The Plant-Level View of an Industrial Policy: The Korean Heavy Industry Drive of 1973

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Introduction

- During the East Asian growth miracle periods, governments were heavily involved.
  - No definitive answer as to the effectiveness of industrial interventions

- This paper:
  1. evaluates Korea's industrial policy during the 1970s using newly-digitized plant-level data
  2. utilizes the fact that the policy targeted **_industries_** and **_regions_**
  3. provides the first analysis of the pattern of resource allocation across manufacturing plants during this period

Summary

- Setting
  - The 1973-1979 heavy and chemical industry drive of the Park regime

- Results
  1. Output, input use, and labor productivity grew significantly faster in targeted industries/regions.

  2. Total factor productivity did not grow faster due to worsened misallocation.

  3. Industrial policy reshaped the economy:
     (i) establishment size distribution shifted to the right and
     (ii) targeted industries became more important in the IO structure.

Related Literature

1. Empirical analysis on the effectiveness of industrial policy
   - Aghion et al. (2015), Criscuolo et al. (2019), Giorcelli (2019), Hanlon (2020), Juhasz (2018), Lane (2020), Manelici and Pantea (2021), Rotemberg (2019)

2. Impact of policy changes on resource allocation within a country
   - Gopinath et al. (2017), Bau and Matray (2020)

3. Renewed debate on Korean industrial policy
   - Kim and Leipziger (1997), Lane (2021), Lee (1996)

Korean Heavy Industry Drive of 1973

- President Park's speech in January 1973
  - *The government is announcing the Heavy and Chemical Industry (HCI) project. ... From now on, the government will accelerate the promotion of HCIs such as steel, shipbuilding and petrochemical industries, and thereby increase their exports*

- Motivated by
  1. North Korea's military provocations and the partial pullout of the US troops
  2. Export promotion with the target annual export of 10 billion US dollars

- Various forms targeting
  1. Industries (e.g. tax incentives, subsidized long-term loans)
  2. Regions (e.g. constructing industrial complexes)

- The policy abruptly ended in 1979.

Korean Heavy Industry Drive of 1973

- Effective tax rates by industries (caluclated by Kwack, 1985)
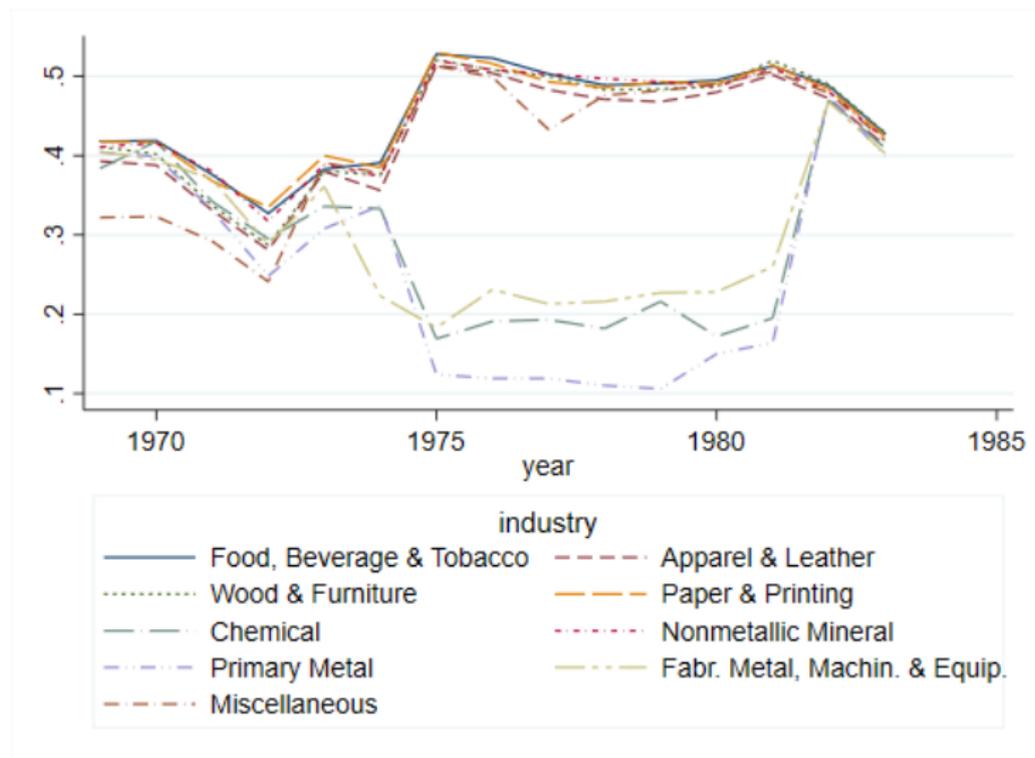
Korean Heavy Industry Drive of 1973

