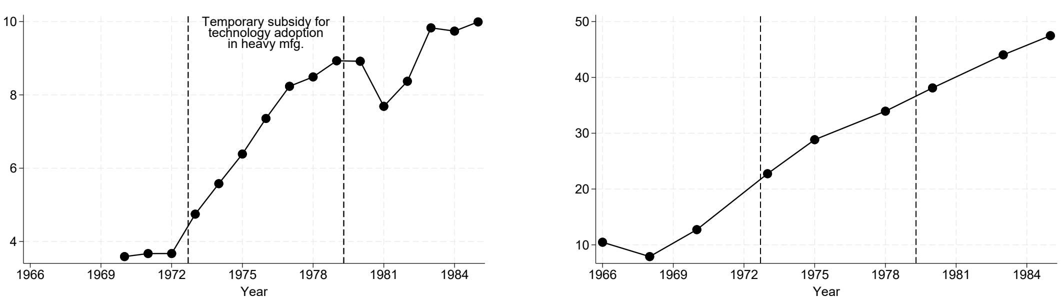
ONLINE APPENDIX
(NOT FOR PUBLICATION)

A. Background

In this section, we provide more details about the historical background.

Additional evidence on the big push and technology adoption. We present additional evidence on the big push and industrialization in South Korea. Figure A.1 shows that employment and export shares started to increase after the policy in 1973 and continued to increase even after the policy ended in 1979, consistent with heavy manufacturing GDP shares.

Figure A.1: Big Push and Industrialization in South Korea. Heavy Manufacturing Employment and Export Shares



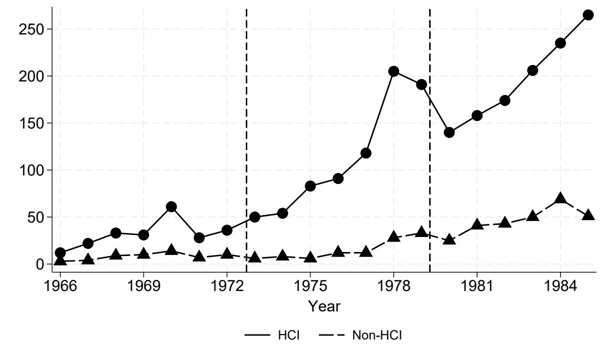
A. Heavy mfg. share of employment (%) B. Heavy mfg. share of exports (%)

Notes. The two dotted vertical lines indicate the start and end of the South Korean government's big push, which temporarily subsidized adoption of modern technologies from foreign firms in heavy manufacturing sectors from 1973 to 1979. Panels A and B illustrate heavy manufacturing sectors' employment shares to total employment and their export shares to total exports, respectively. We obtain sectoral employment data from the KLEMS for the post-1970 period (pre-1970 data is unavailable), and exports from the Bank of Korea's input-output tables.

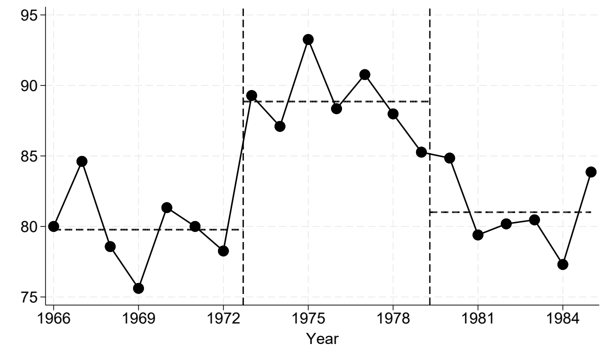
We also compare patterns of non-HCI manufacturing sectors' technology adoption activities to those of HCI sectors in Figure A.2. The figure reports the number of new contracts in both sector groups and the share of new contracts in HCI sectors relative to the total number of new contracts. HCI sectors' adoption activities increased between 1973 and 1979.

Factors that influenced the HCI Drive. The decision to prioritize heavy industries was partly influenced by Japan's post-World War II experience. Japan initially focused on light manufacturing before shifting its focus to heavy industries in 1957, achieving remarkable growth and export success by the late 1960s.

Figure A.2: Big Push and Industrialization in South Korea. Technology Adoption between Non-HCI and HCI Sectors



A. Number of new technology adoption contracts made by heavy & light mfg. firms



B. Shares of new technology adoption contracts by heavy mfg. firm (%)

Notes. Panel A shows the number of new technology adoption contracts signed by heavy and light manufacturing firms. Panel B shows the share of heavy manufacturing contracts in total new adoption contracts.

National security concerns have also been cited as a driver of the policy. Following the Nixon Doctrine, the US announced a partial withdrawal of its military troops from South Korea, raising concerns about national defense amid rising tensions with North Korea. Developing the heavy manufacturing sectors was regarded as a necessary step to strengthen South Korea's military capabilities.

The Ministry of Science and Technology also emphasized the role of technology adoption as a way to catch up with the frontier: "It is necessary to encourage investment from private firms in technology and to maximize the government's investment in it. Efforts must also be directed toward increasing technology adoption . . . Considering our nation's current technological state, adopting foreign advanced technologies and continuously adapting them to our needs seem to be the most effective catching-up strategy" (of Science and Technology, 1972, p. 3–4).

More details on adoption contracts. Adoption fees were in the form of royalty payments or one-time fixed fees. Technology adoption contracts often brought large profits to foreign sellers. For example, as part of a contract between POSCO, the first integrated steel mill in Korea, and Japan's Nippon Steel Corporation, POSCO was required to pay one-time adoption fees amounting to about 20% of Nippon Steel Corporation's annual plant engineering exports.

All contracts required government approvals. Korean buyers first negotiated with foreign sellers and then submitted proposals to the government, detailing payments to foreign firms, capital equipment costs, and estimated sales and exports from the adopted technologies. Technocrats then evaluated these proposals based on their potential economic gains, export prospects, and spillover effects on the Korean economy. Once approved, Korean and foreign firms finalized formal contracts.

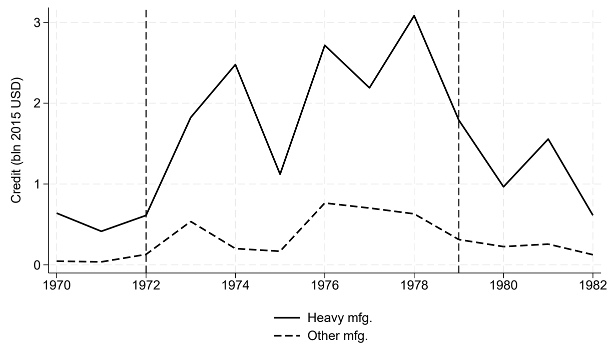
Limited alternative channels for technology upgrading. Beyond technology adoption, there were very few alternatives for accessing modern technologies. During our sample period, less than 0.1% of firms ever patented, and domestic technology transfers comprised under 6% of all transfers involving foreign firms (Kim, 1997). Moreover, foreign direct investment—another commonly used means of technology transfer in developing countries—was heavily restricted to curb economic power of multinational firms (Kim, 1997, p. 42-43).

More details on the temporary nature of the policy. After President Park's death, President Chun, who came to power through a military coup, shifted towards more market-oriented liberalization policies, aiming to distance his administration from the politics of the Park era (Haggard and in Moon, 1990). The new government discontinued subsidizing the heavy manufacturing sectors. Although the HCI Drive spurred growth in heavy manufacturing, it also intensified political tensions by increasing wealth concentration and widening rural-urban inequalities. In response, President Chun pursued market-oriented reforms to distance his administration from the Park era, including abolishing government-guaranteed credit, privatizing banks, and bailing out unproductive chaebols. Appendix Figure A.3 shows that foreign credit allocated to the heavy manufacturing sectors surged only between 1973 and 1979, supporting the narrative of the policy's temporary nature. As documented in Choi and Levchenko (2025), the HCI Drive was a place-based policy, which disproportionately targeted heavy manufacturing sectors in targeted regions. Panels B and C report subsidy per capita in these two groups of regions. It further emphasizes the temporary nature of the policy as shown by high rise in subsidy values in targeted region-sectors.

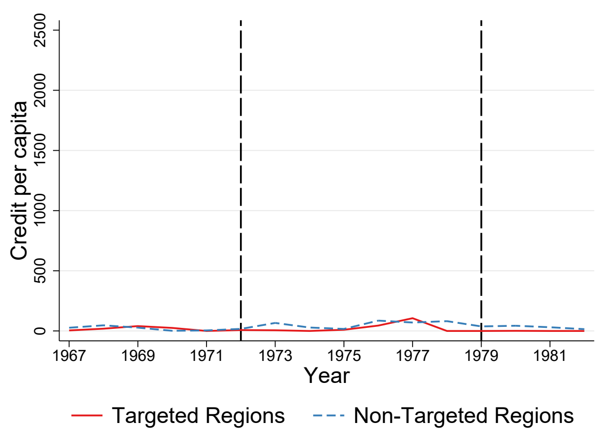
B. Data

Firm-level data. From the contract documents, we obtain three main pieces of information: the names of domestic firms, the names of foreign firms, and the calendar years in which the contracts were made. The balance sheet data includes firms with more than 50 employees. In cases where a firm merged with another, we treated the acquired firm as an exit. For firms with missing sales, we impute sales using asset information. The production locations' addresses are converted to the 2010 administrative divisions of South Korea. Regions are aggregated into 86 regions based on their electoral districts. Firms are categorized into 10 sectors, four of which are classified as heavy manufacturing, as shown in Table B.1. The numbers inside the parentheses are ISIC Revision 3.1 codes.

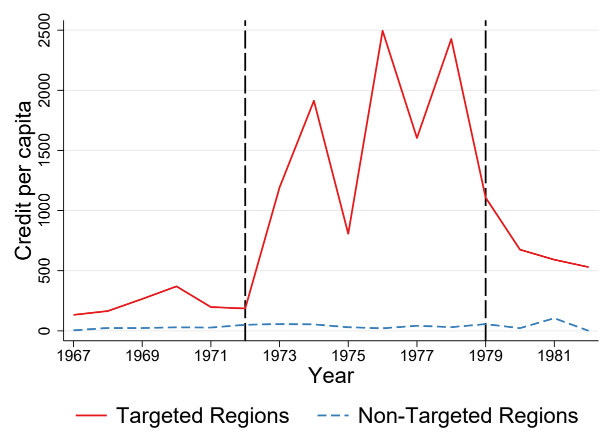
Figure A.3: Supporting Evidence for the Temporary Nature of the Policy. Allocation of Directed Credit



A. Subsidy (2015 USD)



B. Non-HCI sectors' subsidy per capita



C. HCI sectors' subsidy per capita

Notes. The figure provides supporting evidence of the temporary nature of the policy. In Panel A, the red solid and blue long-dashed lines represent the sum of foreign credit (in 2015 million USD) allocated to heavy manufacturing firms and non-heavy manufacturing firms, respectively. The vertical lines indicate the years 1973 and 1979, marking the start and end of the HCI Drive, respectively. The data, sourced from Choi and Levchenko (2025), shows that the sum of foreign credit—the main subsidy instrument—allocated to heavy manufacturing firms surged sharply in 1973 before returning to its original level after 1979. In contrast, credit for other sectors did not experience such a surge between 1973 and 1979. Panels B and C report total credit per capita for targeted and non-targeted sectors in targeted and non-targeted regions. These figures are taken from Figure 2 of Choi and Levchenko (2025).

Table B.1: Sector Classification

Aggregated Industry	Industry
(i) Chemicals, Petrochemicals, & Rubber, Plastic Products*	Coke oven products (231), Refined petroleum products (232) Basic chemicals (241), Other chemical products (242) Man-made fibres (243) except for pharmaceuticals and medicine chemicals (2423) Rubber products (251), Plastic products (252)
(ii) Electrical Equipment*	Office, accounting, & computing machinery (30) Electrical machinery and apparatus n.e.c. (31) Radio, television and communication equipment and apparatus (32) Medical, precision, and optical instruments, watches and clocks (33)
(iii) Basic & Fabricated Metals*	Basic metals (27), Fabricated metals (28)
(iv) Machinery & Transport Equipment*	Machinery and equipment n.e.c. (29) Motor vehicles, trailers and semi trailers (34) Building and repairing of ships and boats (351) Railway and tramway locomotives and rolling stock (352) Aircraft and spacecraft (353), Transport equipment n.e.c. (359)
(v) Food, Beverages, & Tobacco	Food products and beverages (15), Tobacco products (16)
(vi) Textiles, Apparel, & Leather	Textiles (17), Apparel (18) Leather, luggage, handbags, saddlery, harness, and footwear (19)
(vii) Manufacturing n.e.c.	Manufacturing n.e.c. (369)
(viii) Wood, Paper, Printing, & Furniture	Wood and of products, cork (20), Paper and paper products (21) Publishing and printing (22), Furniture (361)
(ix) Pharmaceuticals & Medicine Chemicals	Pharmaceuticals and medicine chemicals (2423)
(x) Other Nonmetallic Mineral Products	Glass and glass products (261), Non-metallic mineral products n.e.c. (269)

Notes. * denotes for heavy manufacturing sectors. The numbers inside parentheses denote ISIC Rev 3.1 codes.

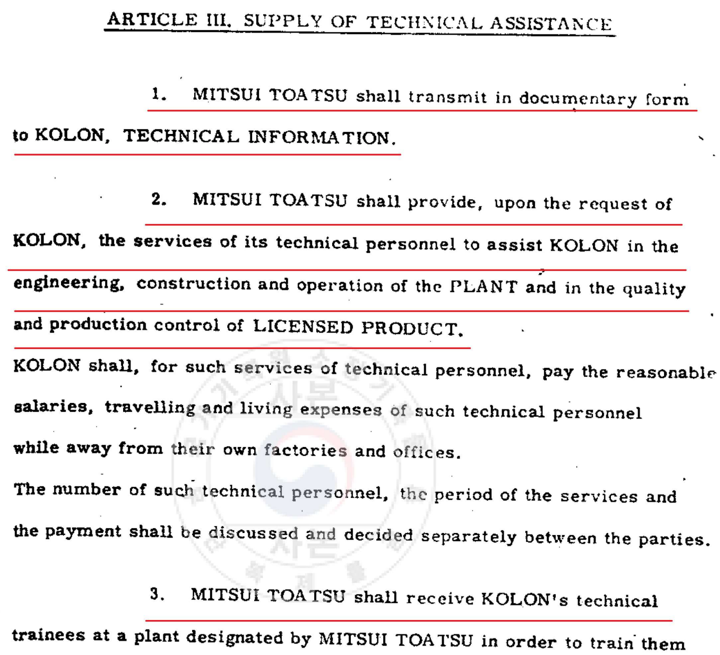
We also supplement our data with KIS-VALUE only for the analysis of the direct effects. It has information on balance sheet variables for firms with assets over 3 billion Korean Won (2.65 million 2015 USD). For some matches with cancellations occurring in later periods, the main dataset—covering up to 1982—provides insufficient post-treatment observations. Therefore, we supplement the main dataset with KIS-VALUE, which provides balance sheet data for post-1982 periods. Although KIS-VALUE covers larger firms than our main firm-level dataset, this is not an issue, as most losers and winners are large firms above the threshold.

Other regional and sectoral data. The regional population data are sourced from the Population and Housing Census, representing a 2% random sample of the total population. We digitize import tariff data from Luedde-Neurath (1986) for the years 1968, 1974, 1976, 1978, 1980, and 1982. The tariffs are categorized under the Customs Cooperation Council Nomenclature (CCCN). We convert CCCN codes to ISIC codes and calculate averages across four-digit ISIC codes. For years with missing data, we impute values using the geometric average. We obtain input-output tables from the Bank of Korea and align the codes in the input-output tables with the ISIC codes.

Adoption example. Appendix Figure B.1 presents an official contract page between Korean and Japanese chemical manufacturers (Kolon and Mitsui Toatsu) for the production of

Nonylphenol. In this contract, Mitsui committed to supplying blueprints, sending its skilled engineers to train Korean workers, and conducting hands-on training at its plants in Japan, where Korean workers could observe the production process firsthand. However, the capital equipment was sourced separately and purchased from the American firm Chemtex (Enos and Park, 1988, p. 131-132).

Figure B.1: Example. A Contract between Kolon and Mitsui Toatsu


ARTICLE III. SUPPLY OF TECHNICAL ASSISTANCE

1. MITSUI TOATSU shall transmit in documentary form to KOLON, TECHNICAL INFORMATION.

2. MITSUI TOATSU shall provide, upon the request of KOLON, the services of its technical personnel to assist KOLON in the engineering, construction and operation of the PLANT and in the quality and production control of LICENSED PRODUCT.
KOLON shall, for such services of technical personnel, pay the reasonable salaries, travelling and living expenses of such technical personnel while away from their own factories and offices.
The number of such technical personnel, the period of the services and the payment shall be discussed and decided separately between the parties.

3. MITSUI TOATSU shall receive KOLON's technical trainees at a plant designated by MITSUI TOATSU in order to train them

Additional descriptive statistics. Columns 1-7 of Table C.1 report descriptive statistics of the balance sheet variables and dummies for export, adoption, and receipt of government support (credit and export promotion) at the firm-year level. Columns 8-11 report shares of firms that ever exported, adopted technologies, and received government support. Out of the 6,230 firms, 9.4% (587 firms) adopted technologies at least once, classified as *ever-adopters*. On average, these ever-adopters were larger (516% and 254% higher sales and employment) and more likely to receive government support than *never-adopters*.

C. Empirics

C.1 An Example of POSCO

We provide an example of POSCO to illustrate how technology adoption benefited firms through three channels documented by our empirical analysis. POSCO, now one of the top five steel producers globally, was the first integrated steel mill in South Korea. Integrated steel mills are vital for industrialization, producing high-quality steel used as inputs for various manufacturing sectors.

In 1968, POSCO signed its first technology adoption contract with Japan's Nippon Steel Corporation (NSC). This contract involved the transfer of blueprints and the training by NSC's engineers for POSCO's engineers. The contract was profitable for NSC, as the fee paid by POSCO amounted to 20% of NSC's annual exports in plant engineering. The Korean government also supported POSCO by subsidizing the costs of capital equipment via guaranteed foreign credit. As a result, POSCO began production in 1973, exemplifying the first finding on the direct effects of adopters.

Moreover, local labor mobility enabled knowledge transfer beyond POSCO. Engineers trained at POSCO gained expertise through learning by doing and reverse engineering. Many later moved to smaller local mills or capital goods producers, spreading their newly acquired knowledge and enhancing the performance of these local firms. From this knowledge, these local firms began producing more sophisticated equipment—such as water treatment systems, dust collection devices, and large magnetic cranes—that had previously been imported during the early 1970s before the implementation of the HCI Drive (Enos and Park, 1988, p. 210-211). This diffusion of knowledge via labor mobility aligns with our second finding on local spillovers.

Furthermore, this diffusion facilitated POSCO's adoption at a later stage. In 1980, POSCO planned to adopt new computerization technology, which required significant capital investment for equipment and plant expansion. Despite no longer receiving government credit, POSCO moved forward with adoption, as the availability of cheaper domestically produced capital inputs, manufactured by local firms, helped reduce setup costs (POSCO, 2018, p.138-141). By 1980, locally produced equipment accounted for 35% of total expenditures on expansion, compared to just 12% during the first adoption in 1968. This underscores the role of local firms in reducing adoption costs, consistent with our third finding and the theoretical model's focus on fixed adoption costs.

C.2 Details on Estimation of Revenue TFP

Our main dataset does not have material inputs. Therefore, we estimate value-added production functions using KIS-VALUE data over the period 1980-1995, which has material input information and value-added calculated as sales times value-added shares from the input-output tables. Then, we obtain labor and capital elasticities and compute TFPR as residuals for the sample between 1970-1982. We account for the possibility that adoption may affect underlying TFP processes by adapting the estimation procedure of Loecker (2013). We cannot estimate gross output functions as in Gandhi et al. (2020) because the main dataset does not have information on material inputs between 1970 and 1982.

C.3 Characteristics of Business Groups

Approximately 5% of firms (306 in total) were affiliated with business groups. These firms were larger and more likely to adopt new technologies and receive government support than non-affiliated firms (Panel D of Table C.1). Table C.2 reports the sectoral distribution of firms for the 15 largest business groups. To formally examine the relationship between group affiliation and technology adoption, we estimate the following regression model:

$$\mathbb{1}[\text{New Contract}_{it}] = \beta \mathbb{1}[\text{Group}_i] + \gamma \ln(\text{Sale}_{it}) + \delta_{njt} + \varepsilon_{it}, \tag{C.1}$$

where δ_{njt} denotes region-sector-year fixed effects. Standard errors are two-way clustered at the region and group levels. The results, reported in Table C.3, show that the business group dummy is positive and statistically significant at the 1% level, even after controlling for firm size and the fixed effects.

C.4 Construction of Additional Controls

Following Donaldson and Hornbeck (2016), we construct market access variable:

$$\Delta \ln \text{MA}^p_{(-i)njt} = \Delta \ln \left(\sum_{m,k} \sum_{i' \in \mathcal{F}_{(-i)mkt_0}} \text{Dist}^{-\chi}_{nm} \times \gamma^j_k \text{Sale}^p_{i't} \right). \tag{C.2}$$

where $\mathcal{F}_{(-i)mkt_0}$ is a set of firms in region-sector mk, excluding i, operating in the initial year t_0, and γ^j_k are the 1970 input-output coefficients. Internal trade costs are proxied using the distance between regions (Dist_{nm}), and χ is set to 1.5 (Costinot and Rodríguez-Clare, 2014). Due to endogeneity, we use predicted sales instead of actual values computed as national-growth (excluding own region) multiplied to initial sales. Specifically, $\text{Sale}^p_{it} = g^{\text{sale}}_{(-n)j} \times \text{Sale}_{it_0}$, where $g^{\text{sale}}_{(-n)j}$ is national-level sector j's growth excluding region n.

