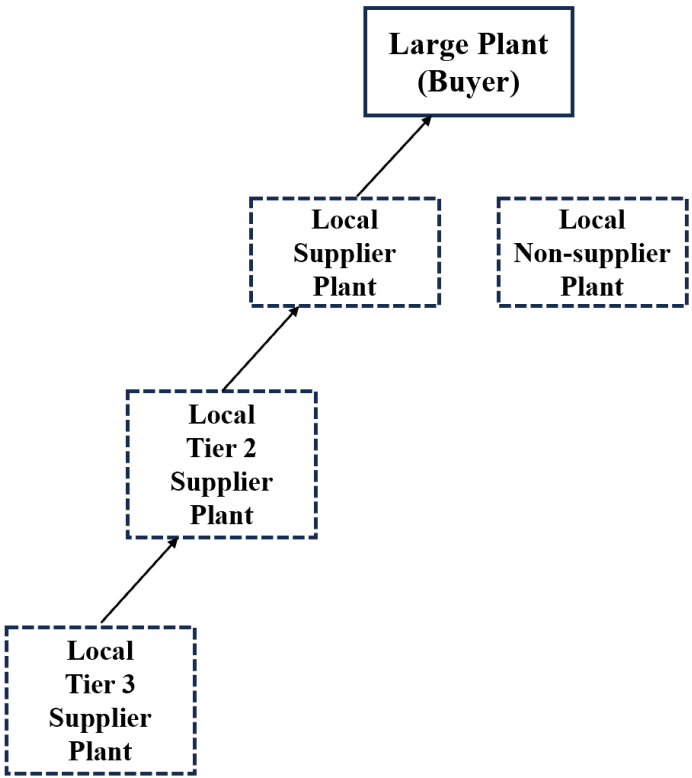
3-1. Supply Chain Expansion

- Local supplier plants expanded their supply chains, whereas local non-supplier plants did not
- Amiti et al. (2024) only look at the effects on the # of buyers and refer to this as "dating agency effect"
- Our findings suggest that local supplier plants consequentially increase the # of suppliers

The Change in Composition

- Local supplier plants acquired better buyers in terms of
  - buyers with higher credit score
  - more established buyers
  - larger buyers

3-2. Tier 2 & 3 Suppliers



3-2. Propagation Effects (1) Plant Activities

- Compare local Tier 2/3 supplier vs. local non-supplier plants

	Distance to Large Plant					
	20km		30km		40km	
Outcomes	(1) Tier 2	(2) Tier 3	(3) Tier 2	(4) Tier 3	(5) Tier 2	(6) Tier 3
Sales	0.006	-0.005	0.005	-0.003	0.005	-0.003
	(0.006)	(0.004)	(0.006)	(0.004)	(0.006)	(0.004)
Cost	0.018**	-0.006	0.013*	-0.007	0.013	-0.003
	(0.008)	(0.007)	(0.008)	(0.006)	(0.009)	(0.005)
Total Wage	0.010**	0.001	0.012***	0.004	0.011**	0.003
	(0.005)	(0.003)	(0.004)	(0.003)	(0.005)	(0.003)
Regular Employment	0.007**	0.001	0.007*	0.002	0.006	0.002
	(0.003)	(0.002)	(0.003)	(0.002)	(0.004)	(0.002)

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

3-2. Propagation Effects (2) Productivity Measures

- Compare local Tier 2/3 supplier vs. local non-supplier plants

	Distance to Large Plant					
	20km		30km		40km	
Outcomes	(1) Tier 2	(2) Tier 3	(3) Tier 2	(4) Tier 3	(5) Tier 2	(6) Tier 3
Labor Productivity	-0.007	-0.005	-0.007	-0.002	-0.007	-0.004
	(0.009)	(0.005)	(0.007)	(0.004)	(0.007)	(0.004)
TFP (OP)	0.050**	-0.001	0.051***	-0.000	0.051***	0.001
	(0.020)	(0.014)	(0.014)	(0.013)	(0.013)	(0.012)
TFP (LP)	0.043**	-0.002	0.047***	-0.004	0.050***	-0.003
	(0.019)	(0.013)	(0.014)	(0.012)	(0.014)	(0.011)
TFP (ACF)	0.051***	-0.002	0.052***	-0.003	0.054***	-0.002
	(0.019)	(0.014)	(0.014)	(0.012)	(0.014)	(0.012)
TFP (Wooldridge)	0.043**	-0.003	0.047***	-0.004	0.050***	-0.003
	(0.020)	(0.013)	(0.014)	(0.012)	(0.013)	(0.011)

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

3-2.3-3. Propagation Effects

- There exist positive propagation effects for local Tier 2 suppliers (but not for local Tier 3 suppliers)
- Intuitively, these effects are much smaller compared to the effects for local direct suppliers