- Construction of industrial complexes in Korea: 9 locations
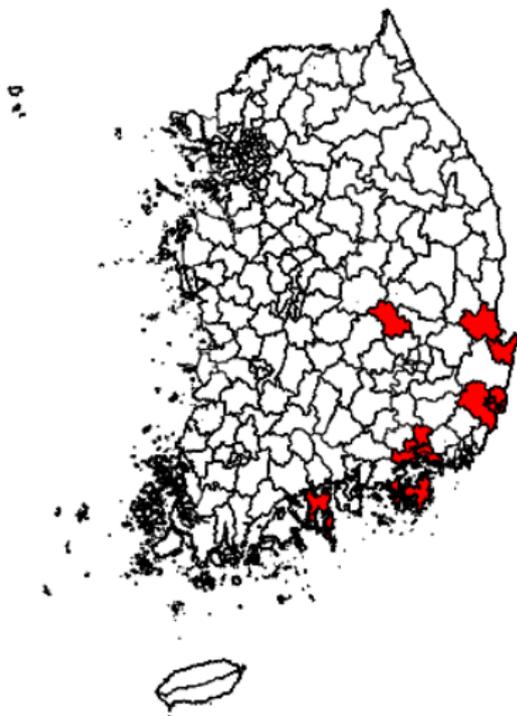
Korean Heavy Industry Drive of 1973

- Example: Changwon (a machinery industry cluster)

(a) In 1974

(b) In 1976

(c) In 1976

Source: National Archives of Korea

Data

- Newly digitized Mining and Manufacturing Survey (MMS), 1967-1987

- Advantages
  1. A unique source of plant-level data covering all plants with 5+ workers
  2. Detailed information on input and output
  3. Aggregation of micro data replicates aggregate statistics well

- Limitations
  1. 1970 and 1972 data is missing
  2. Capital stock is available only in 1968 and after 1977
  3. Plant age is only available after 1980
  4. No plant ID or firm ID, so no panel dimension or ownership structure

- Targeted industries and regions
  - Industries: 15 out of 28 harmonized industries (including three materially supported before 1973) ▸ Details
  - Regions: 3 out of 11 provinces ▸ Details

Output, Input, and Productivity

- A diff.-in-diff. estimator to estimate the impact of the policy:

$$\log Y_{ict} = \alpha + \sum_{j=\{1967-69\}\cup\{1973-87\}} \beta_j[D_{ic} \times \text{Year}_t^j] + \gamma_i + \delta_c + \theta_t + \varepsilon_{ict}$$

  Y_{ict}: outcome variable for industry i in region c in year t.

  D_{ic}: binary indicator equal to one if the industry and the region were treated and zero otherwise.

  γ_i, δ_c, θ_t: industry, region, and year fixed effects, respectively.

- β_j's show the differential evolution of targeted and non-targeted industries relative to 1971.