Table C.1: Descriptive Statistics

	Firm-year level							Firm level			
Var.	Sales (mln 2015 USD) (1)	Emp (thousands) (2)	Fixed asset (mln 2015 USD) (3)	Dum. export (4)	Dum. adoption (5)	Dum. subsidy (6)	Dum. export promo. (7)	Ever export (8)	Ever adoption (9)	Ever subsidy (10)	Ever export promo. (11)
	Panel A. All firms										
Mean	30.89	0.55	13.93	0.30	0.03	0.01	0.03	0.39	0.09	0.03	0.08
SD	174.59	1.42	106.46	0.46	0.17	0.11	0.18				
N	29,786	17809	29633	29,786	29,786	29,786	29,786	6,230	6,230	6,230	6,230
	Panel B. Ever-adopters										
Mean	103.17	1.31	52.86	0.44	0.18	0.04	0.08	0.65	N/A	0.18	0.23
SD	377.98	2.54	245.67	0.5	0.39	0.2	0.27				
N	4,871	3,464	4,862	4,871	4,871	4,871	4,871	587	587	587	587
	Panel C. Never-adopters										
Mean	16.76	0.37	6.29	0.27	N/A	0.01	0.03	0.36	N/A	0.02	0.06
SD	85.4	0.88	36.87	0.44	N/A	0.07	0.16				
N	24,915	14,345	24,771	24,915	N/A	24,915	24,915	5,643	5,643	5,643	5,643
	Panel D. Business group firms										
Mean	142.06	1.95	68.34	0.51	0.13	0.07	0.12	0.75	0.46	0.26	0.30
SD	344.69	3.20	153.15	0.50	0.34	0.25	0.33				
N	2,601	1,940	2,600	2,601	2,601	2,601	2,601	306	306	306	306

Notes. Columns 1-7 of this table report the descriptive statistics of balance sheet variables and dummies for exporting, adopting foreign technologies, receiving directed credit (subsidy), and participating in international trade fairs (export promotion), respectively, at the firm-year level between 1970-1982. Columns 8-11 report the fraction of firms that ever exported, adopted foreign technologies, received directed credit, and participated in international trade fairs, respectively, among the set of unique firms that operated at any time between 1970-1982. Panels A, B, C, and D present data for all firms, ever-adopters, never-adopters, and firms affiliated with business groups, respectively. All monetary values are converted into 2015 US dollars.

Table C.2: Number of Firms across Sectors by the Top 15 Business Groups

	Ranking	Number of firms across sectors										
	(total assets)	All	Chemicals	Electronics	Metals	Transport. equip.	Food	Textile	N.e.c.	Wood	Pharma.	Nonmetallic mineral
Top 15 business groups	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Hyundai	1	13	1	1	3	4	0	0	0	1	0	3
Samsung	2	14	2	6	1	1	1	1	0	2	0	0
Lucky	3	12	2	9	1	0	0	0	0	0	0	0
Daewoo	4	14	2	1	2	3	1	4	1	0	0	0
Hyosung	5	14	5	1	0	2	0	5	0	1	0	0
Ssangyong	6	4	1	1	0	1	0	0	0	0	0	1
Hanil Synthetic Fiber	7	2	1	0	0	0	0	1	0	0	0	0
Gukje	8	9	1	0	3	1	0	3	0	1	0	0
Taihan Electric Wire	9	7	0	5	0	1	1	0	0	0	0	0
Sammi	10	5	0	0	4	0	0	0	0	0	0	1
Kia	11	8	0	0	1	7	0	0	0	0	0	0
Hanwha	12	9	4	1	1	1	1	0	0	0	0	1
Choongbang	13	3	0	0	0	0	0	3	0	0	0	0
Hanguk silk	14	13	2	2	0	1	0	6	1	1	0	0
Kumho	15	8	4	2	1	0	0	1	0	0	0	0

Notes. This table reports the number of firms across different sectors by the top 15 business groups.

Table C.3: Firms Affiliated with Business Groups Were More Likely to Adopt Technology

Dep.	$\mathbb{1}$[New Contract$_{it}$]					
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}$[Group$_i$]	0.11***	0.08***	0.11***	0.10***	0.07***	0.11***
	(0.02)	(0.02)	(0.03)	(0.01)	(0.01)	(0.02)
$\ln \text{Sale}_{it}$		0.02***	0.03***		0.01***	0.02***
		(0.00)	(0.00)		(0.00)	(0.00)
# Clusters	132 × 5950	132 × 5950	86 × 2809	106 × 5669	106 × 5669	66 × 2714
N	29754	29754	13958	27345	27345	13138
Region-sector-year FE				✓	✓	✓

Notes. Standard errors in parentheses are clustered at the region and group levels. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the estimates of eq. (C.1). The dependent variable is a dummy of making adoption contracts. All specifications include region-sector-year fixed effects.

To capture different regional exposure to export demand due to internal trade costs, we include log distance to the nearest port interacted with changes in the log predicted sectoral exports, computed as growth of imports (excluding imports from Korea) of the US and Japan—the two largest export markets for Korea—multiplied to initial sectoral exports. The results remain similar with alternative market access measures, including those based on actual sales and those excluding firms from the same region-sector.

Using data from the 1980 Yearbooks of Industrial Complexes, in column 6, we add dummies for firms in these complexes and control for favorable tax treatment by calculating the years under tax exemptions, interacted with log sectoral effective marginal corporate tax rates.

Trade policies may impact regions differently due to internal trade costs, even though sector fixed effects absorb their common effects. To capture this, we include the log distance to port interacted with changes in both log import and input tariffs, with input tariffs computed using the 1970 input-output coefficients and import tariffs. We also include changes in the inverse hyperbolic sine transformation of each firm's total contract values from trade fairs to capture firm-level export promotion effects (Barteska and Lee, 2023). Finally, we control for firm-specific tariff exemptions on imported inputs for exporters (Connolly and Yi, 2015), by including dummies for initial export status interacted with input tariffs. Column 7 include these five trade-related variables.

C.5 Construction of Controls for Business Group Sales Shares for the Regressions for Local Spillovers and Complementarity

We define a variable, $\text{Share}^{\text{sale}}_{(-i)nj,t-h}$, analogous to the adopter shares in equation (3.2) and include it as a control in equation (3.3) in a reduced-form fashion, with the corresponding IV discussed below. $\text{Share}^{\text{sale}}_{(-i)nj,t-h}$ is the region-sector level share of the sum of sales by business groups in region-sector nj relative to total region-sector sales:

$$\text{Share}^{\text{sale}}_{(-i)nj,t-h} = \frac{\sum_{\tilde{g}\neq g(i)} \text{Sale}_{(-i)\tilde{g}nj,t-h}}{\text{Sale}_{(-i)nj,t-h}}. \tag{C.3}$$

$\text{Sale}_{(-i)\tilde{g}nj,t-h}$ is total sales of firms affiliated with business group $\tilde{g}$, excluding firm i, in region-sector nj in period $t-h$, and $\text{Sale}_{(-i)nj,t-h}$ is total sales of firms in region-sector nj in $t-h$, excluding i.

Analogous to the IV for adopter shares in equation (3.4), we define the following IV for business group sales shares:

$$\text{IV}^{\text{sale}}_{inj,t-h} = \Delta Z^{\text{sale}}_{inj,t-h}, \qquad Z^{\text{sale}}_{inj,t-h} = \sum_{\tilde{g}\neq g(i)} D_{\tilde{g}njt_0} \times \frac{\text{Sale}_{\tilde{g}(-n)j,t-h}}{\widetilde{\text{Sale}}^{p}_{(-i)nj,t-h}}, \tag{C.4}$$

where $D_{\tilde{g}njt_0}$ is a dummy indicating whether business group $\tilde{g}$ has at least one firm in region-sector nj in the initial year t_0. $\text{Sale}_{\tilde{g}(-n)j,t-h}$ is the total sum of sales of sector j firms in year $t-h$ that were affiliated with business group $\tilde{g}$ and that started operating before the initial year t_0, excluding firms located in region n and within a 100 km radius of region n. When summing over these business groups, we exclude business group $g(i)$ with which firm i is affiliated. $\widetilde{\text{Sale}}^{p}_{(-i)nj,t-h}$ is the predicted sales of firms in nj in year $t-h$, excluding i, constructed using the national-level growth of sales and initial sales of local firms. Specifically, $\widetilde{\text{Sale}}^{p}_{(-i)nj,t-h} \equiv g^{\text{sale}}_{(-n)j} \times \text{Sale}_{(-i)nj,t_0-h}$, where $g^{\text{sale}}_{(-n)j}$ is the national-level growth of sector j's total sales, excluding firms in region n, and $\text{Sale}_{(-i)nj,t_0-h}$ is region-sector nj's initial total sales, excluding firm i, in year t_0-h.

C.6 Additional Robustness Checks

C.6.1 Direct Effects on Adopters

Comparison with the full sample TWFE estimator. To assess the implications of correcting for endogeneity, we compare the baseline estimates with those obtained from a standard two-way fixed effects (TWFE) event study specification using the full sample:

$$y_{it} = \sum_{\tau=-5}^{7} \beta_\tau (D_{it}^{\tau} \times \mathbb{1}[\text{Adopt}_{it}]) + \delta_i + \delta_{njt} + \varepsilon_{it}. \quad \text{(C.5)}$$

$\mathbb{1}[\text{Adopt}_{it}]$ is a first-time adoption dummy. δ_{njt} are time-varying region-sector fixed effects that absorb any common shocks at the region-sector-year level, similar to match-year fixed effects in the winners vs. losers research design. Standard errors are clustered at the region level.

The TWFE estimators also indicate increases in adopters' sales post-adoption, but there are noticeable pretrends at $t = -4$, and the magnitude is about 75% smaller than the baseline (col. 5-6 of Table C.7). TFPR shows comparable patterns. These discrepancies may reflect the government's preferential treatment of politically connected firms with low productivity. Kim et al. (2021) provide supporting evidence, showing that allocative efficiency worsened during the HCI Drive and arguing that such preferential treatment may have contributed to this decline.

Alternative matching variables. In the baseline specification, we match exactly on region-sectors. We also consider alternative matching variables: (i) technology sellers' country and sector, (ii) aggregated technology sellers' country and sector, and (iii) aggregated technology sellers' country, state, and sectors. For the aggregated country, we group countries by continent. For example, all European countries are grouped together. In the last case, because the number of matches drops when using seller countries for matching, we aggregate regions upto 15 states to increase the number of matches. The results are reported in Table C.9. Across all matching variables, we find no evidence of pretrends, and the results remain robust.

Alternative inferences. To address potential finite sample bias due to highly leveraged observations, we conduct randomization inference (Young, 2019). Regarding small numbers of clusters, we report wild bootstrap p-values. We also consider alternative clustering at the match or firm levels. For ease of comparison, we estimate an alternative pooled diff-in-diff specification:

$$y_{imt} = \beta_1 \big(\mathbb{1}[0 \leq \tau \leq 3] \times \mathbb{1}[\text{Winner}_{it}] \big) + \beta_2 \big(\mathbb{1}[4 \leq \tau \leq 7] \times \mathbb{1}[\text{Winner}_{it}] \big) + \delta_{im} + \delta_{mt} + \varepsilon_{imt}, \quad \text{(C.6)}$$

and focus on inference for β_2, which captures the average treatment effects between 4 and 7 years after the event. These inferences yield p-values nearly identical to the baseline (Table C.8). Moreover, using the methodology proposed by Rambachan and Roth (2023), we show that the results remain robust to mild violations of the parallel trends assumption (Figure C.3).

Alternative outcomes and estimation samples. We consider alternative outcomes: labor productivity (sales per employee), TFPR based on Olley and Pakes (1996), and log fixed assets. Adoption has positive impacts on these outcomes. We consider a subsample without missing employment data and different matching procedures—varying the number of winners matched to each loser or including all firms that adopted technologies in the event year within the corresponding losers' region-sectors. The results remain robust (Table C.11).

C.6.2 Local Spillovers and Complementarity

Further validation of the exclusion restriction. One potential concern is that group-level decisions outside focal region–sectors may correlate with region–sector–level shocks if business groups are more responsive to local productivity changes or subsidies. For example, positive local shocks could induce groups to increase their overall adoption levels, thereby violating the exclusion restriction. We directly test this possibility using the complex dummy and tax favor, which serve as additional controls in the additional controls in column 6 of Table 1. Specifically, we estimate the following regression model:

$$\begin{aligned}\Delta \ln \text{Sale}_i &= \beta_1 \text{Tax favor}_{nj} + \beta_2 \mathbb{1}[\text{Complex}_{nj}] \\ &\quad + \beta_3\big(\mathbb{1}[\text{Group}_i] \times \text{Tax favor}_{nj}\big) + \beta_4\big(\mathbb{1}[\text{Group}_i] \times \mathbb{1}[\text{Complex}_{nj}]\big) + \delta_n + \delta_j + \varepsilon_i, \quad \text{(C.7)}\end{aligned}$$

where $\mathbb{1}[\text{Complex}_{nj}]$ is an indicator for firms located in industrial complexes, and Tax favor$_{nj}$ denotes tax incentives provided to firms in those complexes. These variables capture region-sector-level policy incentives. We test whether business group firms were more responsive to such incentives. We assess whether business group firms were more responsive to these incentives by including interaction terms between the incentive variables and the business group affiliation indicator.

Table C.15 reports the results. The tax favor coefficient is positive and statistically significant. However, both interaction terms are statistically insignificant, alleviating concerns that business group firms were disproportionately responsive to region-sector-level incentives and thus mitigating potential violations of the exclusion restriction.

To further address these concerns, we re-run the regressions using alternative IVs that exclude business group firms whose fixed assets exceed 30%, 50%, and 70% of the total fixed assets within regions, because larger groups are more likely to influence regional variables. We use fixed assets because they better reflect local firm size, as fixed assets (factories, capital equipment) are immobile, whereas sales reflect values of output sold outside of the region. We also consider excluding the two largest groups (Samsung and Hyundai). The results remain robust (col. 1-4 of Table C.18).

Further validation of the violation of the SUTVA due to spatial interaction. Regarding spatial interactions that may violate the SUTVA, we explore alternative radii ranging from 50 km to 150 km, for the IV (col. 5-8 of Table C.18). The lack of spatial correlations in residuals beyond 75 km based on Moran's I statistics further alleviates this concern (Table C.21). We also check for correlations between the IV and observable credit or export promotion from KOTRA. In cases where the exclusion restriction is violated due to unobserved subsidies, we would expect the IV to be correlated with these variables. However, we find no such correlations (Table C.19).

Alternative Specifications with the Two IVs. In Table C.14, we also consider a specification with two endogenous variables, where both adopter shares and business groups' sales shares are instrumented by their corresponding IVs, which give larger IV estimates for adopter shares. The estimates are larger than our baseline estimates. However, we prefer the specification with a single IV because instrumenting two endogenous variables may exacerbate the finite-sample bias of the IV estimates.

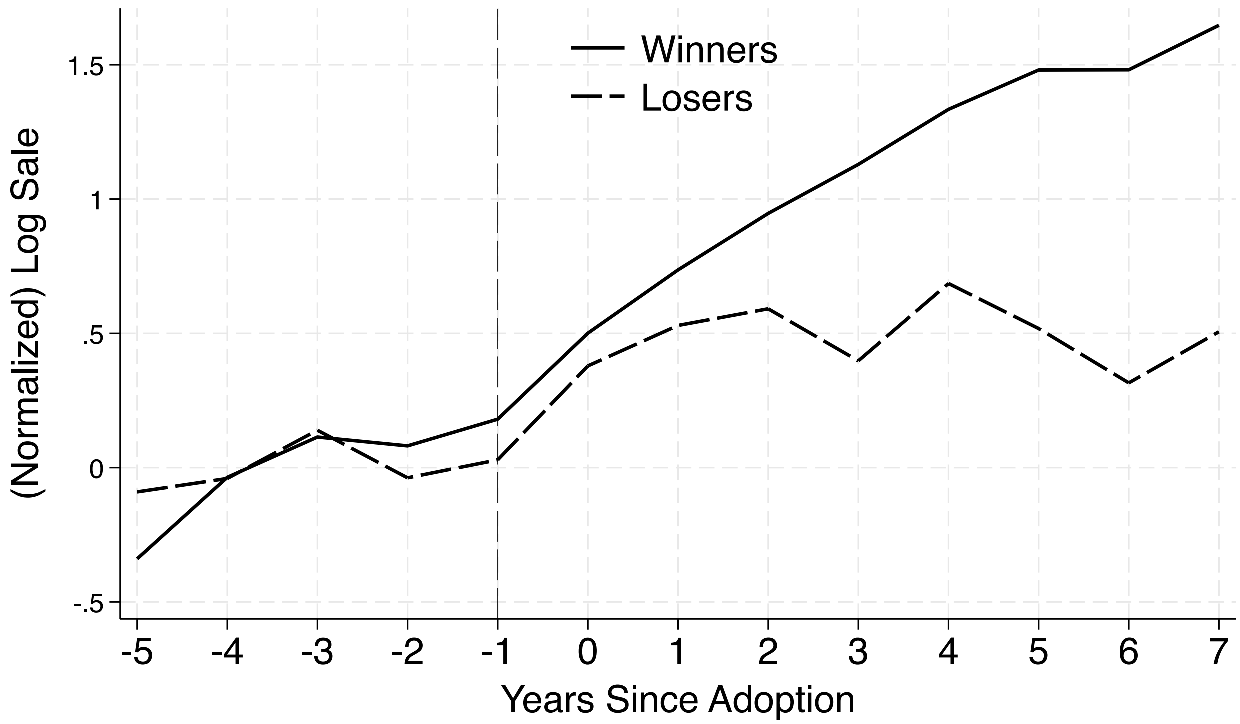
Alternative Thresholds for Heterogeneous Effects Depending on Market Access. The pattern that local complementarity is stronger for regions with larger market access holds for alternative thresholds (Table C.16).

Alternative inference, spatial correlation, and weak IV. We use bootstrapped standard errors to address the possibility that outliers may exaggerate the statistical significance of the IV estimates (Young, 2022); spatial HAC standard errors to account for spatial autocorrelation (Conley, 1999; Colella et al., 2021); and the weak-IV-robust Anderson-Rubin test along with two-step confidence intervals developed by Andrews (2018). The results remain robust (Table C.23). Conley and Kelly (2025) show that studies sensitive to spatial correlation tend to have high z-scores in the Moran test. In our data, the Moran test indicates that spatial autocorrelation becomes insignificant beyond 75 km (Table C.21). The median size of our regions is 597 km^2, suggesting that the level of clustering in our analysis exceeds the potential spatial correlation present in the data.

Firm entry and exit, alternative outcomes, lags, and samples, and omitting y_{it_0}. We examine entry and exit dummies as outcomes and find no significant effects, suggesting that these margins are unlikely to affect the results (Table C.22). We consider alternative outcomes; omitting y_{it_0}; and using a 3-year lag. We push the IV's leave-out logic further by using a subsample of firms unaffiliated with any business groups and operating in a single region. We consider excluding firms in industrial complexes and excluding those with non-missing employment. The results remain robust (Tables C.24 and C.25).

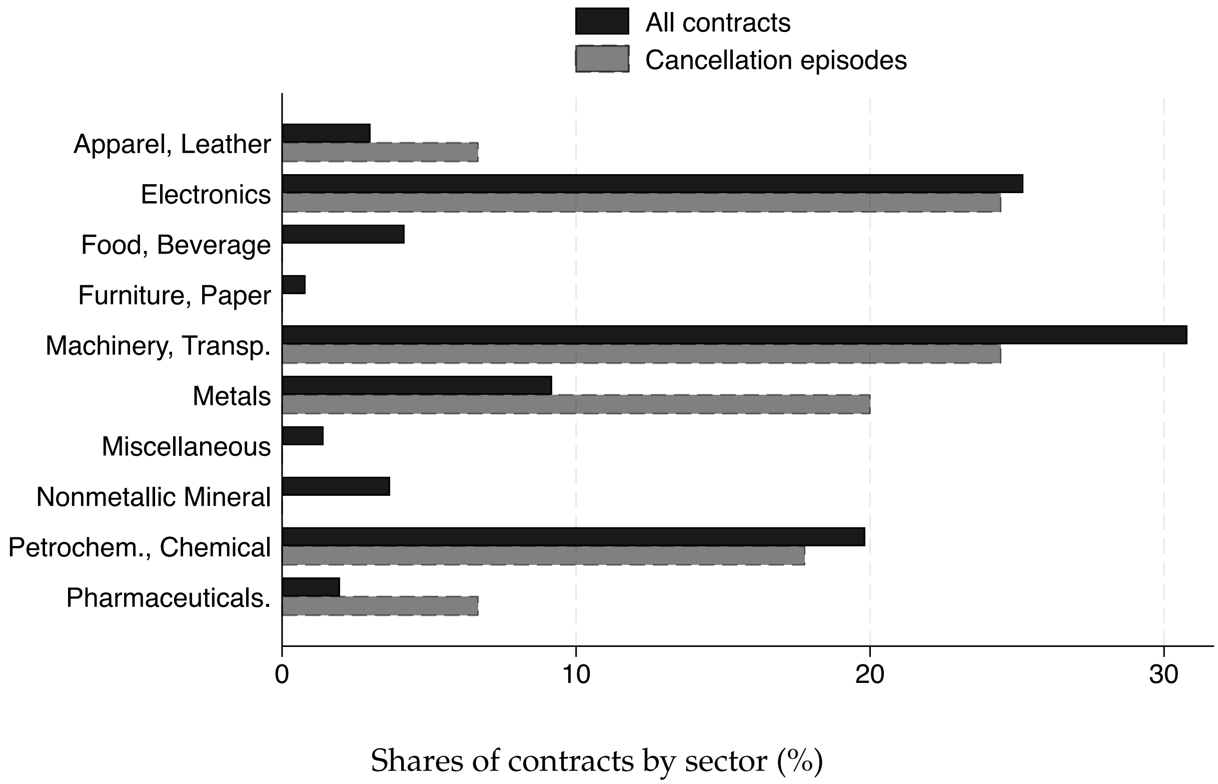
C.7 Additional Figures and Tables

Figure C.1: Raw Plot of the Log Sales of the Winners vs. Losers Sample



Notes. The figure displays the mean of log sales for winners and losers (blue solid and red dashed lines), normalized by the average before the event.