3-3. Government Support

	Distance to Large Plant					
	20km		30km		40km	
	(1)	(2)	(3)	(4)	(5)	(6)
Outcomes	Supported	Not supported	Supported	Not supported	Supported	Not supported
Panel A: Local supplier plant vs local non-supplier plant						
Sales	0.087***	0.045**	0.071***	0.053***	0.071***	0.047***
	(0.033)	(0.017)	(0.027)	(0.017)	(0.017)	(0.017)
Regular Employment	0.046***	0.030***	0.060***	0.029**	0.055***	0.032***
	(0.013)	(0.011)	(0.012)	(0.012)	(0.013)	(0.012)
Panel B: Local non-supplier plant vs distant non-supplier plant						
Sales	-0.011	-0.011	-0.011	-0.005	-0.012	-0.007
	(0.015)	(0.008)	(0.015)	(0.008)	(0.014)	(0.007)
Regular Employment	-0.004	0.002	-0.003	0.002	-0.003	0.002
	(0.012)	(0.004)	(0.011)	(0.003)	(0.010)	(0.003)

Notes: "Supported" corresponds to large plant openings with government or municipal subsidies.[1]
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

[1] About 30% of LPO responded that they considered the government or municipal subsidies as a main reason behind their openings.

3-3. Effect of Government Support

- We find larger impacts on local supplier plants when there is government support behind large plant openings
  - On the other hand, there is no significant loss for local non-supplier plants

- Implication
  - Government support appears to have positive impacts on the performance of local plants through buyer-supplier linkages
  - It is important for policy makers to further accelerate the positive spillover effects on the local economy
  - Future research: how to also improve local non-supplier plants

Conclusion

- We manage to identify the large plant openings in Japan
  - This can be extended further to include TSMC plant openings, etc.
- We causally identify the spillover effects of the large plant openings
  - Sizable, positive and significant impacts on local supplier plants
  - However, negative impacts on local non-supplier plants
- These results extend the existing literature
  - Large plant openings not just create winner vs. loser districts but also create winner and loser plants even inside the winner district
  - It requires caution when discussing the impact
  - Policy makers would need to think about how to better match new large buyer plants and local supplier plants

Thank You!

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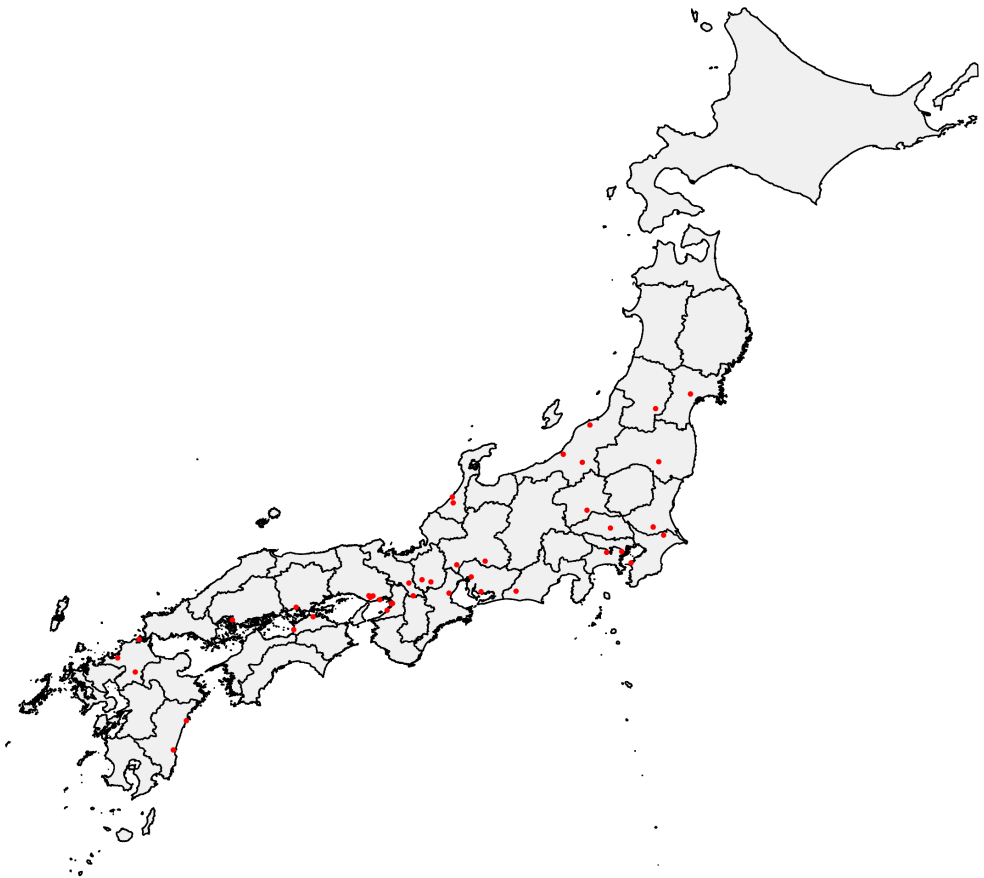
Appendix - Large Plant Openings

Spatial Distribution of Large Plant Openings

- The figure shows the cases with capital investment $\geq$ ¥10 billion.