- Standard errors: two-way clustering over industries and regions

Output, Input, and Productivity
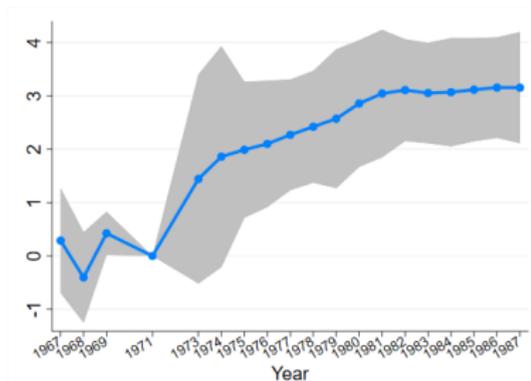

(a) Real Value-added
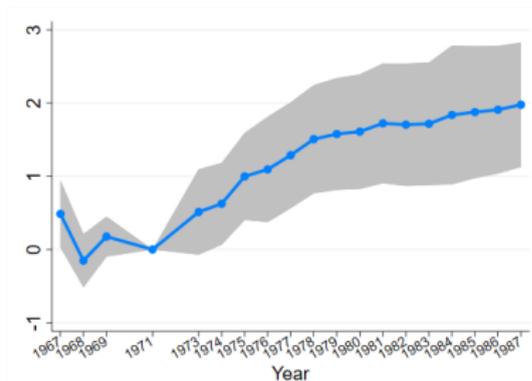
(b) Number of Employees
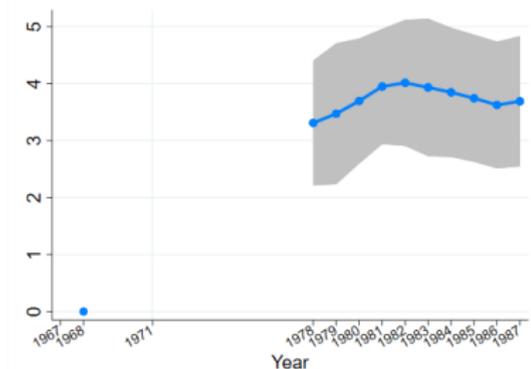
(c) Real Capital Stock

Output, Input, and Productivity
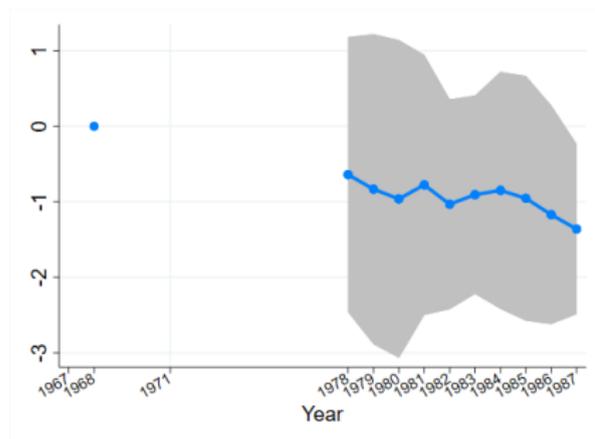
(a) Total Factor Productivity

Under Cobb-Douglas assumption as in

Wooldridge (2009), Levinsohn and Petrin (2003)
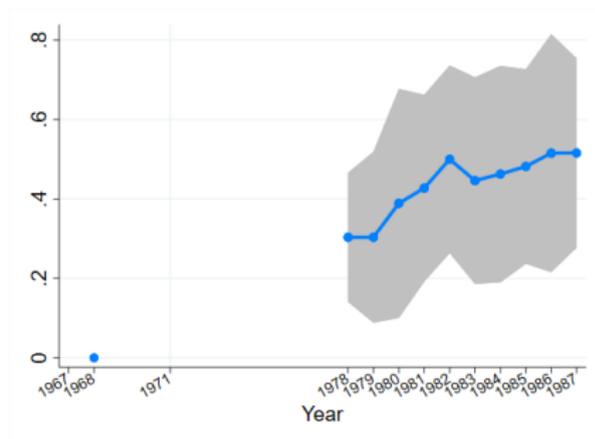
(b) Simple Average of
Establishment-level TFPs

Allocative Efficiency

- Top concentration of output and input increased more in targeted industries/regions.