Figure C.2: Representativeness of Losers. Distributions of Contracts by Sectors



Notes. The figure presents the sectoral distribution of all contracts ($N = 1,634$) and cancellation episodes ($N = 38$).

Table C.4: Representativeness of Losers. Descriptive Statistics: All Adopters vs. Losers

	All Adopters				Loser				(Col. 1 - Col. 5)	
	Mean	Med.	SD	Obs.	Mean	Med.	SD	Obs.	t-stat.	p-val
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log sales	17.40	17.17	1.86	542	17.94	18.04	1.82	219	2.65	[0.11]
Log emp.	6.76	6.86	1.36	396	7.09	7.19	1.43	172	0.95	[0.33]
Log fixed assets	16.54	16.25	2.10	542	16.98	17.08	2.17	219	1.01	[0.32]
Log assets	17.55	17.41	1.93	542	17.96	18.10	1.93	219	1.09	[0.30]
$\mathbb{1}[\text{Credit}_{it}]$	0.10	0	0.30	542	0.12	0	0.32	219	0.10	[0.76]
$\text{Ihs}(\text{Credit}_{it})$	1.86	0	5.62	542	2.17	0	5.95	219	0.07	[0.79]
$\mathbb{1}[\text{KOTRA}_{it}]$	0.10	0	0.30	542	0.13	0	0.33	219	0.29	[0.59]
$\text{Ihs}(\text{KOTRA}_{it})$	1.72	0	5.10	542	2.21	0	5.85	219	0.38	[0.54]
Business group status	0.39	0	0.49	542	0.48	0	0.50	219	0.55	[0.46]

Notes. Panel A reports descriptive statistics of the winners vs. losers design samples from 5 years before the cancellations to the year of the cancellation. Panel B reports descriptive statistics of patent activities by foreign firms matched with winners and losers. We report inverse hyperbolic sine transformation and dummies of cumulative numbers of patents and citations. Panel C reports descriptive statistics of all adopters in the same region-sectors as losers, who adopted technologies at the time when losers made contracts. In the second rows of Panels A and C, the sample size decreases due to missing employment data. Column 9 reports the t-statistics of mean differences between winners and losers with their p-values in brackets in column 10. All monetary values are converted into 2015 US dollars.

Table C.5: Descriptive Statistics: Winners vs. Losers Design Samples from the Year of the Cancellation to 5 Years before the Cancellation

	Winner				Loser				(Col. 1 - Col. 5)	
	Mean	Med.	SD	Obs.	Mean	Med.	SD	Obs.	t-stat.	*p*-val
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A. Winners vs. losers balance										
Log sales	17.58	17.47	1.93	449	17.94	18.04	1.82	219	1.23	[0.29]
Log emp.	7.02	7.13	1.28	329	7.06	7.19	1.43	172	0.02	[0.90]
Log fixed assets	16.75	16.73	2.16	449	16.98	17.08	2.17	219	0.28	[0.60]
Log assets	17.78	17.64	1.96	449	17.96	18.10	1.93	219	0.22	[0.64]
$\mathbb{1}[\text{Credit}_{it}]$	0.11	0	0.31	449	0.12	0	0.32	219	0.01	[0.91]
$\text{Ihs}(\text{Credit}_{it})$	2.09	0	5.94	449	2.17	0	5.95	219	0	[0.95]
$\mathbb{1}[\text{KOTRA}_{it}]$	0.12	0	0.33	449	0.13	0	0.33	219	0.03	[0.87]
$\text{Ihs}(\text{KOTRA}_{it})$	2.02	0	5.49	449	2.21	0	5.85	219	0.06	[0.81]
Business group status	0.43	0	0.50	449	0.48	0	0.50	219	0.16	[0.69]
Panel B. Winners vs. losers. Foreign firm patent activity balance										
Ihs # cum. patents	2.04	0	2.98	90	1.74	0	2.98	38	0.34	[0.56]
Ihs # cum. citations	2.17	0	3.17	90	1.91	0	3.18	38	0.23	[0.63]
$\mathbb{1}[\text{\# cum. patents} \geq 0]$	0.38	0	0.49	90	0.32	0	0.47	38	0.51	[0.48]
$\mathbb{1}[\text{\# cum. citations} \geq 0]$	0.38	0	0.49	90	0.34	0	0.48	38	0.16	[0.69]

Notes. Panel A reports descriptive statistics of the winners vs. losers design samples from 5 years before the cancellations to the year of the cancellation. Panel B reports descriptive statistics of patent activities by foreign firms matched with winners and losers. We report inverse hyperbolic sine transformation and dummies of cumulative numbers of patents and citations. Panel C reports descriptive statistics of all adopters in the same region-sectors as losers, who adopted technologies at the time when losers made contracts. In the second rows of Panels A and C, the sample size decreases due to missing employment data. Column 9 reports the t-statistics of mean differences between winners and losers with their *p*-values in brackets in column 10. All monetary values are converted into 2015 US dollars.

Table C.6: Robustness. Covariate Balance Test

Dep.	$\mathbb{1}[\text{Winner}_{it}]$															
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
$\ln \text{Sale}_{it}$	−0.02							−0.10*	−0.03							−0.12*
	(0.02)							(0.05)	(0.04)							(0.07)
$\ln \text{Employment}_{it}$		−0.00						−0.01		0.01						−0.00
		(0.04)						(0.06)		(0.05)						(0.06)
$\ln \text{Fixed asset}_{it}$			−0.01					−0.09			−0.01					−0.10
			(0.02)					(0.06)			(0.04)					(0.07)
$\ln \text{Asset}_{it}$				−0.01				0.19**				−0.00				0.21*
				(0.02)				(0.09)				(0.04)				(0.12)
$\text{Ihs}(\text{Credit}_{it})$					−0.00			−0.00					0.00			0.00
					(0.01)			(0.01)					(0.01)			(0.01)
$\text{Ihs}(\text{KOTRA}_{it})$						−0.00		0.00						−0.00		−0.00
						(0.01)		(0.01)						(0.01)		(0.01)
$\mathbb{1}[\text{Chaebol}_{it}]$							−0.04	0.03							−0.04	0.05
							(0.11)	(0.11)							(0.14)	(0.14)
Joint F p-val.								0.55								0.70
N	668	501	668	668	668	668	668	501	668	500	668	668	668	668	668	500
Match FE									✓	✓	✓	✓	✓	✓	✓	✓

Notes. Standard errors in parenthesis are clustered at the match and firm levels. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the covariate balance test of the winners vs. losers design samples from 5 years before the cancellation to the year of the cancellation. The dependent variables are dummies of being winners. The regressors are log sales, log employment, log fixed assets, log assets, the inverse hyperbolic sine of credit and the total revenues in international trade fairs, and dummies of being affiliated with business groups. For the joint specification in columns 8 and 16, we report p-values of F-statistics in brackets that test a hypothesis that the observables are jointly zero. Columns 9-16 include match fixed effects. In columns 2, 8, 10, and 16, the sample size decreases due to missing employment data.

Table C.7: Direct Effects on Adopters

Research design	Winners vs. losers				Full sample TWFE			
Dep. var.	Sale	TFPR	Ihs(Credit)	Ihs(KOTRA)	Sale	TFPR	Ihs(Credit)	Ihs(KOTRA)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A. Event study							
5 years before	0.09	0.04	0.20	−1.10	−0.19**	−0.04	−0.06	−0.26
	(0.22)	(0.29)	(1.64)	(1.41)	(0.07)	(0.08)	(0.23)	(0.24)
4 years before	0.12	0.03	1.45	−0.39	−0.09	−0.05	0.12	0.25
	(0.16)	(0.24)	(1.76)	(1.73)	(0.07)	(0.07)	(0.18)	(0.27)
3 years before	0.17	0.03	0.08	−0.31	−0.04	−0.01	−0.08	0.01
	(0.12)	(0.18)	(1.55)	(1.72)	(0.06)	(0.06)	(0.16)	(0.23)
2 years before	−0.06	0.01	1.03	0.83	−0.00	0.02	0.12	0.09
	(0.10)	(0.13)	(1.33)	(0.63)	(0.05)	(0.05)	(0.21)	(0.25)
1 year before								
Year of event	0.12	0.10	0.75	−0.14	0.08*	−0.01	0.42***	0.25
	(0.09)	(0.13)	(1.58)	(1.50)	(0.05)	(0.04)	(0.15)	(0.20)
1 year after	0.25	0.35*	0.76	−0.03	0.19***	0.08	0.65**	0.34
	(0.15)	(0.20)	(1.50)	(1.01)	(0.06)	(0.05)	(0.27)	(0.33)
2 years after	0.24*	0.26	1.39	0.54	0.13	0.09	0.42**	0.94***
	(0.14)	(0.16)	(1.88)	(1.12)	(0.10)	(0.10)	(0.19)	(0.25)
3 years after	0.36	0.27	1.98	−1.05	0.20**	0.11	0.21	0.49
	(0.25)	(0.31)	(1.53)	(1.36)	(0.10)	(0.12)	(0.28)	(0.36)
4 years after	0.66*	0.64*	1.05	0.95	0.24**	0.16	0.14	0.24
	(0.33)	(0.32)	(1.57)	(1.55)	(0.12)	(0.15)	(0.38)	(0.49)
5 years after	0.59*	0.48	−0.52	0.12	0.30***	0.24**	−0.44	0.73
	(0.30)	(0.38)	(1.39)	(1.89)	(0.10)	(0.09)	(0.32)	(0.51)
6 years after	0.71**	0.94**	−0.26	−0.56	0.32***	0.23**	0.46	0.83
	(0.30)	(0.37)	(1.42)	(1.90)	(0.11)	(0.11)	(0.31)	(0.58)
7 years after	0.61**	1.02**	−0.32	0.00	0.32***	0.20*	−0.07	0.59
	(0.24)	(0.44)	(1.40)	(2.30)	(0.09)	(0.10)	(0.41)	(0.52)
	Panel B. Pooled diff-in-diff							
$\mathbb{1}[\text{Winner}_{it}] \times \mathbb{1}[0 \leq \tau \leq 3]$	0.20	0.27*	0.64	0.11	0.15**	0.09	0.30***	0.43**
	(0.15)	(0.14)	(0.74)	(1.08)	(0.06)	(0.07)	(0.08)	(0.18)
$\mathbb{1}[\text{Winner}_{it}] \times \mathbb{1}[4 \leq \tau \leq 7]$	0.58**	0.66**	−0.55	0.37	0.25***	0.20**	−0.12	0.35
	(0.27)	(0.29)	(0.81)	(1.64)	(0.09)	(0.09)	(0.19)	(0.40)
# Clusters	38 × 106	36 × 102	38 × 106	38 × 106	82	63	82	82
N	1071	678	1071	1071	21319	11994	21319	21319
Fixed effects	Match×Firm, Match×Year				Firm, Region×Sector×Year			

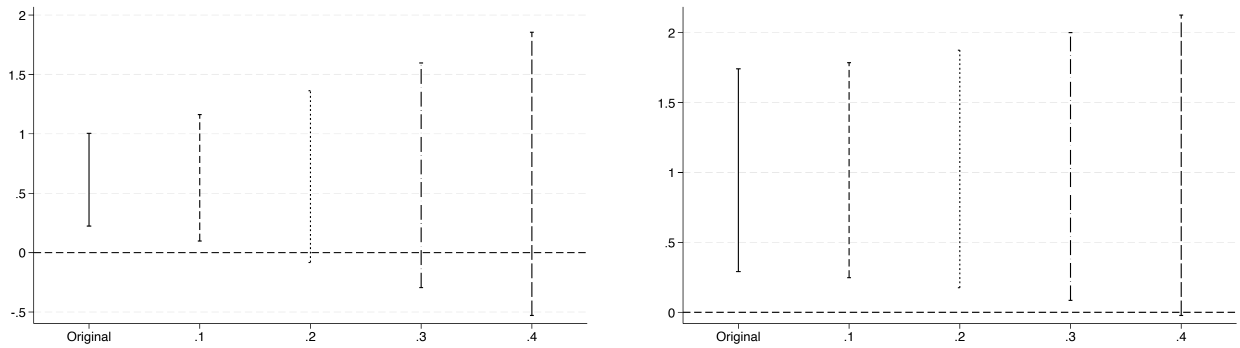
Notes. Standard errors in parentheses are two-way clustered at the firm and match levels in columns 1-3, and at the region level in columns 4-6. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Panel A of columns 1-3 and 4-6 report the estimated event study coefficients β_τ from the winners vs. losers research design (eq. (3.1)) and the full sample TWFE (equation (C.5)), respectively. Panel B reports the estimates from the corresponding pooled diff-in-diff specification. The dependent variables are log sales, TFPR, the inverse hyperbolic of directed credit and the total revenues from international trade fairs. In columns 2 and 6, the sample size decreases due to missing employment data. The coefficient β_{-1} is normalized to zero. Columns 1-3 include match-firm and match-year fixed effects, while columns 4-6 include firm and region-sector-year fixed effects.

Table C.8: Robustness. Alternative Inference and Levels of Clustering. Pooled Diff-in-diff. Direct Effects on Adopters. Winners vs. Losers Design

Dep.	Sale	TFPR	Ihs(Credit)	Ihs(KOTRA)
	(1)	(2)	(3)	(4)
Coefficient $\mathbb{1}[\text{Winner}_{it}] \times \mathbb{1}[4 \leq \tau \leq 7]$	0.58	0.66	−0.55	0.37
Alternative inference				
Baseline	[0.04]	[0.03]	[0.50]	[0.82]
Randomization inference	[0.04]	[0.03]	[0.58]	[0.85]
Wild bootstrap	[0.04]	[0.04]	[0.58]	[0.86]
Wild bootstrap-jackknifes	[0.04]	[0.03]	[0.58]	[0.85]
# Clusters	38×106	35×102	38×106	38×102
Alternative levels of clustering				
Match-level	[0.04]	[0.03]	[0.50]	[0.82]
# Clusters	38	36	38	38
Firm-level	[0.03]	[0.01]	[0.54]	[0.82]
# Clusters	106	102	106	106
N	852	537	852	852
Fixed effects	Match×Firm, Match×Year			

Notes. This table reports p-values, corresponding to the null that the estimated coefficient of $\mathbb{1}[\text{Winner}_{it}] \times \mathbb{1}[\text{Post}_{mt}]$ of the pooled diff-in-diff specification is equal to zero, from alternative inference procedures. In columns 1-4, the dependent variables are log sales, TFPR, and the inverse hyperbolic sine of directed credit and total revenues from trade fairs. In column 2, the sample size decreases due to missing employment data. P-values based on standard errors two-way clustered at the match and firm-levels are reported in brackets, obtained from the baseline asymptotic inference, randomization inference (Young, 2019), wild bootstrap, and alternative clustering at the match and firm-levels. All specifications include match-year and match-firm fixed effects.

Figure C.3: Robustness. Sensitivity to Violations of the Parallel Trend Assumption. Direct Effects on Adopters. Winners vs. Losers Design



A. Log sale B. TFPR

Notes. This figure presents results of the sensitivity checks for potential violations of the parallel trend assumption based on Rambachan and Roth (2023). The figure reports the estimated 90% confidence intervals, based on standard errors two-way clustered at the firm and match levels, for β_4 of eq. (3.1) over different values of M which is a parameter that governs magnitude of violations to the parallel trend assumption: $\Delta^{RM}(M) = \{\delta : \forall t \geq 0, |\delta_{t+1} - \delta_t| \leq M \times \max_{s\leq 0} |\delta_{s+1} - \delta_s|$, where $\max_{s\leq 0} |\delta_{s+1} - \delta_s|$ is the maximum pre-treatment violation of parallel trends. $M = 1$ is a natural benchmark, which bounds the worst-case post-treatment difference in trends by the maximum in pre-treatment periods (Rambachan and Roth, 2023, p.2563). β_{-1} is normalized to zero. In Panels A and B, the dependent variables are log sales and TFPR, respectively. All specifications include match-year and match-firm fixed effects.

Table C.9: Robustness. Alternative Matching Variables. Direct Effects on Adopters

Matching variables	sector, region year (baseline)		sector, seller cty state, year		sector, agg-seller cty state, year	
Dep.	Sale	TFPR	Sale	TFPR	Sale	TFPR
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A. Event Study					
5 years before	0.09	0.04	−0.09	0.10	0.01	0.06
	(0.22)	(0.29)	(0.34)	(0.39)	(0.28)	(0.38)
4 years before	0.12	0.03	0.28	0.25	0.18	0.13
	(0.16)	(0.24)	(0.29)	(0.35)	(0.22)	(0.33)
3 years before	0.17	0.03	0.37	0.05	0.40	−0.15
	(0.12)	(0.18)	(0.25)	(0.35)	(0.23)	(0.40)
2 years before	−0.06	0.01	0.03	0.38	0.06	0.00
	(0.10)	(0.13)	(0.23)	(0.31)	(0.13)	(0.31)
1 year before						
Year of event	0.12	0.10	0.34*	0.27	0.26	0.16
	(0.09)	(0.13)	(0.19)	(0.41)	(0.17)	(0.33)
1 year after	0.25	0.35*	0.51*	0.93*	0.39	0.72*
	(0.15)	(0.20)	(0.25)	(0.50)	(0.23)	(0.40)
2 years after	0.24*	0.26	0.39	0.49	0.29	0.38
	(0.14)	(0.16)	(0.25)	(0.36)	(0.23)	(0.28)
3 years after	0.36	0.27	0.73**	0.97*	0.66**	0.82*
	(0.25)	(0.31)	(0.31)	(0.50)	(0.31)	(0.44)
4 years after	0.66*	0.64*	1.01**	1.13**	0.97*	0.98**
	(0.33)	(0.32)	(0.47)	(0.51)	(0.47)	(0.46)
5 years after	0.59*	0.48	0.90*	1.10*	0.83*	0.96*
	(0.30)	(0.38)	(0.45)	(0.55)	(0.46)	(0.51)
6 years after	0.71**	0.94**	0.99**	1.34***	0.84*	1.13**
	(0.30)	(0.37)	(0.41)	(0.44)	(0.46)	(0.45)
7 years after	0.61**	1.02**	1.05***	1.47**	0.83**	1.20*
	(0.24)	(0.44)	(0.35)	(0.59)	(0.37)	(0.64)
# Clusters	106 × 38	102 × 36	46 × 18	42 × 16	51× 22	48 × 20
N	1071	678	433	250	465	264

Notes. Standard errors in parenthesis are two-way clustered at the firm and match levels. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the estimated event study coefficients β_τ from winners vs. losers research design (eq. (3.1)). β_{-1} is normalized to zero. In columns 1-2, 3-4, and 5-6, the control groups are constructed by exactly matching on sector-region-year, sector-aggregated region-seller country-year, sector-aggregated region-aggregated seller country-year, respectively. In columns 1, 3, and 5 (2, 4, and 6), the dependent variables are log sales (TFPR). In even columns, the sample size decreases due to missing employment data. All specifications include match-firm and match-year fixed effects.