Appendix - Additional Findings

Additional Findings

- Heterogeneity
  - Product differentiation
  - Technological proximity between plants
- Local concentration
  - HHI

Heterogeneity Effects on Local Suppliers

	Distance to Large Plant					
	20km		30km		40km	
Panel A: Product Diff.	(1) Diff.	(2) Not Diff.	(3) Diff.	(4) Not Diff.	(5) Diff.	(6) Not Diff.
Sales	0.075***	0.053***	0.073***	0.057***	0.069***	0.057***
	(0.024)	(0.016)	(0.022)	(0.015)	(0.020)	(0.013)
Regular Employment	0.036***	0.038***	0.032**	0.049***	0.034***	0.047***
	(0.014)	(0.012)	(0.013)	(0.013)	(0.011)	(0.013)

	20km		30km		40km	
Panel B: Tech. Proximity	(1) Tech. distant	(2) Tech. close	(3) Tech. distant	(4) Tech. close	(5) Tech. distant	(6) Tech. close
Sales	0.068**	0.051***	0.065**	0.053***	0.100***	0.026
	(0.032)	(0.019)	(0.030)	(0.014)	(0.020)	(0.017)
Regular Employment	0.038**	0.037***	0.026**	0.049***	0.043***	0.040***
	(0.016)	(0.013)	(0.013)	(0.013)	(0.015)	(0.012)

Notes: Product differentiation is categorized based on Rauch (1999). Technological proximity is calculated at the industry level based on Belderbos et al. (2014). We divide the sample by those with technological proximity above and below median. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Heterogeneity Effects on Local Suppliers

- We find larger impacts on local supplier plants compared to local non-supplier plants:
  - when they sell differenciated products
    and
  - when the technological distance between large buyer plants and local supplier plants is large

- Implication
  - Positive spillover effects are larger when buyer and supplier plants have different positions in product/technology space
  - It could be due to generic technological spillover (e.g., management practices) rather than specific technological spillover (e.g., niche technology)

Local Concentration: HHI

- Compare local supplier vs. local non-supplier plants

	Distance to Large Plant							
	10km		20km		30km		40km	
Outcomes	(1) More Concentrated	(2) Less Concentrated	(3) More Concentrated	(4) Less Concentrated	(5) More Concentrated	(6) Less Concentrated	(7) More Concentrated	(8) Less Concentrated
Sales	0.083***	0.060	0.059***	0.065***	0.072***	0.042**	0.070***	0.047***
	(0.030)	(0.037)	(0.021)	(0.023)	(0.022)	(0.019)	(0.020)	(0.018)
Cost	0.104***	-0.018	0.079***	0.016	0.080***	0.026	0.100***	0.010
	(0.039)	(0.028)	(0.027)	(0.026)	(0.029)	(0.027)	(0.029)	(0.019)
Total Wage	0.038*	0.012	0.065***	0.024*	0.044***	0.031**	0.044***	0.039**
	(0.022)	(0.022)	(0.018)	(0.013)	(0.017)	(0.014)	(0.015)	(0.017)
Regular Employment	0.034**	0.009	0.038***	0.029***	0.051***	0.028**	0.047***	0.034***
	(0.014)	(0.020)	(0.011)	(0.011)	(0.013)	(0.012)	(0.011)	(0.012)

Notes: "More Concentrated" corresponds to the area with HHI in pre-opening period (2007–2009) being above median within each 4-digit industry. "Less Concentrated" corresponds to the rest of the sample. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Local Concentration: HHI

- Compare local non-supplier vs. distant non-supplier plants

	Distance to Large Plant							
	10km		20km		30km		40km	
Outcomes	(1) More Concentrated	(2) Less Concentrated	(3) More Concentrated	(4) Less Concentrated	(5) More Concentrated	(6) Less Concentrated	(7) More Concentrated	(8) Less Concentrated
Sales	-0.016	-0.018	-0.007	-0.008	-0.002	-0.005	-0.004	-0.006
	(0.010)	(0.012)	(0.007)	(0.010)	(0.007)	(0.009)	(0.007)	(0.009)
Cost	-0.002	0.002	-0.008	0.005	-0.001	0.005	-0.006	0.003
	(0.014)	(0.011)	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)
Total Wage	-0.017*	-0.014	-0.003	-0.011	-0.002	-0.007	-0.005	-0.006
	(0.009)	(0.010)	(0.007)	(0.009)	(0.006)	(0.008)	(0.005)	(0.008)
Regular Employment	-0.001	0.003	-0.001	0.006	-0.000	0.007	-0.002	0.008
	(0.004)	(0.008)	(0.003)	(0.007)	(0.003)	(0.006)	(0.003)	(0.006)

Notes: "More Concentrated" corresponds to the area with HHI in pre-opening period (2007–2009) being above median within each 4-digit industry. "Less Concentrated" corresponds to the rest of the sample. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Local Concentration

- We find larger positive impacts on local supplier plants when the area is more concentrated before large plant openings
- Implication
  - Pre-large plant opening local condition matters
  - More local concentration leads to the clearer distinction between winning (supplier) plants and losing (non-supplier) plants