Table C.10: Robustness. Additional Controls. Direct Effects on Adopters

Dep.	Log sale (1)	TFPR (2)	Log sale (3)	TFPR (4)	Log sale (5)	TFPR (6)	Log sale (7)	TFPR (8)	Log sale (9)	TFPR (10)
5 years before	0.09	0.04	0.09	0.05	0.09	0.05	0.13	0.15	0.14	0.17
	(0.22)	(0.29)	(0.22)	(0.28)	(0.22)	(0.29)	(0.22)	(0.24)	(0.22)	(0.24)
4 years before	0.12	0.03	0.13	0.05	0.12	0.04	0.10	0.08	0.11	0.10
	(0.16)	(0.24)	(0.16)	(0.23)	(0.16)	(0.24)	(0.16)	(0.21)	(0.15)	(0.21)
3 years before	0.17	0.03	0.17	0.03	0.17	0.03	0.15	0.06	0.15	0.07
	(0.12)	(0.18)	(0.12)	(0.18)	(0.12)	(0.18)	(0.12)	(0.17)	(0.12)	(0.17)
2 years before	−0.06	0.01	−0.06	0.01	−0.06	0.02	−0.07	−0.01	−0.07	−0.00
	(0.10)	(0.13)	(0.10)	(0.12)	(0.10)	(0.13)	(0.11)	(0.12)	(0.10)	(0.12)
1 year before										
Year of event	0.12	0.10	0.12	0.11	0.12	0.11	0.10	0.09	0.11	0.12
	(0.09)	(0.13)	(0.09)	(0.14)	(0.09)	(0.14)	(0.09)	(0.14)	(0.09)	(0.14)
1 year after	0.25	0.35*	0.25	0.36*	0.25	0.36*	0.23	0.33*	0.23	0.35*
	(0.15)	(0.20)	(0.15)	(0.20)	(0.15)	(0.20)	(0.15)	(0.19)	(0.15)	(0.20)
2 years after	0.24*	0.26	0.24*	0.28*	0.24*	0.28	0.23*	0.27*	0.24*	0.30*
	(0.14)	(0.16)	(0.14)	(0.16)	(0.14)	(0.17)	(0.14)	(0.15)	(0.14)	(0.16)
3 years after	0.36	0.27	0.37	0.29	0.37	0.30	0.32	0.25	0.33	0.28
	(0.25)	(0.31)	(0.25)	(0.31)	(0.25)	(0.33)	(0.25)	(0.33)	(0.25)	(0.35)
4 years after	0.66*	0.64*	0.67*	0.65**	0.67*	0.66*	0.59*	0.60*	0.60*	0.63*
	(0.33)	(0.32)	(0.33)	(0.31)	(0.33)	(0.33)	(0.32)	(0.31)	(0.33)	(0.32)
5 years after	0.59*	0.48	0.59*	0.47	0.60*	0.54	0.51*	0.52	0.52*	0.56
	(0.30)	(0.38)	(0.30)	(0.38)	(0.31)	(0.41)	(0.27)	(0.34)	(0.28)	(0.36)
6 years after	0.71**	0.94**	0.70**	0.93**	0.71**	0.96**	0.62**	1.11***	0.62**	1.10***
	(0.30)	(0.37)	(0.30)	(0.38)	(0.30)	(0.38)	(0.28)	(0.38)	(0.28)	(0.38)
7 years after	0.61**	1.02**	0.61**	1.00**	0.62**	1.04**	0.53**	1.11***	0.53**	1.10***
	(0.24)	(0.44)	(0.24)	(0.45)	(0.24)	(0.45)	(0.23)	(0.33)	(0.23)	(0.34)
Directed credit			✓	✓					✓	✓
Complex ctrl					✓	✓			✓	✓
Trade ctrl							✓	✓	✓	✓
# Clusters	106 × 38	102 × 36	106 × 38	102 × 35	106 × 38	102 × 36	106 × 38	102 × 36	106 × 38	102 × 36
N	1071	678	1071	678	1071	678	1071	678	1071	678

Notes. Standard errors in parenthesis are two-way clustered at the firm and match levels. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the estimated event study coefficients β_τ from winners vs. losers research design (eq. (3.1)). β_{-1} is normalized to zero. In odd and even columns, the dependent variables are log sales and TFPR. Columns 3 and 4 include the inverse hyperbolic sine of directed credit. Columns 5 and 6 includes tax favors associated with being in industrial complexes. Columns 7 and 8 include changes in log import/input tariffs, interacted with log distance to port and initial export status, and the inverse hyperbolic sine of the total revenues/number of participation in international trade fairs. Columns 9 and 10 include all additional controls. All specifications include match-firm and match-year fixed effects.

Table C.11: Robustness. Alternative Outcomes and Estimation Samples. Direct Effects on Adopters

Robustness	Alternative outcomes			Alternative samples				
Dep.	Labor prod.	$TFPR^{OP}$	Fixed asset	Sale				
Sample.	Baseline			Non-missing emp.	# match = 2	# match = 3	# match = 5	All adopters
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
5 years before	−0.17	−0.02	−0.02	0.17	−0.02	0.04	0.08	0.09
	(0.63)	(0.47)	(0.26)	(0.27)	(0.25)	(0.22)	(0.23)	(0.22)
4 years before	−0.07	−0.02	−0.01	0.08	0.08	0.11	0.13	0.13
	(0.48)	(0.37)	(0.21)	(0.25)	(0.19)	(0.16)	(0.16)	(0.16)
3 years before	−0.20	−0.05	−0.05	0.13	0.11	0.15	0.17	0.20
	(0.37)	(0.27)	(0.15)	(0.15)	(0.13)	(0.12)	(0.12)	(0.12)
2 years before	−0.15	−0.04	0.15	0.04	−0.07	−0.05	−0.06	−0.04
	(0.19)	(0.16)	(0.18)	(0.11)	(0.11)	(0.11)	(0.10)	(0.11)
1 year before								
Year of event	0.15	0.14	−0.06	0.07	0.16	0.12	0.12	0.15*
	(0.18)	(0.16)	(0.09)	(0.12)	(0.10)	(0.09)	(0.09)	(0.09)
1 year after	0.48*	0.43*	−0.11	0.28	0.22	0.26	0.25	0.30*
	(0.25)	(0.21)	(0.13)	(0.19)	(0.15)	(0.16)	(0.15)	(0.15)
2 years after	0.39*	0.32*	−0.12	0.17	0.17	0.23	0.23*	0.27*
	(0.22)	(0.18)	(0.13)	(0.14)	(0.14)	(0.14)	(0.13)	(0.14)
3 years after	0.31	0.27	0.06	0.20	0.23	0.33	0.35	0.38
	(0.25)	(0.28)	(0.19)	(0.31)	(0.21)	(0.26)	(0.25)	(0.25)
4 years after	0.33	0.45	0.39	0.81***	0.56*	0.65*	0.65*	0.68**
	(0.42)	(0.33)	(0.31)	(0.21)	(0.30)	(0.34)	(0.33)	(0.33)
5 years after	0.96*	0.57	0.55	0.69***	0.58*	0.57*	0.58*	0.60*
	(0.54)	(0.39)	(0.38)	(0.23)	(0.30)	(0.31)	(0.30)	(0.30)
6 years after	0.95	0.84**	0.40	1.26**	0.64**	0.67**	0.68**	0.70**
	(0.58)	(0.33)	(0.36)	(0.47)	(0.31)	(0.31)	(0.30)	(0.30)
7 years after	0.25	0.96	0.09	1.38***	0.63**	0.60**	0.58**	0.61**
	(1.28)	(0.58)	(0.22)	(0.31)	(0.26)	(0.24)	(0.25)	(0.25)
# Clusters	102 × 36	102 × 36	106 × 38	102 × 36	88 × 38	99 × 38	112 × 38	122 × 38
N	678	678	1,063	678	865	975	1,135	1,228
Fixed effect	Match×Year, Match×Firm							

Notes. Standard errors in parenthesis are two-way clustered at the firm and match levels. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the estimated event study coefficients β_τ from winners vs. losers research design (eq. (3.1)). β_{-1} is normalized to zero. In columns 1, 4, and 5-9, the dependent variables are log labor productivity, TFPR based on Olley and Pakes (1996), log fixed asset, dummies of exporting, and log sales, respectively. In columns 1-2, the sample size decreases due to missing employment data. In column 5, we consider estimation sample with non-missing employment information. In columns 6, 7, and 8, we consider alternative numbers of matched winners of 2, 3, and 5, respectively. In column 9, we construct a set of winners using all firms that adopted technologies in the year of the event within the corresponding losers' region-sectors. All specifications include match-firm and match-year fixed effects.

Table C.12: Local Spillover. TFPR

	OLS	IV						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dep. ΔTFPR$_{it}$ 1972-1979 or 1973-1980							
$\Delta\text{Share}_{(-i)nj,t-2}$	-0.34	1.97***	1.63***	1.55***	1.59***	1.64***	1.74***	1.64***
	(0.37)	(0.63)	(0.55)	(0.56)	(0.57)	(0.54)	(0.55)	(0.55)
KP-F		18.53	22.83	19.85	22.18	22.66	26.68	19.17
# Clusters	67×742							
N	824	824	824	824	824	824	824	824
Fixed effects	Region, Sector, Sector×Group							
Business group sales share			✓	✓	✓	✓	✓	✓
Region-sector ctrl				✓				✓
Directed credit					✓			✓
Complex ctrl						✓		✓
Trade ctrl							✓	✓

Notes. Standard errors in parentheses are two-way clustered at the region and business group levels. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the OLS and IV estimates of eq. (3.3). Adopter shares and IV are defined in eq. (3.2) and (3.4). The sample consists of firms that never adopted technology between 1970-1982. The dependent variables are changes in TFPR (1972-1979/1973-1980), respectively. In Panel B, the sample size decreases due to missing employment. Columns 3-8 include business groups' predicted sales shares (eq. (C.4); see Appendix C.5). Column 4 includes predicted market access (eq. (C.2)) and log distance to port interacted with predicted exports. Column 5 includes the inverse hyperbolic sine of cumulative credit received (1972-1979/1973-1980). Column 6 includes industrial complex dummies and tax favors provided for firms in industrial complexes. Column 7 includes changes in log import/input tariffs, interacted with log distance to port and initial export status, and the inverse hyperbolic sine of total revenues and the number of participation in international trade fairs (1972-1979/1973-1980). Column 8 includes all additional controls. All specifications include region, sector, and sector-group fixed effects, and the initial levels of the dependent variables. KP-F is the Kleibergen-Paap F-statistics.

Table C.13: First Stage Regression. Local Spillovers and Complementarity

	Local spillovers						Local complementarity		
Second stage dep.	$\Delta \ln \text{Sale}_{it}$			ΔTFPR_{it}			$\Delta\mathbb{1}[\text{New Contract}_{it}]$		
First stage dep.	$\Delta\text{Share}_{(-i)nj,t-2}$ 1972-1979 or 1973-1980								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\text{IV}^{\geq 100\text{km},t_0}_{(-i)nj,t-2}$	0.19***	0.19***	0.19***	0.17***	0.17***	0.18***	0.19***	0.19***	0.19***
	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)
# clusters	$79 \times 1{,}294$			67×742			$86 \times 1{,}548$		
N	1,492	1,492	1,492	824	824	824	1,977	1,977	1,977
Fixed effects	Region, Sector, Group×Sector								
Business group sales share		✓	✓		✓	✓		✓	✓
Additional ctrl			✓			✓			✓

Notes. Standard errors two-way clustered at the region and business group levels are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Columns 1-2, and 3-4 report the first stage regression results of Table 1, respectively. Adopter shares and IV are defined in eqs. (3.2) and (3.4), respectively. In columns 1-6, the sample consists of firms that never adopted technology during the sample period, while in columns 7-9, the sample consists of all firms. In columns 4-6, the sample size decreases due to missing employment data. Columns 3. 6, and 9 include the vector of additional controls used in column 8 of Tables 1. All specifications include the initial dependent variables, the predicted business groups' sales shares within region sectors (eq. (C.4), detailed in Appendix C.5), and region, sector, and sector-group fixed effects.

Table C.14: Robustness. Alternative Specification with the Two Endogenous Variables. Local Spillovers and Complementarity

Dep.	1972-1979 or 1973-1980					
	$\Delta \ln \text{Sale}_{it}$		ΔTFPR_{it}		$\Delta\mathbb{1}[\text{New Contract}_{it} > 0]$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta\text{Share}_{(-i)nj,t-2}$	4.06***	3.72***	2.54***	2.42***	0.76**	0.76**
	(1.16)	(1.03)	(0.90)	(0.83)	(0.33)	(0.33)
$\Delta\text{Share}^{\text{sale}}_{(-i)nj,t-2}$	1.33**	0.92	0.75**	0.70**	−0.15	−0.13
	(0.64)	(0.65)	(0.33)	(0.35)	(0.27)	(0.24)
KP-F	5.78	7.31	7.28	8.17	7.54	10.28
SW-F, $\text{IV}_{(-i)nj,t-2}$	11.31	13.55	12.31	13.04	10.85	9.51
SW-F, $\text{IV}^{\text{sale}}_{(-i)nj,t-2}$	12.29	16.66	17.36	21.06	15.44	21.48
# Clusters	$79 \times 1{,}294$		67×742		$86 \times 1{,}548$	
N	1,492	1,492	824	824	1,977	1,977
Fixed effects	Region, Sector, Sector × Group					
Additional ctrl		✓		✓		✓

Notes. Standard errors two-way clustered at the region and business group levels are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. $\text{Share}^{\text{sale}}_{(-i)nj,t-2}$ is business groups' sales shares within region-sectors, excluding own group, defined in eq. (C.3), instrumented by the corresponding IV (eq. (C.4), detailed in Appendix C.5). In columns 1-2, 3-4, and 5-6, the dependent variables are changes in log sales, TFPR, and dummies of making new adoption contracts between 1972-1979 or 1973-1980, respectively. In columns 1-4, the sample consists of firms that never adopted technology during the sample period, while in columns 5-6, the sample consists of all firms. In columns 3-4, the sample size decreases due to missing employment data. KP-F and SW-F are the Kleibergen-Paap and Sanderson-Windmeijer F-statistics. Columns 2, 4, and 6 include the vector of additional controls used in column 8 of Table 1. All specifications include the initial dependent variables and region, sector, and sector-group fixed effects.

Table C.15: Business Groups are Not More Responsive to Region-Sector Level Incentives. OLS

Dep.	$\Delta \ln \text{Sale}_{it}$ 1972-1979 or 1973-1980	
	(1)	(2)
$\mathbb{1}[\text{Complex}_{nj}]$	0.07	0.07
	(0.15)	(0.16)
Tax favor_{nj}	0.44^{**}	0.43^{*}
	(0.22)	(0.23)
$\mathbb{1}[\text{Group}_i] \times \mathbb{1}[\text{Complex}_{nj}]$		-0.17
		(0.29)
$\mathbb{1}[\text{Group}_i] \times \text{Tax favor}_{nj}$		0.08
		(0.23)
# Clusters	$79 \times 1{,}294$	$79 \times 1{,}294$
N	1492	1492

Notes. Standard errors in parenthesis are two-way clustered at the region and business group levels. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the OLS estimates obtained from where we regress sales growth on a dummy of being located in industrial complexes ($\mathbb{1}[\text{Complex}_{nj}]$), tax favor provided for firms in these complexes (Tax favor_{nj}) is, and their interaction terms with a dummy of being affiliated with any business groups ($\mathbb{1}[\text{Group}_i]$). All specifications include region, sector, and sector-group fixed effects, and the initial levels of dependent variables.

Table C.16: Robustness. Alternative Cutoff. Heterogeneous Effects of Local Complementarity in Technology Adoption Decisions

Dep.	$\Delta\mathbb{1}$[New Contract$_{it}$] 1972-1979 or 1973-1980			
Cutoff percentile of MA	70th	75th	80th	85th
	(1)	(2)	(3)	(4)
Low MA × ΔShare$_{(-i)nj,t-2}$	−3.02	0.24	0.29*	0.21
	(2.12)	(0.18)	(0.17)	(0.15)
High MA × ΔShare$_{(-i)nj,t-2}$	0.86**	1.01*	1.02*	1.05*
	(0.38)	(0.54)	(0.55)	(0.57)
KP-F	2.00	20.51	21.88	17.42
SW-F, Low MA	4.09	338.47	451.48	341.58
SW-F, High MA	23.51	45.66	49.38	45.43
p-val. (low MA = High MA)	[0.08]	[0.09]	[0.11]	[0.13]
# Clusters	86 × 1,548	86 × 1,548	86 × 1,548	86 × 1,548
N	1,977	1,977	1,977	1,977
Fixed effect	Region, Sector, Group×Sector			
Business group sales share	✓	✓	✓	✓
Additional ctrl	✓	✓	✓	✓

Notes. Standard errors in parenthesis are two-way clustered at the region and business group levels. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the IV estimates of eq. (3.3). Adopter shares Share$_{(-i)nj,t-h}$ and the IV are defined in eqs. (3.2) and (3.4). Columns 1-4 include interaction terms between adopter shares and dummies for low and high initial market access, defined based on the 70th, 75th, 80th, and 85th percentiles, respectively. The dependent variables are changes of dummies of making new adoption contracts between 1972-1979 or 1973-1980. All specifications include the predicted business groups' sales shares (eq. (C.4), detailed in Appendix C.5), the vector of additional controls used in column 8 of Table 1, and region, sector, and sector-group fixed effects, and the initial levels of dependent variables. KP-F and SW-F are the Kleibergen-Paap and Sanderson-Windmeijer F-statistics, respectively. We also report the p-values in brackets associated with the null that the coefficients of the two interaction terms are equal.

Table C.17: Robustness. Additional Evidence on Coordination Failure: Adoption Likelihood Increases with Prior Local Adoptions from the Same Country.

Dep.	$\mathbb{1}$[New Contract] 1972-1979 or 1973-1980							
	Seller Country				Seller Aggregated Country			
	Initially Adopted		Not Initially Adopted		Initially Adopted		Not Initially Adopted	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta\text{Share}_{(-i)nj,t-2}$	0.29*	0.25*	0.54	0.55	0.30*	0.27*	0.55	0.56
	(0.16)	(0.14)	(0.41)	(0.40)	(0.16)	(0.15)	(0.42)	(0.40)
KP-F	17.66	18.26	17.62	18.21	17.66	18.26	17.62	18.21
# Clusters	$86 \times 1{,}548$							
N	1977	1977	1977	1977	1977	1977	1977	1977
Fixed effect	Region, Sector, Group×Sector							
Business group sales share	✓	✓	✓	✓	✓	✓	✓	✓
Aditional ctrl		✓		✓		✓		✓

Notes. Standard errors two-way clustered at the region and business group levels are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the IV estimates of eq. (3.3). Adopter shares and IV are defined in eqs. (3.2) and (3.4). In columns 1-2 (3-4), the dependent variables are changes in dummies for new contracts with countries from which other local firms had already (not yet) adopted in the initial period; columns 5-8 define these variables analogously, but aggregate countries to the continent level, except for the US and Japan. All specifications include business groups' predicted sales shares within region-sectors (eq. (C.4), detailed in Appendix C.5), the initial dependent variables, and region, sector, and sector-group fixed effects. Additional controls include the same set of controls used in column 8 of Table 1. KP-F is the Kleibergen-Paap F-statistics.

Table C.18: Robustness. Alternative IVs. Local Spillovers and Complementarity

Robustness	Excl. business groups whose total fixed assets exceed certain thresholds			Excl. Samsung Hyundai	Alternative distance			
	30%	50%	70%		50 km	75 km	125 km	150 km
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A. Dep. $\Delta \ln Sale_{it}$ *1972-1979 or 1973-1980*							
$\Delta\text{Share}_{(-i)nj,t-2}$	2.60***	2.74***	2.72***	2.73***	2.61***	2.73***	2.72***	2.74***
	(0.74)	(0.75)	(0.75)	(0.76)	(0.76)	(0.73)	(0.73)	(0.72)
KP-F	27.24	22.37	22.28	23.27	22.82	21.92	21.07	20.74
# Clusters				$79 \times 1{,}294$				
N	1,492	1,492	1,492	1,492	1,492	1,492	1,492	1,492
	Panel B. Dep. $\Delta TFPR_{it}$ *1972-1979 or 1973-1980*							
$\Delta\text{Share}_{(-i)nj,t-2}$	1.73***	1.74***	1.73***	1.68***	1.60***	1.64***	1.64***	1.65***
	(0.57)	(0.56)	(0.56)	(0.57)	(0.56)	(0.55)	(0.53)	(0.53)
KP-F	30.58	25.71	25.60	24.63	23.96	23.17	22.21	21.86
# Clusters				67×742				
N	824	824	824	824	824	824	824	824
	Panel C. Dep. $\Delta \mathbb{1}[New\ Contract_{it} > 0]$ *1972-1979 or 1973-1980*							
$\Delta\text{Share}_{(-i)nj,t-2}$	1.08**	1.09**	1.08**	0.85**	0.77*	0.85**	0.79*	0.79*
	(0.48)	(0.48)	(0.47)	(0.42)	(0.40)	(0.42)	(0.40)	(0.40)
KP-F	17.64	18.99	18.96	17.55	19.46	17.76	15.00	15.07
# Clusters				$86 \times 1{,}548$				
N	1,977	1,977	1,977	1,977	1,977	1,977	1,977	1,977
Fixed effect				Region, Sector, Group×Sector				
Business group sales share	✓	✓	✓	✓	✓	✓	✓	✓

Notes. Standard errors two-way clustered at the region and business group levels are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the IV estimates of eq. (3.3). Adopter shares and IV are defined in eqs. (3.2) and (3.4). In Panels A, B, and C, the dependent variables are changes in log sales, TFPR, and dummies of making new adoption contracts between 1972-1979 or 1973-1980, respectively. In Panels A and B, the sample consists of firms that never adopted technology during the sample period, while in Panel C, the sample consists of all firms. In Panel B, the sample size decreases due to missing employment data. All specifications include business groups' predicted sales shares within region-sectors (eq. (C.4), detailed in Appendix C.5), the initial dependent variables, and region, sector, and sector-group fixed effects. KP-F is the Kleibergen-Paap F-statistics.

Table C.19: Robustness. Correlation between Observed Subsidy-Related Variables and the IV. Local Spillovers and Complementarity

Dep.	1972-1979 or 1973-1980			
	ΔIhs(Cum. Credit)		ΔIhs(Cum. Kotra)	
	(1)	(2)	(3)	(4)
$IV_{inj,t-2}$	−0.00	0.06	2.06	2.51
	(1.32)	(1.47)	(2.80)	(2.62)
# Clusters	86 × 1,548			
N	1,977	1,977	1,977	1,977
Fixed effects	Region, Sector, Group×Sector			
Business group sales share	✓	✓	✓	✓
Additional ctrl		✓		✓

Notes. Standard errors two-way clustered at the region and business group levels are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the OLS coefficients obtained by regressing subsidy-related variables on the IV defined in eq. (3.4). In columns 1-2 and 3-4, the dependent variables are changes in the inverse hyperbolic sine of cumulative directed credit and contract values made in international trade fairs between 1972-1979 or 1973-1980, respectively. Columns 2 and 4 include the vector of variables used in column 8 of Table 1. All specifications include business groups' predicted sales shares within region-sectors (eq. (C.4), detailed in Appendix C.5), the initial dependent variables, and region, sector, and sector-group fixed effects. KP-F is the Kleibergen-Paap F-statistics.

Table C.20: Robustness. Placebo. Local Spillovers and Complementarity

Dep.	1970-1972 or 1971-1973					
	$\Delta \ln \text{Sale}_{it}$			$\Delta \mathbb{1}[\text{New Contract}_{it}]$		
	OLS	RF	IV	OLS	RF	IV
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \text{Share}_{(-i)nj,t-2}$	0.07		2.17	0.05		−0.38
	(0.36)		(1.67)	(0.07)		(0.30)
$\text{IV}_{nj,t-2}$		0.55			−0.08	
		(0.47)			(0.07)	
KP-F			18.21			11.99
# clusters		73×830			86×1,395	
N	1,004	1,004	1,004	1,788	1,788	1,788
Fixed effects	Region, Sector, Group×Sector					
Business group sales share	✓	✓	✓	✓	✓	✓

Notes. Standard errors two-way clustered at the region and business group levels are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the OLS, reduced-form, and IV estimates of eq. (3.3). Adopter shares and IV are defined in eqs. (3.2) and (3.4). In columns 1-3 and 4-6, the dependent variables are changes in log sales or dummies of making new adoption contracts between 1970-1972 or 1971-1973, respectively. In Columns 1-3, the sample consists of firms that never adopted technologies during the sample period, while in columns 4-6, the sample consists of all firms. All specifications include business groups' predicted sales shares within region-sectors (eq. (C.4), detailed in Appendix C.5), the initial depedent variables, and region, sector, and sector-group fixed effects. KP-F is the Kleibergen-Paap F-statistics.

Table C.21: Robustness. Spatial Correlation. Moran's I Statistics. Local Spillovers and Complementarity

Dep.	1972-1979 or 1973-1980											
	$\Delta \ln \text{Sale}_{it}$				ΔTFPR_{it}				$\Delta \mathbb{1}[\text{New Contract}_{it}]$			
Morans' I	75 km (1)	100 km (2)	150 km (3)	200 km (4)	75 km (5)	100 km (6)	150 km (7)	200 km (8)	75 km (9)	100 km (10)	150 km (11)	200 km (12)
z-score	−1.25	−0.94	−0.79	−0.68	−0.95	−0.83	−0.77	−0.70	−1.18	−0.86	−0.71	−0.64
p-val	[0.21]	[0.35]	[0.43]	[0.50]	[0.34]	[0.41]	[0.44]	[0.49]	[0.24]	[0.39]	[0.48]	[0.52]
N	1,492	1,492	1,492	1,492	842	842	842	842	1,977	1,977	1,977	1,977
Fixed effects	Region, Sector, Sector × Group											
Business group sales share	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes. This table reports Moran's I statistics which test the presence of spatial auto-correlations upto different thresholds. Moran's I statistics are computed based on residuals from the regression models in eq. (3.3). In columns 1-4, 5-8, and 9-12, the dependent variables are changes in log sales, TFPR, and dummies of making new contracts between 1972-1979 or 1973-1980, respectively. In columns 1-8, the sample consists of firms that never adopted technologies during the sample period, while in columns 9-12, the sample consists of all firms. In columns 5-8, the sample size decreases due to missing employment data. All specifications include business groups' predicted sales shares within region-sectors (eq. (C.4), detailed in Appendix C.5), the initial dependent variables, and region, sector, and sector-group fixed effects. KP-F is the Kleibergen-Paap F-statistics.

Table C.22: Robustness. Firm Entry and Exit. Local Spillovers and Complementarity

Dep.	Exit dummy in 1979 or 1980		Entry dummy in 1979 or 1980	
	(1)	(2)	(3)	(4)
$\Delta\text{Share}_{nj,t-2}$	−0.23	−0.09	−0.02	−0.04
	(0.61)	(0.70)	(0.15)	(0.17)
KP-F	13.87	13.35	21.88	26.50
# Clusters	86 × 2,502	86 × 2,502	86 × 3,360	86 × 3,360
N	4,118	4,118	6,231	6,231
Fixed effects	Region, Sector, Group×Sector			
Business group sales share	✓	✓	✓	✓
Additional ctrl		✓		✓

Notes. Standard errors two-way clustered at the region and business group levels are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The table report the IV estimates of equation (3.3). The dependent variables are the exit and entry dummies in 1979 or 1980 in columns 1-2 and 3-4, respectively. Between 1972-1979, there were 1,800 firms operating in 1972. Out of 1,800, 932 firms were continuously operating in both 1972 and 1979 and 868 firms exited in 1980, whereas 2,288 firms entered in 1979. Between 1973-1980, there were 2,176 firms operating in 1973. Out of 2,176, 1,069 firms were continuously operating in both 1973 and 1980 and 1,107 firms exited in 1980, whereas 1,981 firms entered in 1980. The firms that continuously operated (927 and 1,062 firms in the two respective periods) serve as the estimation sample for spillover and complementarity regressions in Table 1. Out of 1,989, 12 observations were dropped due to inclusion of fixed effects. Columns 2 and 4 include the the vector of additional controls used in column 8 of Table 1. All specifications include business groups' predicted sales shares within region-sectors (equation (C.4), detailed in Appendix C.5), and region, sector, and group-sector fixed effects. KP-F is the Kleibergen-Paap F-statistics.

Table C.23: Robustness. Alternative Inference. Local Spillovers and Complementarity

Dep.	1972-1979 or 1973-1980		
	$\Delta \ln \text{Sale}_{it}$	ΔTFPR_{it}	$\Delta\mathbb{1}[\text{New Contract}_{it} > 0]$
	(1)	(2)	(3)
Coefficient $\Delta\text{Share}_{nj,t-2}$	2.70	1.63	0.85
Baseline p-val	[0.00]	[0.00]	[0.04]
Bootstrap p-val (Young, 2022)	[0.03]	[0.22]	[0.08]
Spatial HAC p-val (Conley, 1999)			
Bandwidth 75 km	[0.00]	[0.00]	[0.05]
Bandwidth 100 km	[0.00]	[0.00]	[0.04]
Bandwidth 150 km	[0.00]	[0.00]	[0.03]
Alternative clustering p-val			
Region	[0.00]	[0.00]	[0.04]
Region-sector	[0.00]	[0.02]	[0.07]
Two-way, region-sector & group	[0.00]	[0.02]	[0.07]
Weak-IV-robust inference			
Anderson-Rubin test p-val	[0.00]	[0.00]	[0.04]
Two-step AR-CI 95% (Andrews, 2018)	$\{1.22, 4.19\}$	$\{0.74, 2.84\}$	$\{0.09, 1.76\}$
N	1,492	842	1,977
Fixed effects	Region, Sector, Sector×Group		
Business group sales share	✓	✓	✓

Notes. This table reports p-values and confidence intervals, corresponding to the null that the coefficient of $\Delta\text{Share}_{(-i)nj,t-2}$ is zero, based on alternative inference procedures. P-values and confidence intervals are in brackets and braces, respectively. The baseline p-values are based on standard errors two-way clustered at the region and business group levels. The bootstrap p-values are obtained by applying wild bootstrap. Spatial HAC is inference based on spatial heteroskedasticity autocorrelation consistent standard errors following Conley (1999). Two-step AR-CI 95% is the 95% confidence interval of the Anderson-Rubin test based on Andrews (2018). In columns 1, 2, and 3, the dependent variables are changes in log sales, TFPR, and dummies of making new adoption contracts between 1972-1979 or 1973-1980, respectively. In columns 1-2, the sample consists of firms that never adopted technologies, while in column 3, the sample consists of all firms. In column 2, the sample size decreases due to missing employment data. All specifications include region, sector, group-sector fixed effects, and the initial dependent variables. KP-F is the Kleibergen-Paap F-statistics.

Table C.24: Robustness. Alternative Outcomes, Lag, and Estimation Samples, and Omitting y_{it_0}. Local Spillovers

Robustness	Alternative outcomes				Omitting y_{it_0}	Alternative lag	Alternative samples		
Dep.	$\Delta \text{TFPR}^{OP}_{it}$	$\Delta \ln \text{Labor prod}_{it}$	$\Delta \mathbb{1}[\text{Export}_{it} > 0]$	$\Delta \ln \text{Fixed asset}_{it}$	$\Delta \ln \text{Sale}_{it}$				
Samples.	Never-adopter						Non-missing emp.	Excl. business group firms	Excl. regions with industrial complex
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\Delta \text{Share}_{(-i)nj,t-2}$	0.96**	1.07*	0.99**	4.85***	1.80*		3.46***	2.55***	1.93**
	(0.46)	(0.56)	(0.46)	(1.07)	(0.91)		(0.92)	(0.75)	(0.80)
$\Delta \text{Share}_{(-i)nj,t-3}$						2.43***			
						(0.51)			
KP-F	23.63	23.61	21.86	21.70	21.75	126.74	21.79	22.09	17.68
# Clusters	67 × 742	67 × 742	79 × 1,294	79 × 1,291	79 × 1,294	79 × 1,294	67 × 742	79 × 1,221	76 × 999
N	824	824	1,492	1,489	1,492	1,492	824	1,360	1,117
Fixed effect	Region, Sector, Group×Sector								
Business group sales share	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes. Standard errors in parenthesis are two-way clustered at the region and business group levels. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the IV estimates of eq. (3.3). Adopter shares $\text{Share}_{(-i)nj,t-h}$ and the IV are defined in eqs. (3.2) and (3.4). The sample consists of firms that never adopted technologies during the sample period. In columns 1, 2, 3, 4, and 5-9, the dependent variables are changes in TFPR based on Olley and Pakes (1996), log labor productivity, dummies of exporting, log fixed asset, and log sales, respectively, between 1972-1979 or 1973-1980. In columns 1-3, the sample size decreases due to missing data. All specifications, except for column 5, include the initial dependent variables. In column 6, we consider the alternative lag of 3. We consider the alternative estimation sample with non-missing employment in column 7; the sample that excludes firms affiliated with business groups in column 8; and the sample that exclude firms in regions with the industrial complexes in column 9. All specifications include the business group sales shares control (eq. (C.4), detailed in Appendix C.5), and region, sector, and sector-group fixed effects. KP-F is the Kleibergen-Papp F-statistics.

Table C.25: Robustness. Alternative Lags and Estimation Samples, and Omitting y_{it_0}. Local Complementarity

Robustness	Omitting y_{it_0}	Alternative lag	Alternative sample		
Dep.	$\Delta\mathbb{1}[\text{New Contract}_{it} > 0]$ 1972-1979 or 1973-1980				
Sample	Full sample		Non-missing emp.	Excl. business group firms	Excl. regions with industrial complex
	(1)	(2)	(3)	(4)	(5)
$\Delta\text{Share}_{(-i)nj,t-2}$	1.11**		0.79	0.66*	1.12**
	(0.44)		(0.53)	(0.39)	(0.48)
$\Delta\text{Share}_{(-i)nj,t-3}$		0.43*			
		(0.23)			
KP-F	16.69	143.87	12.44	11.24	12.70
# Clusters	86 × 1,548	86 × 1,548	76 × 950	83 × 1,454	84 × 1,194
N	1,977	1,977	1,177	1,701	1,430
Fixed effect	Region, Sector, Group×Sector				
Business group sales share	✓	✓	✓	✓	✓

Notes. Standard errors in parenthesis are two-way clustered at the region and business group levels. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the IV estimates of eq. (3.3). Adopter shares $\text{Share}_{(-i)nj,t-h}$ and the IV are defined in eqs. (3.2) and (3.4). The dependent variables are changes in dummies of making new adoption contracts between 1972-1979 or 1973-1980. In columns 1-2, the sample consists of all firms. We consider the alternative estimation sample with non-missing employment in column 3; the sample that excludes firms affiliated with business groups in column 4; the sample that exclude firms in regions with the industrial complexes in column 5. All specifications include the business group sales shares control (eq. (C.4), detailed in Appendix C.5), the initial levels of dependent variables, and region, sector, and sector-group fixed effects. KP-F is the Kleibergen-Papp F-statistics.

D. Simple Model

D.1 Derivation of Equations (4.3) and (4.4)

We first show that $Q_t = A(\lambda_t^T)f(\lambda_{t-1}^T)L$ and $\frac{w_t}{P_t} = \frac{1}{\mu}A(\lambda_t^T)f(\lambda_{t-1}^T)$, where $A(\lambda_t^T) = \Big[\frac{\theta}{\tilde{\theta}}\big((\eta^{\sigma-1} - 1)(\lambda_t^T)^{\frac{\tilde{\theta}}{\theta}} + 1\big)\Big]^{\frac{1}{\sigma-1}}$ and $\tilde{\theta} = \theta - (\sigma - 1)$. Note that $\frac{L}{Q_t} = \frac{\int l_{it}\mathrm{d}i}{Q_t} = \int \frac{y_{it}}{Q_t}\frac{1}{z_{it}}\mathrm{d}i = \int \frac{1}{z_{it}}\big(\frac{p_{it}}{P_t}\big)^{-\sigma}\mathrm{d}i$ holds, where $z_{it} = \eta f(\lambda_{t-1}^T)\phi_{it}$ for adopters and $z_{it} = f(\lambda_{t-1}^T)\phi_{it}$ for non-adopters. Using that $p_{it} = \frac{\mu w_t}{z_{it}}$ and $P_t = \mu w_t[\int z_{it}^{\sigma-1}\mathrm{d}i]^{\frac{1}{1-\sigma}}$, we obtain $Q_t = [\int z_{it}^{\sigma-1}\mathrm{d}i]^{\frac{1}{\sigma-1}}L$. From the assumption of Pareto distribution, we can further derive that

$$Q_t = \underbrace{\left[\frac{\theta}{\tilde{\theta}}\Big((\eta^{\sigma-1} - 1)(\bar{\phi}_t^T)^{-\tilde{\theta}} + 1\Big)\right]^{\frac{1}{\sigma-1}} f(\lambda_{t-1}^T)}_{=[\int z_{it}^{\sigma-1}\mathrm{d}i]^{\frac{1}{\sigma-1}}} L = \underbrace{\left[\frac{\theta}{\tilde{\theta}}\Big((\eta^{\sigma-1} - 1)(\lambda_t^T)^{\frac{\tilde{\theta}}{\theta}} + 1\Big)\right]^{\frac{1}{\sigma-1}}}_{=A(\lambda_t^T)} f(\lambda_{t-1}^T)L, \quad \text{(D.1)}$$

where the second equality is derived from $(\lambda_t^T)^{-\frac{1}{\theta}} = \bar{\phi}_t^T$. Using that $Q_t = \big[\int z_{it}^{\sigma-1}\mathrm{d}i\big]^{\frac{1}{\sigma-1}} L = A(\lambda_t)f(\lambda_{t-1})L$ and $P_t = \mu w_t \big[\int z_{it}^{\sigma-1}\mathrm{d}i\big]^{\frac{1}{1-\sigma}}$, we obtain

$$\frac{w_t}{P_t} = \frac{w_t}{[\int (\mu w_t/z_{it})^{1-\sigma}\mathrm{d}i]^{\frac{1}{1-\sigma}}} = \frac{1}{\mu}A(\lambda_t^T)f(\lambda_{t-1}^T). \quad \text{(D.2)}$$

Substituting equations (D.1) and (D.2) into the following adoption cutoff

$$(\bar{\phi}_t^T)^{\sigma-1} = \frac{\sigma P_t F^T}{(\eta^{\sigma-1} - 1)(\mu w_t)^{1-\sigma} f(\lambda_{t-1}^T)^{\sigma-1} P_t^{\sigma} Q_t}, \quad \text{(D.3)}$$

we obtain that

$$\lambda_t^T = \left(\frac{(\eta^{\sigma-1} - 1)}{\sigma F^T} A(\lambda_t^T)^{2-\sigma} f(\lambda_{t-1}^T)L\right)^{\frac{\theta}{\sigma-1}}. \quad \text{(D.4)}$$

Let $\hat{\lambda}_t^T$ be the solution of equation (D.4). Note that given λ_{t-1}^T, $\hat{\lambda}_t^T$ is uniquely determined by equation (D.4) because the left hand side is strictly increasing in λ_t^T and the right hand side is strictly decreasing in λ_t^T due to that $\sigma > 2$ (Assumption 1(i)). Because the equilibrium share is bounded by 1, the equilibrium share is $\lambda_t^T = \hat{\lambda}_t^T$ if $A(\hat{\lambda}_t^T)^{2-\sigma} f(\lambda_{t-1}^T)\frac{\eta^{\sigma-1}-1}{\sigma F^T}L < 1$ or $\lambda_t^T = 1$ if $A(\hat{\lambda}_t^T)^{2-\sigma} f(\lambda_{t-1}^T)\frac{\eta^{\sigma-1}-1}{\sigma F^T}L \geq 1$.

D.2 Proofs of Propositions

Proposition 1(i) (Uniqueness). Because the left hand side of equation (D.4) strictly increases in λ_t^T but the right hand side strictly decreases in λ_t^T due to Assumption 1(i), there exists a unique value of $\hat{\lambda}_t^T$ that satisfies this equation. If the obtained $\hat{\lambda}_t^T$ from this equation is greater than 1, because the equilibrium share is bounded by 1, $\lambda_t^T = 1$. Therefore, given λ_{t-1}^T, there exists a unique equilibrium share λ_t^T each period, which forms a unique dynamic equilibrium path given an initial share $\lambda_{t_0}^T$.

Proposition 1(ii) (Comparative statics). Taking the derivative of equation (D.7) with respect to η and δ, we obtain

$$\frac{\partial G}{\partial \eta} = A(\hat{\lambda}_t^T)^{3-2\sigma} f(\lambda_{t-1}^T) L \frac{(\sigma-1)\eta^{\sigma-2}}{\sigma F^T} \frac{\theta}{\tilde{\theta}} \left[\frac{1}{\sigma-1}(\eta^{\sigma-1}-1)(\hat{\lambda}_t^T)^{\frac{\tilde{\theta}}{\theta}} + 1 \right] > 0, \tag{D.5}$$

$$\frac{\partial G}{\partial \delta} = A(\hat{\lambda}_t^T)^{2-\sigma} \frac{(\eta^{\sigma-1}-1)}{\sigma F^T} f(\lambda_{t-1}^T) L \lambda_{t-1}^T > 0. \tag{D.6}$$

Applying the implicit function theorem and using the signs of equations (D.8), (D.6), and (D.5), we obtain $\frac{\partial \hat{\lambda}_t^T}{\partial \eta} = -\frac{\partial G/\partial \eta}{\partial G/\partial \hat{\lambda}_t^T} > 0$ and $\frac{\partial \hat{\lambda}_t^T}{\partial \delta} = -\frac{\partial G/\partial \delta}{\partial G/\partial \hat{\lambda}_t^T} > 0$. Therefore, $\frac{\partial \hat{\lambda}_t^T}{\partial \eta} \geq 0$ and $\frac{\partial \hat{\lambda}_t^T}{\partial \delta} \geq 0$ hold strictly for the non-boundary solutions and as equality for the boundary solutions.

Proposition 1(iii) (Dynamic complementarity). We apply the implicit function theorem. Let

$$G(\hat{\lambda}_t^T; L, \eta, \delta, \lambda_{t-1}^T) = A(\hat{\lambda}_t^T)^{2-\sigma} f(\lambda_{t-1}^T) L \frac{(\eta^{\sigma-1}-1)}{\sigma F^T} - (\hat{\lambda}_t^T)^{\frac{\sigma-1}{\theta}} = 0. \tag{D.7}$$

Taking the derivative of equation (D.7) with respect to λ_t^T, we obtain

$$\frac{\partial G}{\partial \hat{\lambda}_t^T} = \underbrace{\frac{2-\sigma}{\sigma-1}}_{<0} \times \underbrace{A(\hat{\lambda}_t^T)^{3-2\sigma}(\hat{\lambda}_t^T)^{-\frac{\sigma-1}{\theta}} f(\lambda_{t-1}^T) \frac{(\eta^{\sigma-1}-1)^2}{\sigma F^T} L}_{>0} - \underbrace{\frac{\sigma-1}{\theta}(\hat{\lambda}_t^T)^{-\frac{\tilde{\theta}}{\theta}}}_{>0} < 0, \tag{D.8}$$

where the last inequality comes from the fact that $\frac{2-\sigma}{\sigma-1} < 0$ due to that $\sigma > 2$ (Assumption 1(i)). Taking the derivative with respect to λ_{t-1}^T,

$$\frac{\partial G}{\partial \lambda_{t-1}^T} = A(\hat{\lambda}_t^T)^{2-\sigma} \frac{(\eta^{\sigma-1}-1)}{\sigma F^T} f(\lambda_{t-1}^T) L \delta > 0. \tag{D.9}$$

Applying the implicit function theorem and using the signs of equations (D.8) and (D.9), we obtain $\frac{\partial \hat{\lambda}_t^T}{\partial \lambda_{t-1}^T} = -\frac{\partial G/\partial \lambda_{t-1}^T}{\partial G/\partial \hat{\lambda}_t^T} > 0$. Therefore, $\frac{\partial \lambda_t^T}{\partial \lambda_{t-1}^T} > 0$ holds for the non-boundary solutions and the equality holds for the boundary solutions.

Proposition 1(iv) (Multiple steady states). First, we show that $\hat{\lambda}_t^T$ is strictly convex in λ_{t-1}^T; that is, $\frac{\partial^2 \hat{\lambda}_t^T}{\partial(\lambda_{t-1}^T)^2} > 0$. Applying the implicit function theorem twice,

$$\frac{\partial^2 \hat{\lambda}_t^T}{\partial(\lambda_{t-1}^T)^2} = \frac{-1}{(\partial G/\partial \hat{\lambda}_t^T)^3}\left[\frac{\partial G^2}{\partial(\lambda_{t-1}^T)^2}\left(\frac{\partial G}{\partial \hat{\lambda}_t^T}\right)^2 - 2\frac{\partial^2 G}{\partial \hat{\lambda}_t^T \partial \lambda_{t-1}^T}\frac{\partial G}{\partial \lambda_{t-1}^T}\frac{\partial G}{\partial \hat{\lambda}_t^T} + \frac{\partial^2 G}{\partial(\hat{\lambda}_t^T)^2}\left(\frac{\partial G}{\partial \lambda_{t-1}^T}\right)^2\right]. \tag{D.10}$$

We examine the sign of each term of the right hand side of the above equation.

$$\frac{\partial^2 G}{\partial(\lambda_{t-1}^T)^2} = A(\hat{\lambda}_t^T)^{2-\sigma}\frac{(\eta^{\sigma-1}-1)}{\sigma F^T}L f(\lambda_{t-1}^T)\delta^2 > 0. \tag{D.11}$$

$$\frac{\partial^2 G}{\partial \hat{\lambda}_t^T \partial \lambda_{t-1}^T} = \frac{\partial^2 G}{\partial \lambda_{t-1}^T \partial \hat{\lambda}_t^T} = \underbrace{\frac{2-\sigma}{\sigma-1}}_{<0}\underbrace{A(\hat{\lambda}_t^T)^{3-2\sigma}\frac{(\eta^{\sigma-1}-1)^2}{\sigma F^T}L(\hat{\lambda}_t^T)^{-\frac{\sigma-1}{\theta}} f(\lambda_{t-1}^T)\delta}_{>0} < 0. \tag{D.12}$$

$$\begin{aligned}\frac{\partial^2 G}{\partial(\hat{\lambda}_t^T)^2} = {} & \underbrace{\frac{(2-\sigma)(3-2\sigma)}{(\sigma-1)^2}}_{>0}\underbrace{A(\hat{\lambda}_t^T)^{4-3\sigma}(\hat{\lambda}_t^T)^{-\frac{2(\sigma-1)}{\theta}} f(\lambda_{t-1}^T)\frac{(\eta^{\sigma-1}-1)^3}{\sigma F^T}L}_{>0} \\ & + \underbrace{\frac{\sigma-2}{\theta}A(\hat{\lambda}_t^T)^{3-2\sigma}(\hat{\lambda}_t^T)^{-\frac{\sigma-1}{\theta}-1} f(\lambda_{t-1}^T)\frac{(\eta^{\sigma-1}-1)^2}{\sigma F^T}L}_{>0} + \underbrace{\frac{\sigma-1}{\theta}\frac{\tilde{\theta}}{\theta}(\hat{\lambda}_t^T)^{-\frac{\tilde{\delta}}{\theta}-1}}_{>0} > 0,\end{aligned} \tag{D.13}$$

where each term of the right hand side of equation (D.13) is positive due to that $\sigma > 3$. Substituting the signs of equations (D.8), (D.9), (D.11), (D.12), and (D.13) into equation (D.10), we obtain $\frac{\partial^2 \hat{\lambda}_t^T}{\partial(\lambda_{t-1}^T)^2} > 0$, which proves the strict convexity.

Because the intercept of λ_t^T-axis is always positive and $\hat{\lambda}_t^T$ is strictly increasing and strictly convex in λ_{t-1}^T, the locus defined by $(\lambda_{t-1}^T, \lambda_t^T)$ that satisfies equation (4.3) can intersect with the 45-degree line two times at most. Note that the intercept is always positive because of the assumption of unbounded Pareto distribution which always guarantees a positive share of adopters.

Because $\hat{\lambda}_t^T$ strictly increases in δ, there exists $\underline{\delta}$ such that the 45-degree line and the short-run locus meet at $\lambda_{t-1}^T = 1$, holding other parameters constant; that is, $\underline{\delta}$ satisfies $A(1;\eta)^{2-\sigma} f(\hat{\lambda}^T;\underline{\delta})\frac{(\eta^{\sigma-1}-1)}{\sigma F^T}L - 1 = 0$ for $\hat{\lambda}^T = 1$. Similarly, holding other parameters constant, there exists $\underline{\eta}$ that satisfies $A(1;\underline{\eta})^{2-\sigma} f(\hat{\lambda}^T;\delta)\frac{(\underline{\eta}^{\sigma-1}-1)}{\sigma F^T}L - 1 = 0$ for $\hat{\lambda}^T = 1$. Also, because $\hat{\lambda}_t^T$ is strictly convex in λ_{t-1}^T, holding other parameters constant, there exists $\bar{\delta}$ and $\bar{\eta}$ such that the 45-degree line is tangent to the short-run locus implicitly defined by equation (D.7); that is, $\bar{\delta}$ and $\bar{\eta}$ satisfy $A(\hat{\lambda}^T;\eta)^{2-\sigma} f(\hat{\lambda}^T;\bar{\delta})\frac{(\eta^{\sigma-1}-1)}{\sigma F^T}L - \hat{\lambda}^T = 0$ and $A(\hat{\lambda}^T;\bar{\eta})^{2-\sigma} f(\hat{\lambda}^T;\delta)\frac{(\bar{\eta}^{\sigma-1}-1)}{\sigma F^T}L - \hat{\lambda}^T = 0$

for some value $\hat{\lambda}^T$, respectively.

For $\delta \in [0, \underline{\delta})$ or $\eta \in [0, \underline{\eta})$, the equilibrium share is always below one and the short-run locus implicitly defined by equation(4.3) intersect with the 45-degree line only once. For $\delta \in (\bar{\delta}, 1]$ or $\eta \in (\bar{\eta}, 1]$, the short-run locus intersects with the 45-degree line at $\lambda^T = \lambda_t^T = \lambda_{t-1}^T = 1$ only once. For $\delta \in (\underline{\delta}, \bar{\delta})$ or $\eta \in (\underline{\eta}, \bar{\eta})$, the short-run locus and the 45-degree line intersect three times, leading to three multiple steady states. At the boundary values $\delta \in \{\underline{\delta}, \bar{\delta}\}$ or $\eta \in \{\underline{\eta}, \bar{\eta}\}$, the short-run locus and the 45-degree line intersect twice, leading to two multiple steady states.

Proposition 1(v) (Welfare). The welfare of household is $\frac{w_t + \Pi_t/L}{P_t}$ where Π_t are the aggregate profits summed across all firms in the economy. Note that

$$\frac{\Pi_t}{P_t} = \frac{1}{P_t} \int \frac{1}{\sigma} \left(\frac{\mu w_t}{z_{it}}\right)^{1-\sigma} P_t^\sigma Q_t \mathrm{d}i = \frac{1}{\sigma} \mu^{1-\sigma} \left(\frac{w_t}{P_t}\right)^{1-\sigma} \left[\int z_{it}^{\sigma-1} \mathrm{d}i \right] Q_t = \frac{1}{\sigma} A(\lambda_t^T) f(\lambda_{t-1}^T) L, \quad \text{(D.14)}$$

where the last equality comes from equations (D.1) and (D.2). The above equation implies that welfare in each period $\frac{w_t + \Pi_t/L}{P_t}$ is equal to $f(\lambda_{t-1}^T) A(\lambda_t^T)$ and welfare in a steady state is $f(\lambda^T) A(\lambda^T)$, which strictly increases in λ^T. Therefore, a steady state with a larger adopter share Pareto-dominates others with lower shares.

Proof of Proposition 2 (i) (Big push). Suppose an economy features multiple steady states S^{Pre}, S^{U}, and S^{Ind} and is initially stuck in the underdevelopment region $\lambda_{t_0} \in [0, S^{\text{U}})$. We first consider input subsidies for adopters. With the subsidies, firms' costs of production become $(1 - s_{it}) w_t l_{it}$ where $s_{it} = \bar{s}_t$ for $T_{it} = 1$ and 0 otherwise, where $0 < \bar{s}_t < 1$ is an subsidy rate for adopters. Firm charges price $p_{it} = \frac{\mu(1-s_{it}) w_t}{z_{it}}$. The cutoff is

$$(\bar{\phi}_t^T)^{\sigma-1} = \frac{\sigma P_t F^T}{((\frac{\eta}{1-\bar{s}_t})^{\sigma-1} - 1)(\mu w_t)^{1-\sigma} f(\lambda_{t-1}^T)^{\sigma-1} P_t^\sigma Q_t}. \quad \text{(D.15)}$$

$Q_t = A(\lambda_t^T) f(\lambda_{t-1}^T)$ still holds with subsidies, but the expression for $\frac{w_t}{P_t}$ gets slightly modified: $\frac{w_t}{P_t} = \frac{1}{\mu} \tilde{A}(\lambda_t^T, \bar{s}_t) f(\lambda_{t-1}^T)$, where $\tilde{A}(\lambda_t^T, \bar{s}_t) = \left[\frac{\theta}{\tilde{\theta}} \left(\left(\left(\frac{\eta}{1-\bar{s}_t} \right)^{\sigma-1} - 1 \right) (\lambda_t^T)^{\frac{\tilde{\theta}}{\theta}} + 1 \right) \right]^{\frac{1}{\sigma-1}}$. The equilibrium share of adopters can be expressed as

$$\lambda_t^T = \left[\frac{\left(\frac{\eta}{1-\bar{s}_t} \right)^{\sigma-1} - 1}{\sigma F^T} L A(\lambda_t^T) \tilde{A}(\lambda_t^T, \bar{s}_t)^{1-\sigma} f(\lambda_{t-1}^T) \right]^{\frac{\theta}{\sigma-1}}. \quad \text{(D.16)}$$

Similarly with subsidies to fixed adoption costs $(1 - \bar{s}_t) P_t F^T$, the cutoff becomes

$$(\bar{\phi}_t^T)^{\sigma-1} = \frac{\sigma(1 - \bar{s}_t) P_t F^T}{(\eta^{\sigma-1} - 1)(\mu w_t)^{1-\sigma} f(\lambda_{t-1}^T)^{\sigma-1} P_t^\sigma Q_t} \quad \text{(D.17)}$$

and the equilibrium adopter shares are

$$\lambda_t^T = \left[\frac{\eta^{\sigma-1}-1}{\sigma(1-\bar{s}_t)F^T} LA(\lambda_t^T)^{2-\sigma} f(\lambda_{t-1}^T)\right]^{\frac{\theta}{\sigma-1}}. \tag{D.18}$$

In the cases of both subsidies, the right hand sides of both equations (D.16) and (D.18) strictly increase in $\bar{s}_t$, and $\lim_{\bar{s}_t \to 1} \lambda_t^T \to 1$. Therefore, there exists $\underline{s}$ such that satisfies $\lambda_t^T = S^{\mathrm{U}}$. For $\bar{s}_t > \underline{s}$, $\lambda_t^T > S^{\mathrm{U}}$ and the economy starts to converge to S^{Ind}.

Proof of Proposition 2(ii) (Market size). By applying the implicit function theorem, it can be shown that $\frac{\partial \lambda_t^T}{\partial L} < 0$, implying that higher L shift the short-run equilibrium curve downward and therefore $\frac{\partial S^U}{\partial L} < 0$ and $\frac{\partial \underline{S}}{\partial L} < 0$. □

D.3 Source of Dynamic Complementarity and Comparison with Buera et al. (2021)

Comparison with Buera et al. (2021). Suppose there are no spillovers ($\delta = 0$). Our simple model in Section 4 collapses to a special case of the full model presented by Buera et al. (2021), excluding idiosyncratic distortions and intermediate inputs in production. Our model does not admit multiple equilibria within each period due to the assumption that $\sigma > 2$ (Assumption 1(i)). Without spillovers, the previous adopter shares do not affect the current equilibrium and the equilibrium adopter share can be expressed as $\lambda_t^T = \left(\frac{(\eta^{\sigma-1}-1)}{\sigma F^T} LA(\lambda_t^T)^{2-\sigma}\right)^{\frac{\theta}{\sigma-1}}$. Because $\sigma > 2$, the right hand side is strictly decreasing in λ_t^T, implying that there is always a unique equilibrium. Note that when $\sigma < 2$, because the right hand side becomes strictly increasing in λ_t^T, there can be multiple equilibria, the possibility studied in Buera et al. (2021).

Fixed adoption costs in units of labor. In the case when fixed adoption costs are in units of labor, the model does not exhibit dynamic complementarity, regardless of the presence of spillovers. The key equations for the cutoff productivity and the equilibrium shares are given by: $(\bar{\phi}_t^T)^{\sigma-1} = \frac{\sigma F^T}{(\eta^{\sigma-1}-1)\mu^{1-\sigma} f(\lambda_{t-1}^T)^{\sigma-1} P_t^{\sigma} Q_t}$ and $\lambda_t^T = \left(\frac{\mu(\eta^{\sigma-1}-1)}{\sigma F^T} LA(\lambda_t^T)^{1-\sigma}\right)^{\frac{\theta}{\sigma-1}}$. The equilibrium share is uniquely determined regardless of the values of λ_{t-1}^T. This is because higher previous shares λ_{t-1}^T increase overall productivity in t through spillovers, which in turn, leads to higher demand for labor. This increased demand raises the equilibrium wage, resulting in higher adoption costs $w_t F^T$. These increased costs exactly offset the larger incentives for adoption induced by spillovers.

D.4 Possible Microfoundations for Adoption Spillovers

This subsection provides two possible microfoundations for spillovers. For both cases, we consider a closed economy setup with one sector and one region as in the simple model.

Local diffusion of knowledge. A firm receives exogenous productivity $\tilde{\phi}_{it}$ and makes two decisions each period: whether to adopt modern technology T_{it} and the level of innovation a_{it} similar to Desmet and Rossi-Hansberg (2014):

$$\pi_{it} = \max_{T_{it}\in\{0,1\},a_{it}\in[0,\infty)} \left\{ \frac{1}{\sigma}\left(\frac{\mu w_t}{\tilde{\eta}^{T_{it}} a_{it}^{\gamma_1} \tilde{\phi}_{it}}\right)^{1-\sigma} P_t^{\sigma} Q_t - T_{it} P_t F^T - w_t a_{it}^{\alpha_1} g(\lambda_{t-1}^T) P_t^{\sigma} Q_t \right\}, \tag{D.19}$$

where $\tilde{\eta}$ governs direct productivity gains from adoption, and $a_{it}^{\alpha_1} g(\lambda_{t-1}^T) P_t^{\sigma} Q_t$ is the cost of innovation in units of labor. The cost of innovation is proportional to market size $P_t^{\sigma} Q_t$ and increases in a_{it} because $\alpha_1 > 0$. We normalize $w_t = 1$ without loss of generality.

The positive externalities arise from the fact that the innovation costs decrease with the previous adopter share $\partial g(\lambda_{t-1}^T)/\partial \lambda_{t-1}^T < 0$, reflecting that more local firms can learn from adopters and use this knowledge for their own innovation. We impose that $\tilde{\alpha} = \alpha_1 - \gamma_1(\sigma - 1) > 0$, which guarantees the second-order condition of the maximization problem. A firm's optimal level of a_{it} is characterized as $a_{it} = (\frac{\gamma_1}{\alpha_1}\mu^{-\sigma})^{\frac{1}{\tilde{\alpha}}} g(\lambda_{t-1}^T)^{-\frac{1}{\tilde{\alpha}}} (\tilde{\eta}^{T_{it}} \tilde{\phi}_{it})^{\frac{\sigma-1}{\tilde{\alpha}}}$. Because $-1/\tilde{\alpha} > 0$ and $(\sigma-1)/\tilde{\alpha} > 0$, a_{it} increases in λ_{t-1}^T, T_{it}, and $\tilde{\phi}_{it}$. Substituting the optimal a_{it} into equation (D.19), a firm's maximization problem becomes

$$\pi_{it} = \max_{T_{it}\in\{0,1\}} \left\{ \bar{C}\left(\frac{1}{g(\lambda_{n,t-1}^T)^{-\frac{\gamma_1}{\tilde{\alpha}}} (\tilde{\eta}^{\frac{\alpha_1}{\tilde{\alpha}}})^{T_{it}} (\tilde{\phi}_{it})^{\frac{\alpha_1}{\tilde{\alpha}}}}\right)^{1-\sigma} P_t^{\sigma} Q_t - T_{it} P_t F^T \right\}, \tag{D.20}$$

where $\bar{C}$ is a collection of model parameters. $g(\lambda_{n,t-1}^T)^{-\frac{\gamma_1}{\tilde{\alpha}}}$ can be mapped to $f(\lambda_{n,t-1}^T)$, $(\tilde{\phi}_{it})^{\frac{\alpha_1}{\tilde{\alpha}}}$ to ϕ_{it}, and $\tilde{\eta}^{\frac{\alpha_1}{\tilde{\alpha}_1}}$ to η of the simple model in Section 4.

This microfoundation aligns with a case study from (Kim, 1997, p. 182-184). Wonil Machinery Work (henceforth Wonil) started its business as a small hot and cold rolling mill producer. One local firm imported a more sophisticated 4-high nonreverse cold rolling mill, which was a technology widely used in developed countries. Wonil's engineers had an opportunity to observe how the local firm was operating these state-of-the-art mills and obtained technical information indirectly from this local firm. From this opportunity, Wonil developed its own 4-high cold rolling mill blueprints and began producing them.

Learning externalities and labor mobility. There is a unit measure of engineers and firm owners. Engineers live in two periods: childhood and adulthood. Once they reach adulthood in the second period, they give birth to a child. They only consume and work during their adulthood. Engineers who work in firms that adopt new technologies pass their knowledge to their children. This parental learning increases the engineering skills of the children as they grow up, enhancing their skills by a factor of $\gamma_1 > 1$. If parents do not work in firms with foreign technology, their children's engineering skills remain at a level of 1.

Engineers and owners are randomly matched one-to-one (Acemoglu, 1996). After matching, production takes place, and the two parties jointly maximize profits. The profits generated by this match are divided between engineers and owners based on Nash bargaining, with managers receiving a proportion of $\tilde{\beta}$. Since owners make adoption decisions before a match occurs, they must base these decisions on anticipated profits. Due to the random matching process, owners are paired with high-skilled engineers with a probability of λ^T_{t-1} and low-skilled engineers with a probability of $1 - \lambda^T_{t-1}$.

A firm's maximization problem is

$$\pi_{it} = \max_{T_{it} \in \{0,1\}} (1 - \tilde{\beta}) \left\{ \frac{1}{\sigma} \left(\frac{\mu w_t}{\tilde{f}(\lambda^T_{t-1}) \eta^{T_{it}} \phi_{it}} \right)^{1-\sigma} P_t^\sigma Q_t - T_{it} P_t F^T \right\}, \tag{D.21}$$

where $\tilde{f}(\lambda^T_{t-1}) = [\lambda^T_{t-1}(\gamma_1^{\sigma-1} - 1) + 1]^{\frac{1}{\sigma-1}}$ can be mapped to $f(\lambda^T_{t-1})$ of the simple of in Section 4. This mobility channel is consistent with the case of POSCO in Section C.1.

E. Quantitative Model

Sector. A final goods producer aggregates varieties using a CES aggregator:

$$Q_{njt} = \Big[\sum_m \int_{i \in \Omega_{mj}} (q_{imnjt})^{\frac{\sigma-1}{\sigma}} \mathrm{d}i + (q^f_{njt})^{\frac{\sigma-1}{\sigma}} \Big]^{\frac{\sigma}{\sigma-1}}, \tag{E.1}$$

where q_{imnjt} and q^f_{njt} are region n's quantities demanded of a variety produced by domestic firm i located in region m and foreign firms, respectively. The price index is given by

$$P_{njt} = \Big[\sum_m \int_{i \in \Omega_{mj}} (p_{injt})^{1-\sigma} \mathrm{d}i + (d^x_{nj}(1 + t_{jt}) P^f_{jt})^{1-\sigma} \Big]^{\frac{1}{1-\sigma}}. \tag{E.2}$$

Firm. Firms have the following CRS production technology:

$$y_{it} = z_{it} L_{it}^{\gamma_j^L} \prod_k (M^k_{it})^{\gamma^k_j}, \qquad \gamma^L_j + \sum_k \gamma^k_j = 1. \tag{E.3}$$

Unit costs of input bundles are

$$c_{njt} = (\frac{w_{nt}}{\gamma_j^L})^{\gamma_j^L} \prod_k (\frac{P_{nkt}}{\gamma_j^k})^{\gamma_j^k}. \tag{E.4}$$

Firm i's quantities demanded from region m and Foreign are $q_{inmjt} = (p_{inmjt})^{-\sigma} P_{mjt}^{\sigma} Q_{mjt}$ and $q_{injt}^x = (p_{injt}^x)^{-\sigma} D_{jt}^x$, respectively. A firm optimally charges a constant markup over its marginal cost. Thus, a firm i's price in region-sector nj charged to buyers in region m is $p_{inmjt} = \frac{\mu d_{nmj} c_{njt}}{z_{it}\tau_{it}}$, and export prices are $p_{injt}^x = \frac{\mu d_{nj}^x c_{njt}}{z_{it}\tau_{it}}$.

A firm's profit after maximizing over T_{it} and x_{it} is:

$$\pi_{it} = \max_{x_{it}, T_{it}} \sum_m \left[\frac{1}{\sigma} \left(\frac{\mu d_{nmj}(1-s_{njt})^{T_{it}} c_{njt}}{\phi_{it}\eta^{T_{it}} f(\lambda_{nj,t-1}^T)} \right)^{1-\sigma} \tau_{it}^{\sigma} P_{mjt}^{\sigma} Q_{mjt} \right] + x_{it} \left[\frac{1}{\sigma} \left(\frac{\mu d_{nj}^x (1-s_{njt})^{T_{it}} c_{njt}}{\phi_{it}\eta^{T_{it}} f(\lambda_{nj,t-1}^T)} \right)^{1-\sigma} \tau_{it}^{\sigma} D_{jt}^x - w_{nt} F_j^x \right] - T_{it} c_{njt} F^T, \tag{E.5}$$

where x_{it} is a binary export decision.

Firms' adoption and export decisions are characterized by the cutoff productivities. To avoid a taxonomic presentation, we only consider a case in which fixed adoption costs are high enough so that the adoption cutoff is higher than the export cutoff in all regions. In the quantitative analysis, we allow for other possibilities. The export cutoff $\bar{\phi}_{njt}^x$ is determined at where operating profits in foreign markets are equal to fixed export costs:

$$\bar{\phi}_{njt}^x = \left(\frac{(\mu c_{njt})^{\sigma-1} \sigma w_{nt} F_j^x}{f(\lambda_{nj,t-1}^T)^{\sigma-1} \bar{\tau}^{\sigma} (d_{nj}^x)^{1-\sigma} D_{jt}^x} \right)^{\frac{1}{\sigma(1+\xi)-1}}. \tag{E.6}$$

The adoption cutoff $\bar{\phi}_{njt}^T$ is determined at where profits when adopting technology and profits when not adopting are equalized:

$$\bar{\phi}_{njt}^T = \left\{ \frac{(\mu c_{njt})^{\sigma-1} \sigma c_{njt} F^T}{\bar{\tau}^{\sigma} \left(\left(\frac{\eta}{1-s_{njt}} \right)^{\sigma-1} - 1 \right) f(\lambda_{nj,t-1}^T)^{\sigma-1} \left(\sum_m d_{nmj}^{1-\sigma} P_{mjt}^{\sigma} Q_{mjt} + (d_{nj}^x)^{1-\sigma} D_{jt}^x \right)} \right\}^{\frac{1}{\sigma(1+\xi)-1}}.$$

A share of adopters is expressed as

$$\lambda^T_{njt} = 1 - G_{njt}(\bar{\phi}^T_{njt}) = \begin{cases} 1 & \text{if} \quad \bar{\phi}^T_{njt} \leq \phi^{\min}_{njt} \\ \frac{(\bar{\phi}^T_{njt}/\phi^{\min}_{njt})^{-\theta} - \kappa^{-\theta}}{1-\kappa^{-\theta}} & \text{if} \quad \phi^{\min}_{njt} < \bar{\phi}^T_{njt} \leq \kappa\phi^{\min}_{njt} \\ 0 & \text{if} \quad \kappa\phi^{\min}_{njt} \leq \bar{\phi}^T_{njt}, \end{cases}$$

where $G_{njt}(\phi)$ is productivity distribution of region-sector nj in period t. A mass of adopters is $M^T_{njt} = M_{nj}\lambda^T_{njt}$. Similarly, a share and mass of exporters are $\lambda^x_{njt} = 1 - G_{njt}(\bar{\phi}^x_{njt})$ and $M^x_{njt} = M_{nj}\lambda^x_{njt}$.

Preference. Representative households have Cobb-Douglas preferences:

$$\ln C_{nt}, \qquad C_{nt} = \prod_{j=1}^{J} C^{\alpha_j}_{njt} \tag{E.7}$$

subject to the budget constraints: $P_{nt}C_{nt} = (1-\tau^w_t + \bar{\pi}_t)w_{nt}$. Their total income $(1-\tau^w_t+\bar{\pi}_t)w_{nt}$ is the sum of after-tax wages $(1-\tau^w_t)w_{nt}$ and dividend income $\bar{\pi}_t w_{nt}$, where total profits and government spending are distributed across households in regions proportional to their labor incomes. The corresponding price index is $P_{nt} = \prod_{j=1}^{J}(P_{njt}/\alpha_j)^{\alpha_j}$.

Region-sector level aggregation. We define the region-sector level average firm productivity inclusive of distortions and subsidies as

$$\begin{aligned} \bar{\phi}^{\text{avg}}_{njt} &= f(\lambda^T_{nj,t-1})\left[\int_{\phi^{\min}_{njt}}^{\bar{\phi}^T_{njt}} \phi^{\sigma-1}_{it}(\bar{\tau}\phi^{\xi}_{it})^{\sigma} dG_{njt}(\phi_{it}) + \int_{\bar{\phi}^T_{njt}}^{\kappa\phi^{\min}_{njt}} \left(\frac{\eta\phi_{it}}{1-s_{njt}}\right)^{\sigma-1}(\bar{\tau}\phi^{\xi}_{it})^{\sigma} dG_{njt}(\phi_{it})\right]^{\frac{1}{\sigma-1}} \\ &= f(\lambda^T_{njt-1})\left(\frac{\bar{\tau}^{\sigma}\theta(\phi^{\min}_{njt})^{\theta}}{\tilde{\theta}(1-\kappa^{-\theta})}\left\{\left((\phi^{\min}_{njt})^{-\tilde{\theta}} - (\bar{\phi}^T_{njt})^{-\tilde{\theta}}\right) + \left(\frac{\eta}{1-s_{njt}}\right)^{\sigma-1}\left((\bar{\phi}^T_{njt})^{-\tilde{\theta}} - (\kappa\phi^{\min}_{njt})^{-\tilde{\theta}}\right)\right\}\right)^{\frac{1}{\sigma-1}}, \end{aligned} \tag{E.8}$$

where $\tilde{\theta} = \theta - \sigma(1+\xi) - 1$, which can be expressed as a function of $\bar{\phi}^T_{njt}$. $\bar{\phi}^{\text{avg}}_{njt}$ captures the average cost advantage of sector j firms in region n. $\bar{\phi}^{\text{avg}}_{njt}$ decreases in $\bar{\phi}^T_{njt}$ but increase in

s_{njt} and $\lambda^T_{nj,t-1}$. The average productivity for exporters can be expressed similarly:

$$\bar{\phi}^{\text{avg,x}}_{njt} = f(\lambda^T_{nj,t-1})\Big[\int_{\phi^{\text{x}}_{njt}}^{\bar{\phi}^T_{njt}} \phi_{it}^{\sigma-1}(\bar{\tau}\phi_{it}^{\xi})^{\sigma}dG_{njt}(\phi_{it}) + \int_{\bar{\phi}^T_{njt}}^{\kappa\phi^{\min}_{njt}} \Big(\frac{\eta\phi_{it}}{1-s_{njt}}\Big)^{\sigma-1}(\bar{\tau}\phi_{it}^{\xi})^{\sigma}dG_{njt}(\phi_{it})\Big]^{\frac{1}{\sigma-1}}$$
$$= f(\lambda^T_{njt-1})\Bigg(\frac{\bar{\tau}^{\sigma}\theta(\phi^{\min}_{njt})^{\theta}}{\tilde{\theta}(1-\kappa^{-\theta})}\Big\{\big((\bar{\phi}^{\text{x}}_{njt})^{-\tilde{\theta}} - (\bar{\phi}^T_{njt})^{-\tilde{\theta}}\big) + \Big(\frac{\eta}{1-s_{njt}}\Big)^{\sigma-1}\big((\bar{\phi}^T_{njt})^{-\tilde{\theta}} - (\kappa\phi^{\min}_{njt})^{-\tilde{\theta}}\big)\Big\}\Bigg)^{\frac{1}{\sigma-1}}. \tag{E.9}$$

The average productivity for adopters is expressed as

$$\bar{\phi}^{\text{avg,T}}_{njt} = f(\lambda^T_{nj,t-1})\Big[\int_{\bar{\phi}^T_{njt}}^{\kappa\phi^{\min}_{njt}} \Big(\frac{\eta\phi_{it}}{1-s_{njt}}\Big)^{\sigma-1}(\bar{\tau}\phi_{it}^{\xi})^{\sigma}dG_{njt}(\phi_{it})\Big]^{\frac{1}{\sigma-1}}$$
$$= f(\lambda^T_{njt-1})\Bigg(\frac{\bar{\tau}^{\sigma}\theta(\phi^{\min}_{njt})^{\theta}}{\tilde{\theta}(1-\kappa^{-\theta})}\Big\{\Big(\frac{\eta}{1-s_{njt}}\Big)^{\sigma-1}\big((\bar{\phi}^T_{njt})^{-\tilde{\theta}} - (\kappa\phi^{\min}_{njt})^{-\tilde{\theta}}\big)\Big\}\Bigg)^{\frac{1}{\sigma-1}}, \tag{E.10}$$

Similarly, we define the following variables:

$$\breve{\phi}^{\text{avg}}_{njt} = f(\lambda^T_{nj,t-1})\Big[\int_{\phi^{\min}_{njt}}^{\bar{\phi}^T_{njt}} \phi_{it}^{\sigma-1}(\bar{\tau}\phi_{it}^{\xi})^{\sigma-1}dG_{njt}(\phi_{it}) + \int_{\bar{\phi}^T_{njt}}^{\kappa\phi^{\min}_{njt}} \Big(\frac{\eta\phi_{it}}{1-s_{njt}}\Big)^{\sigma-1}(\bar{\tau}\phi_{it}^{\xi})^{\sigma-1}dG_{njt}(\phi_{it})\Big]^{\frac{1}{\sigma-1}}$$
$$= f(\lambda^T_{njt-1})\Bigg(\frac{\bar{\tau}^{\sigma-1}\theta(\phi^{\min}_{njt})^{\theta}}{\breve{\theta}(1-\kappa^{-\theta})}\Big\{\big((\phi^{\min}_{njt})^{-\breve{\theta}} - (\bar{\phi}^T_{njt})^{-\breve{\theta}}\big) + \Big(\frac{\eta}{1-s_{njt}}\Big)^{\sigma-1}\big((\bar{\phi}^T_{njt})^{-\breve{\theta}} - (\kappa\phi^{\min}_{njt})^{-\breve{\theta}}\big)\Big\}\Bigg)^{\frac{1}{\sigma-1}}, \tag{E.11}$$

where $\breve{\theta} = \theta - (\sigma-1)(1+\xi)$. For adopters,

$$\breve{\phi}^{\text{avg,T}}_{njt} = f(\lambda^T_{nj,t-1})\Big[\int_{\bar{\phi}^T_{njt}}^{\kappa\phi^{\min}_{njt}} \Big(\frac{\eta\phi_{it}}{1-s_{njt}}\Big)^{\sigma-1}(\bar{\tau}\phi_{it}^{\xi})^{\sigma-1}dG_{njt}(\phi_{it})\Big]^{\frac{1}{\sigma-1}}$$
$$= f(\lambda^T_{njt-1})\Bigg(\frac{\bar{\tau}^{\sigma-1}\theta(\phi^{\min}_{njt})^{\theta}}{\breve{\theta}(1-\kappa^{-\theta})}\Big\{\Big(\frac{\eta}{1-s_{njt}}\Big)^{\sigma-1}\big((\bar{\phi}^T_{njt})^{-\breve{\theta}} - (\kappa\phi^{\min}_{njt})^{-\breve{\theta}}\big)\Big\}\Bigg)^{\frac{1}{\sigma-1}}, \tag{E.12}$$

Region-sector level aggregate variables can be expressed as a function of the six average productivity defined above. The price index is

$$P^{1-\sigma}_{njt} = \sum_m \Big[M_{mj}\Big(\frac{\mu d_{mnj}c_{mjt}}{\breve{\phi}^{\text{avg}}_{mjt}}\Big)^{1-\sigma}\Big] + (d^x_{nj}(1+t_{jt})P^f_{jt})^{1-\sigma}. \tag{E.13}$$

Region n's share of the total sector j expenditure on goods from domestic region m and from Foreign are expressed as

$$\pi_{mnjt} = \Big(\frac{\mu d_{mnj} c_{mjt} / \breve{\phi}^{\text{avg}}_{mjt}}{P_{njt}}\Big)^{1-\sigma}, \qquad \pi^f_{njt} = \Big(\frac{d^x_{nj}(1+t_{jt})P^f_{jt}}{P_{njt}}\Big)^{1-\sigma}. \tag{E.14}$$

Regional gross output for domestic expenditures R^d_{njt} and the total value of exports R^x_{njt} are

$$R^d_{njt} = M_{nj}(\mu c_{njt}/\bar{\phi}^{\text{avg}}_{njt})^{1-\sigma} \sum_m d^{1-\sigma}_{nmj} P^\sigma_{mjt} Q_{mjt}, \qquad R^x_{njt} = M^x_{njt}(\mu d^x_{nj} c_{njt}/\bar{\phi}^{\text{avg,x}}_{njt})^{1-\sigma} D^x_{jt}. \tag{E.15}$$

The total regional gross output is $R_{njt} = R^d_{njt} + R^x_{njt}$. Regional gross output of adopters is

$$R^T_{njt} = M_{nj}(\mu c_{njt}/\bar{\phi}^{\text{avg,T}}_{njt})^{1-\sigma}\Big(\sum_m d^{1-\sigma}_{nmj} P^\sigma_{mjt} Q_{mjt} + (d^x_{nj})^{1-\sigma} D^x_{jt}\Big) \tag{E.16}$$

Also, we define gross output net of output distortions:

$$\begin{aligned}
\breve{R}^d_{njt} &= M_{nj}(\mu c_{njt}/\breve{\phi}^{\text{avg}}_{njt})^{1-\sigma} \sum_m d^{1-\sigma}_{nmj} P^\sigma_{mjt} Q_{mjt} \\
\breve{R}^x_{njt} &= M^x_{njt}(\mu d^x_{nj} c_{njt}/\breve{\phi}^{\text{avg,x}}_{njt})^{1-\sigma} D^x_{jt} \\
\breve{R}^T_{njt} &= M_{nj}(\mu c_{njt}/\breve{\phi}^{\text{avg,T}}_{njt})^{1-\sigma}\Big(\sum_m d^{1-\sigma}_{nmj} P^\sigma_{mjt} Q_{mjt} + (d^x_{nj})^{1-\sigma} D^x_{jt}\Big).
\end{aligned} \tag{E.17}$$

The total regional gross output net of distortions is $\breve{R}_{njt} = \breve{R}^d_{njt} + \breve{R}^x_{njt}$.

Market clearing. Labor market clearing implies

$$w_{nt} L_{nt} = \Big[\sum_j \gamma^L_j \Big(\frac{1}{\mu} R_{njt} + M^T_{njt} c_{njt} F^T\Big) + M^x_{njt} w_{nt} F^x_j\Big], \tag{E.18}$$

where R_{njt} is total revenues. The right-hand side is the sum of labor used for production, fixed adoption costs, and fixed export costs. Goods market clearing implies

$$R^d_{njt} = \sum_m \pi_{nmjt}(\alpha_j w_{nt} L_{nt} + \gamma^j_k \frac{1}{\mu} R_{nkt} + \gamma^j_k M^T_{njt} c_{njt} F^T), \tag{E.19}$$

where R^d_{njt} is domestic revenue. The government budget is balanced each period:

$$\sum_{n,j} \frac{t_{jt}}{1+t_{jt}} \pi^f_{njt} P_{njt} Q_{njt} + \tau^w_t \sum_n w_{nt} L_{nt} = \sum_{n,j} \frac{s_{njt}}{1-s_{njt}} M_{nj} \frac{1}{\mu} R^T_{njt} + \sum_{n,j}(R_{njt} - \breve{R}_{njt}), \tag{E.20}$$

where the left-hand side is sum of government revenues from import tariffs, labor tax, and firm-specific taxes.

Equilibrium. We formally define the equilibrium as follows.

Definition 1. *Given initial conditions* $\{\lambda^T_{njt_0}, L_{nt_0}\}$ *and paths of the fundamentals* $\{\phi^{min}_{njt}, P^f_{jt}, D^x_{jt}\}$*, tariffs* $\{t_{jt}\}$*, subsidies* $\{s_{njt}\}$*, and, an equilibrium is a path of wages* $\{w_{nt}\}$*, price indices* $\{P_{njt}\}$*, a set of functions* $\{p_{inmjt}, q_{inmjt}, p^x_{injt}, q^x_{injt}, T_{it}, x_{it}\}$*, labor tax* $\{\tau^w_t\}$*, and adopter shares* $\{\lambda^T_{njt}\}$ *such that for each period* t*, (i) firms maximize profits; (ii) households maximize utility; (iii) labor markets clear; (iv) goods markets clear; (v) trade is balanced; (vi) the government budget is balanced; and (vii) firm adoption decisions endogenously determine a path of the state variable* λ^T_{njt}*.*

Potential misallocation due to the policy. While subsidies aimed to foster technology adoption, some may have been allocated to less-productive firms, for example, due to political connections (Kim et al., 2021). In our model, subsidies are exclusively allocated to productive firms adopting technologies, thereby turning off this misallocation channel. Therefore, our quantitative findings should be interpreted as an upper bound of the true impacts.

Relationships to the recent big push models. We compare our model to those recently developed by Buera et al. (2021) and Kline and Moretti (2014). First, similar to Buera et al. (2021), the use of final goods for adoption costs is a source of multiplicity, as detailed in Appendix D.3. However, the spillovers, absent in their model, combined with this feature, creates the potential for multiple steady states in our model. While Buera et al. (2021) explore how idiosyncratic distortions and intermediate input intensities amplify effects of a big push in a closed economy setup, we extend their model to an open economy with rich spatial interactions and show that market access amplifies a big push. Second, in the models of Kline and Moretti (2014) and more recently Cerrato and Filippucci (2025), multiple steady states arise from factor mobility and agglomeration, as workers or capital move to more productive regions, enhancing productivity through agglomeration. In our model, labor is immobile, which shuts down this channel.

E.1 The Assumption of Static Adoption Decisions

The assumptions of the static adoption decisions make the state variable backward-looking. This simplification helps preserve rich spatial heterogeneity and connect the model to the empirical findings while facilitating computational implementation. For example, Desmet and Rossi-Hansberg (2014), Arkolakis et al. (2019), Peters (2022), and Nagy (2023) similarly simplify agents' forward-looking decisions to make models more tractable while preserving spatial complexity.

However, if adoption costs were sunk rather than fixed, adoption decisions would be forward-looking and depend on the entire path of future variables. Also, in this case, firm productivity persistence will also matter. Even so, dynamic complementarity could still lead to multiple steady states (e.g. Alvarez et al., 2023). Targeting the same path of state variables and static equilibrium outcomes in a forward-looking model with multiple steady states would not change our results qualitatively because the static equilibrium outcomes remain the same. However, welfare effects and magnitude of the quantitative results might differ. With sunk costs, persistence in firm productivity also matters. For example, Roberts and Tybout (1997) show that both persistence and sunk export costs were important in generating hysteresis in export status. They also found that firm productivity is highly persistent. In our case, persistence combined with sunk costs generates greater hysteresis, the effect of the big push may be amplified.

With dynamic decisions, self-fulfilling beliefs influence equilibrium selection (Matsuyama, 1995), a mechanism that is absent in our model due to the static decisions. Recently, Garg (2025) studies equilibrium selection under multiplicity in a static setup. Becko (2023) studies how coordination failures can be corrected by a "Super-Pigouvian" policy, which compensates agents for their welfare impacts while considering the effects of their actions on other agents' future behaviors in a dynamic setup with rational expectations. Incorporating self-fulfilling beliefs and equilibrium selection into our framework will be a promising avenue for future research.

F. Quantification

F.1 Calibration of ξ_j

To calibrate ξ_j, we follow di Giovanni et al. (2011) and Buera et al. (2021). For $s \geq 0$, the following relationship holds among non-exporters within region-sectors nj:

$$\mathbb{P}[Sale_{it} \geq s] \propto s^{\frac{-\theta}{\sigma(1+\xi_j)-1}}. \tag{F.1}$$

Because exporters have discretely larger sales around the export cutoff (di Giovanni et al., 2011), we focus on the sample of non-exporters, whose sales distribution follows a Pareto with shape parameter $\frac{-\theta}{\sigma(1+\xi_j)-1}$.

Following di Giovanni et al. (2011), we recover $\frac{\theta}{\sigma(1+\xi_j)-1}$ by regressing the log rank of firm sales within region-sectors on log sales for HCI firms: $\ln(\text{Rank}_{injt}) = a - b\ln(\text{Sale}_{injt}) + \varepsilon_{injt}$. We exclude regions with only fewer than five firms. Based on the estimated $\hat{b}$, for given values of σ and θ, we recover the corresponding ξ_j values reported in Table F.1. We find negative

Table F.1: Recovered Distortion Parameter

σ	5			4	6
$\frac{\theta}{\sigma-1}$	1.06	1.02	1.10	1.06	1.06
	(1)	(2)	(3)	(4)	(5)
ξ_{heavy}	−0.30	−0.31	−0.27	−0.11	−0.40

Notes. This table reports the recovered ξ_j for heavy manufacturing. Reported values correspond to different combinations of σ and θ.

values for ξ_j, implying that more productive firms were relatively more taxed. The negative estimate appears counterintuitive in light of the common perception that the government favored large firms. One possible explanation is that our calibration is based only on non-exporting firms, which are disproportionately smaller and less likely to receive subsidies. Moreover, during the 1970s, South Korean firms were not yet as large or concentrated as they are today. Choi (2024) documents that firm concentration began to rise in the early 1970s but remained at a much lower level throughout that decade.

F.2 Algorithm

Data inputs. The quantitative exercises require the following data inputs:

1. Initial adopter shares $\{\lambda^{T,\text{Data}}_{nj,68}\}_{n\in\mathcal{N},j\in\mathcal{J}^T}$ and initial population $\{L^{\text{Data}}_{n,72}\}_{n\in\mathcal{N}}$
2. Region-sector gross output $\{R^{\text{Data}}_{njt}\}_{n\in\mathcal{N},j\in\mathcal{J},t\in\{72,76,80\}}$
3. Sectoral exports and import shares $\{\text{EX}^{\text{Data}}_{jt},\pi^{f,\text{Data}}_{jt}\}_{j\in\mathcal{J},t\in\{72,76,80\}}$
4. Sectoral PPI changes between t and $t-1$, for $t\in\{76,80\}$
5. Aggregate real GDP growth between t and $t-1$, for $t\in\{76,80\}$
6. Import tariffs $\{t_{jt}\}_{j\in\mathcal{J},t\in\{72,76,80\}}$

Algorithm.

1. Guess parameters.
2. Guess fundamentals $\{c_{fj},D_{fj}\}_{j\in\mathcal{J}}$, and $\{\phi^{\min}_{nj}\}_{n\in\mathcal{N},j\in\mathcal{J}}$.
3. Given parameters $\{\mathbf{\Theta}^{\text{M}},\bar{s}\}$, we solve the model and update the fundamentals $\mathbf{\Psi}_t$ for each period. Then, we fit region- and sector-level aggregate outcomes to the data counterparts. This step corresponds to solving for the constraints of the minimization problem.
   (a) Update $\{D^{f'}_{jt}\}$ by fitting the export intensities of the model to those in the data $\frac{\text{EX}^{\text{Data}}_{jt}}{\sum_n R^{\text{Data}}_{njt}}$.
   (b) Update $\{P^{F'}_{jt}\}$ by fitting the import shares of the model to those in the data $\pi^{f,\text{Data}}_{jt}$.
   (c) For each sector, update $\{\phi^{\min'}_{njt}\}$ relative to the reference region until the shares of regional gross output exactly match the data counterparts $\frac{GO^{\text{Data}}_{njt}}{\sum_m GO^{\text{Data}}_{mjt}}$. Within each

sector, the regional gross output distribution only identifies the relative levels, so we normalize the Pareto lower bound parameters of the reference region n_0 to 1 for each sector and period.

(d) We recover the absolute levels of $\{\phi_{n_0jt}^{\min'}\}$ using sector PPI and real GDP growth. In the model, we construct PPIs as weighted averages of regional price indices, weighted by the 1970 regional gross output. Because PPIs only identify relative sectoral productivity growth, we identify the relative sector's Pareto lower bound using real GDP growth. The 1970 Pareto lower bounds of the reference regions are set to 1.

4. After updating the geographic fundamentals, given values of parameters and subsidies, we evaluate the objective function.
5. We iterate steps 1-4 until we find values of $\{\hat{\mathbf{\Theta}}^{\mathrm{M}}, \hat{\mathbf{s}}_t\}$ that minimize the objective function.

F.3 External Validity of the Subsidy Estimates

The annual average of total foreign credit provided between 1973 and 1979 was approximately 2.5% of 1972 GDP. The average nominal interest rate on these loans was about 9%, while the U.S. dollar-based inflation rate averaged 8%, yielding a real interest rate of roughly 1%. In contrast, official domestic bank loans carried nominal interest rates around 20%, and with average domestic inflation of 14.5%, the real rate was about 5.5%. The average loan maturity was six years. Hence, when receiving government-guaranteed directed credit instead of borrowing from domestic banks, firms effectively saved

$$(0.055 - 0.01) \times 6 \times 2.5\% \text{ of GDP} \approx 0.68\% \text{ of GDP},$$

where the three terms represent the interest rate differential, average maturity, and total credit-to-GDP ratio, respectively. This calculation aligns closely with our 0.6% estimate.

The direction of bias in this calculation is ambiguous. Because these interest rate differentials may not represent direct fiscal costs by the government, our subsidy estimate could overstate the actual fiscal cost. However, given that a substantial share (around 30%) of loans originated from informal credit markets where nominal interest rates reached 30-40%, much higher than those offered through formal domestic financial institutions (Cole and Park, 1980), the 0.68% figure could also understate the true cost.

F.4 Additional Exercises

F.4.1 Alternative Policy Schemes

Alternative subsidized regions. To examine the role of regional characteristics, we re-run the analysis while randomly selecting 35 subsidized regions out of 86—the same number as in the main exercise—and applying the same subsidy rate. We simulate this process 1,000 times. Specifically, we run the following regression using 1,000 simulations: $y_b = \bar{\mathbf{X}}_b' \boldsymbol{\beta} + \varepsilon_b$, where $\bar{\mathbf{X}}_b = \frac{1}{|\mathcal{N}_b^s|} \sum_{n \in \mathcal{N}_b^s} \mathbf{X}_{n,72}$, $\bar{\mathbf{X}}_b$ is the average of observables $\mathbf{X}_{n,72}$ across the subsidized regions, and $\mathcal{N}_b^s$ is the set of 35 subsidized regions in simulation b. Among four variables—log distance to port, population, market access, and natural advantage—only distance to port and market access are significantly positively correlated with steady state differences in heavy manufacturing GDP shares and welfare changes across simulations (Table F.3). These results re-emphasize the role of market access.

General subsidy. Would the big push occur if the government provided general subsidies at an 8.1% rate, the same rate as in the main exercise, to all heavy manufacturing firms in the subsidized regions, regardless of their adoption activities? We find that these general subsidies do not lead to the big push, with smaller welfare gains at just 0.29% (Panel A of Figure F.3). This is because such subsidies reduce production costs for all firms, increasing domestic competition and lowering adoption incentives for firms that might have otherwise adopted technologies. This highlights that industrial policy should focus on addressing coordination failures, rather than distributing funds without targeted goals. This result aligns with Buera and Trachter (2024), who show that adoption subsidies are more cost-effective than general revenue subsidies.

Optimal subsidy rate. The calibrated subsidies are not necessarily optimal, leaving room for potential welfare improvements. We numerically search for the optimal subsidy rate that maximizes aggregate welfare, conditional on the same set of subsidized regions. We find that an optimal rate of 12% yields welfare gains of 2%, a 0.78 percentage point higher than the baseline rate, and leads to a different steady state with even higher heavy manufacturing GDP shares than the steady state attained under the baseline rate (Panel B of Figure F.3). Unlike the simple model, which has at most three steady states, the quantitative model may admit more than three due to more complex spatial interactions.

F.4.2 Statistical uncertainty

The main calibration uses point estimates of $(\sigma-1)\eta$ and $(\sigma-1)\delta$ without accounting for their statistical uncertainties. To assess sensitivity to these uncertainties, we consider combinations of η and δ over a wide range of values within their 95% confidence intervals and re-calibrate the remaining parameters and fundamentals for each value. Allen and Donaldson (2020) conduct similar exercises to assess robustness for statistical uncertainties associated with estimated parameters.

An alternative approach would be to bootstrap both the regression and quantitative analyses, following recent studies such as Peters (2022), Fan et al. (2023), and Choi and Levchenko (2025). However, this procedure is difficult to be implemented here because the point estimates of η and δ are identified from distinct sources of variation: the former from firm-level variation in the winners-versus-losers design, and the latter from cross-sectional variation at the region-sector level. The statistical inference for η is based on two-way clustering at the firm and match levels, while that for δ is based on clustering at the region and group levels. Moreover, the small number of samples for the winner vs. losers research design further complicates the feasibility of the bootstrap procedure.

Over these combinations, most combinations yield multiple steady states (Table F.5), except for the case of $\eta = 1.2$ and $\delta = 1.24$. Conceptually, the bootstrap procedure results in a joint distribution over these combinations. While we did not fully compute this joint distribution, the fact that most combinations yield multiple steady states shows that our quantitative results are robust.

F.4.3 Spatial mobility

We extend the baseline model to incorporate spatial mobility of households. At the beginning of each period, households make *myopic* migration decisions that maximizes their static utility in each period, following Peters (2022). After relocating, they supply labor and earn wages in their new regions. Households choose where to live based on factors such as amenities, real income migration frictions, and preference shocks: $\max_n \left\{U_{mnt}(\varepsilon_{mnt})\right\}$, where $\mathcal{U}_{nmt}(\varepsilon_{nmt}) = V_{mt}C_{mt}d_{nm}\varepsilon_{nmt}$. V_{mt} is an exogenous amenity in region m that makes regions more or less attractive to live in, d_{nm} is the utility cost of moving from n to m, and ε_{nmt} is an iid preference shock drawn from a Fréchet distribution with the shape parameter ν. The parameter ν is the migration elasticity that governs how responsive migration flows are to real income changes in destination regions. The share of households moving from n to m in t is given by $\mu_{nmt} = \frac{(V_{mt}\omega_{mt}d_{nm})^{\nu}}{\sum_{m'}(V_{m't}\omega_{m't}d_{nm'})^{\nu}}$. Population L_{nt} becomes a state variable, in addition to adopter shares λ^T_{njt}, evolving as $L_{nt} = \sum_m \mu_{nm,t-1}L_{m,t-1}$.

Because each period corresponds to 4 years, we set $\nu = 0.5$ based on the migration elasticity of 0.5 at the annual frequency estimated by Choi (2024), which also aligns with the long-run value of 2 of Peters (2022). We parametrize migration costs as $d_{nm} = (\text{Dist}_{nm})^{\zeta}$ and estimate a gravity equation $\mu_{nm} = \exp(\nu\zeta\text{Dist}_{nm} + \delta_n + \delta_m)\varepsilon_{nmt}$ using PPML. We use 1990-

1995 migration flow data for individuals aged 20 to 55, obtained from the 1995 Population and Housing Census, the closest available data to the sample period. We obtain $\nu\zeta = 1.39$. Amenities are backed out by fitting population distributions for the years of 1972, 1976, and 1980.

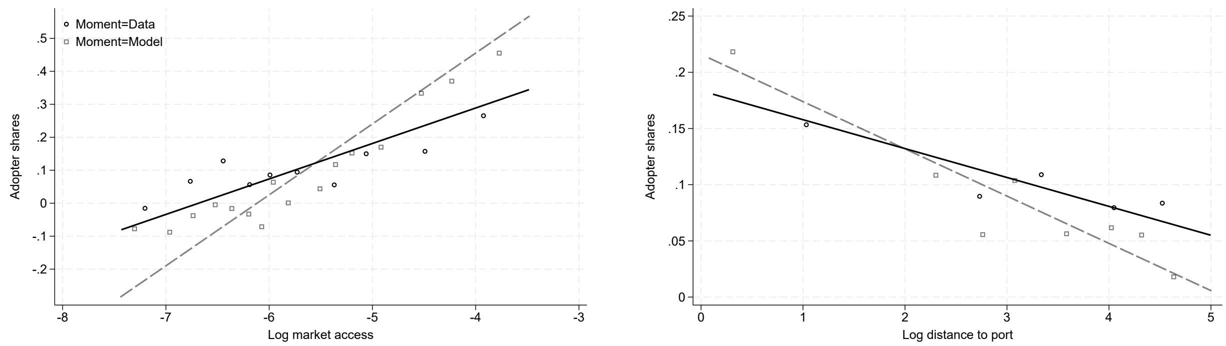
We extend the model to incorporate myopic migration decisions of households as in Peters (2022). Migration amplifies the big push, as labor relocates to regions with higher adoption levels, thereby reducing production and adoption costs in those regions (col. 1 of Table F.4).

F.4.4 Alternative parameter values

We explore alternative values for σ and θ (col. 3-6 of Table F.4). Lower σ amplifies the effects because our estimates do not separately identify η or δ from σ and both increase with lower σ. Lower θ also increases the effects, as they reduce dispersion in productivity. This results in a larger mass of firms being concentrated just below the cutoff, causing more firms to be affected by shifts in the cutoff due to subsidies.

F.5 Additional Figures and Tables

Figure F.1: Non-targeted Moments. Adopter Shares and Market Access



A. Market access B. Distance to port

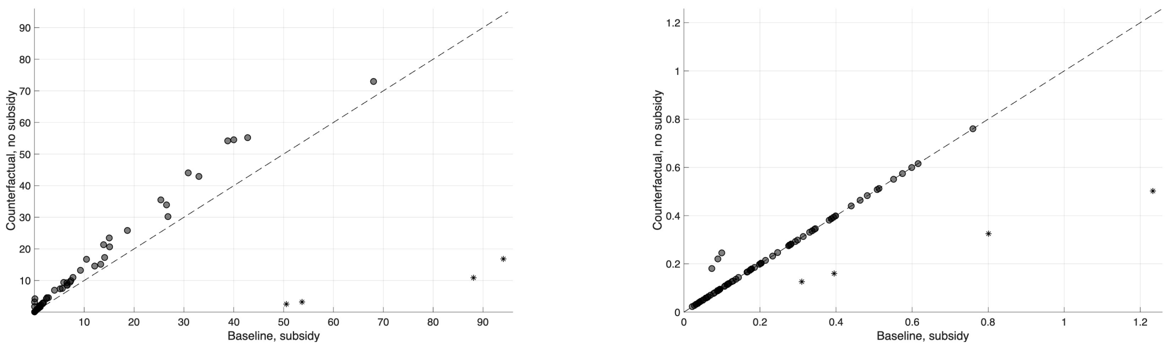
Notes. Panels A and B illustrate binscatter plots of market access (eq. (C.2)) and log distance to port (a proxy for export costs) versus adopter shares in both the model and the data, respectively. Each circle represents the average values of these two variables within bins that are optimally selected following Cattaneo et al. (2024).

Table F.2: Additional Non-Targeted Moments

	Model			Data		
Dep.	Emp (1)	Export (2)	Exporter share (3)	Emp (4)	Export (5)	Exporter share (6)
λ^T_{njt}	0.271***	0.379***	0.497***	0.282*	0.310***	0.549***
	(0.062)	(0.138)	(0.143)	(0.142)	(0.092)	(0.166)
Adj. R^2	0.91	0.55	0.73	0.73	0.78	0.37
N	258	258	258	258	258	258

Notes. This table presents the non-targeted moments of the model. The dependent variables are each region's heavy manufacturing employment in columns 1 and 4, export in columns 2 and 5, and shares of exporters in columns 3 and 6. Employment and exports are normalized by corresponding sum of total manufacturing sectors. All specifications include region fixed effects.

Figure F.2: Local Effects of the Big Push



Steady state local heavy mfg.

A. GDP share B. Productivity

Notes. Panels A and B illustrate each region's GDP shares and productivity $M_{nj}[\int z_{it}(\phi)^{\sigma-1}dG_{njt}(\phi)]^{1/(\sigma-1)}$ of the heavy manufacturing sector in the steady states of the baseline and counterfactual economies (x and y axes). Each dot represents a region, with dots located below the 45-degree line, colored red, indicating regions with higher steady state GDP shares and productivity in the baseline than the counterfactual.

Table F.3: Alternative Subsidy Scheme. Randomized Subsidy Regions

Dep.	$\triangle$ ln Heavy mfg. GDP shares				$\triangle$Welfare			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Avg. ln Dist. Port$_n$	-1.46^{***}				-2.87^{***}			
	(0.14)				(0.52)			
Avg. ln MA$_{n,heavy,72}$		1.23^{***}				3.95^{***}		
		(0.19)				(0.66)		
Avg. ln $\phi^{\min}_{n,heavy,72}$			-0.02				2.42	
			(0.40)				(1.48)	
ln $L_{n,72}$				-0.21				-1.39^{*}
				(0.20)				(0.74)
N	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000

Notes. We randomize which regions receive subsidies while holding the total number of subsidized regions constant at 35, as in the baseline calibration. This exercise is repeated 1,000 times. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the OLS estimates of the following regression model: $y_b = \bar{\mathbf{X}}_b'\boldsymbol{\beta} + \varepsilon_b$, where $\bar{\mathbf{X}}_b = (1/|\mathcal{N}_b^s|) \times \sum_{n\in\mathcal{N}_b^s} \mathbf{X}_{n,72}$, $\bar{\mathbf{X}}_b$ is the average of observable $\mathbf{X}_{n,72}$ across the subsidized regions, and $\mathcal{N}_b^s$ is the set of 35 subsidized regions in simulation b. Avg. ln Dist. Port$_n$ is the average of the log minimum distance to the nearest port of subsidized regions in each simulation; Avg. ln MA$_{n,heavy,72}$ is the average log initial market size of heavy manufacturing firms (eq. (C.2)); Avg. ln $\phi^{\min}_{n,heavy,72}$ is the average log natural advantage; and Avg. ln $L_{n,72}$ is the average log initial population.

Table F.4: Robustness. Spatial Mobility and Sensitivity Analysis for Alternative Parameter Values

Baseline	Spatial Mobility	Alternative parameter values			
		$\sigma = 3$	$\sigma = 6$	$\theta = 1.02$	$\theta = 1.10$
(1)	(2)	(3)	(4)	(5)	(6)
Δ Heavy mfg. GDP share (%)					
3.59	1.93	4.59	1.22	2.73	2.93
Does the big push occur?					
Y	Y	Y	Y	Y	Y

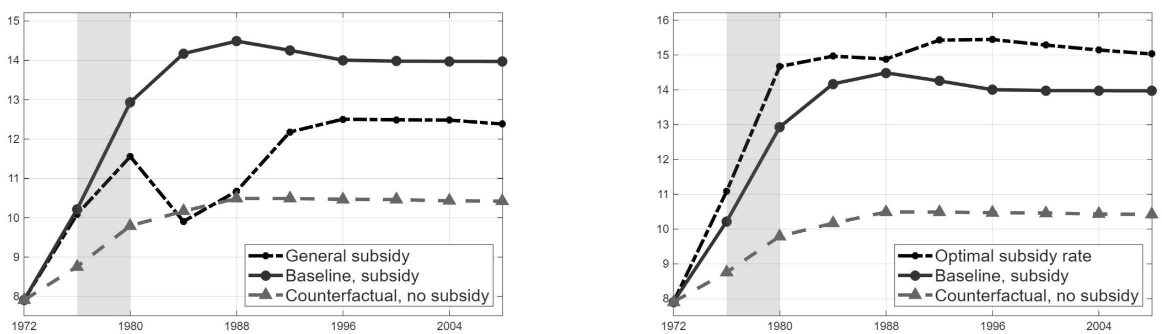
Notes. This table reports robustness exercises with spatial mobility (col. 2) and the sensitivity analysis under alternative sets of the externally parameters (col. 3-6). For each alternative set, the geographic fundamentals and remaining parameters are re-calibrated. Appendix F.4.3 explains the extended model with spatial mobility and its calibration procedure in detail.

Table F.5: Robustness. Statistical Uncertainty

		$(\sigma-1)\ln\eta$				
		0.3	0.4	0.6	0.9	1.2
$(\sigma-1)\delta$	1.24	0.61	0.38	0.20	0.75	0.03
	1.48	0.74	0.82	0.94	1.07	1.11
	2.0	0.53	1.06	1.23	2.16	1.79
	2.7	0.65	1.32	2.33	**3.59**	4.65
	3.4	3.92	1.48	4.73	4.87	2.46

Notes. This table reports a sensitivity analysis examining the statistical uncertainty in the point estimates of the parameters η and δ. We consider values within their lower 95% confidence intervals, and for each value, geographic fundamentals and remaining parameters are re-calibrated. Results based on the baseline calibration are shown in bold.

Figure F.3: Alternative Subsidy Scheme



Heavy mfg. GDP share (%)

A. General subsidy B. Optimal subsidy rate

Notes. This figure presents the heavy manufacturing sector's GDP shares in scenarios with general subsidies and the optimal subsidy rate of 12% (purple), baseline adoption subsidies (red), and no subsidies (blue).

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