- How about misallocation?

- Hsieh and Klenow (2009) method where the TFP at the industry-region level can be expressed as

$$\log TFP_s = \frac{1}{\sigma - 1} \log \left(\sum_{i=1}^{N_s} A_{si}^{\sigma-1} \right) - \frac{\sigma}{2} \mathrm{var}(\log TFPR_{si}) \ .$$

Allocative Efficiency
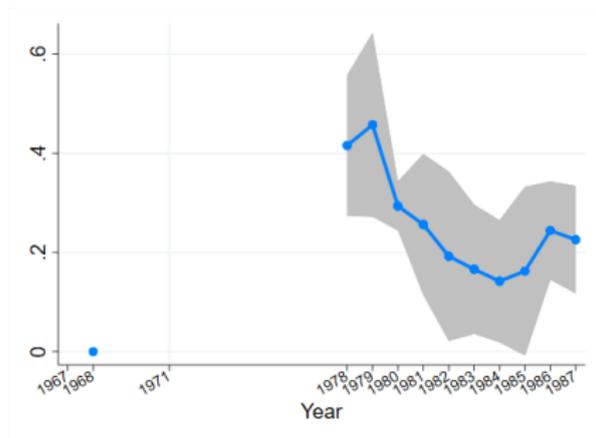
(a) Standard Deviation of TFPR
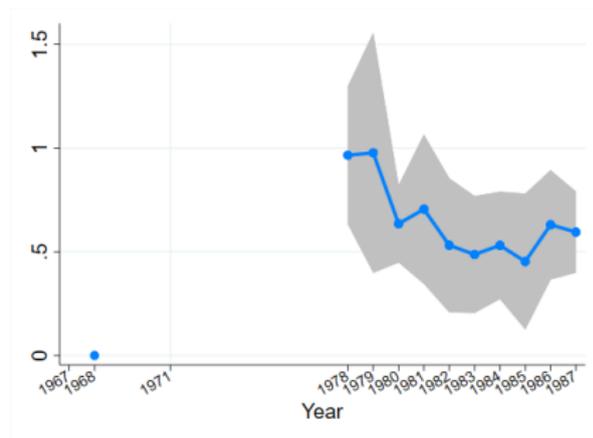
(b) Correlation b/w TFPR & TFPQ

Allocative Efficiency

- Direct and indirect discriminatory support contributed to the worsening resource misallocation across plants within targeted industries and regions—cf. the rise of the *chaebols*
- The decline in misallocation measure since 1980 coincides with the policy of "rationalization" by the successor regime
- Economic impact of the worsened misallocation
  - The variance of log TFPR increased by 34 percent (decreased by 24 percent) in the targeted (non-targeted) industries/regions
  - The TFP of the targeted industries/regions would have been higher by 40 percent in 1980, if the degree of misallocation within them relative to the non-targeted ones had remained the same between 1968 and 1980.

Allocative Efficiency

- Entrants vs. incumbents
  - Plant age information is only available after 1980
  - In 1980, we compare entrants during the policy period (age 0-7 plants) and incumbents (age 8+ plants)

$$Var(\text{TFPR}_{ic}) = \frac{N_y}{N_y + N_o} Var_y(\text{TFPR}_{ic}) + \frac{N_o}{N_y + N_o} Var_o(\text{TFPR}_{ic})$$
$$+ \frac{N_y}{N_y + N_o}(\overline{\text{TFPR}_y} - \overline{\text{TFPR}})^2 + \frac{N_o}{N_y + N_o}(\overline{\text{TFPR}_o} - \overline{\text{TFPR}})^2$$

	Entrants variance share	Incumbents variance share
Targeted	0.74	0.24
Non-targeted	0.65	0.33

  - Dispersion among entrants more pronounced in the target industries/regions

Establishment Size Distribution
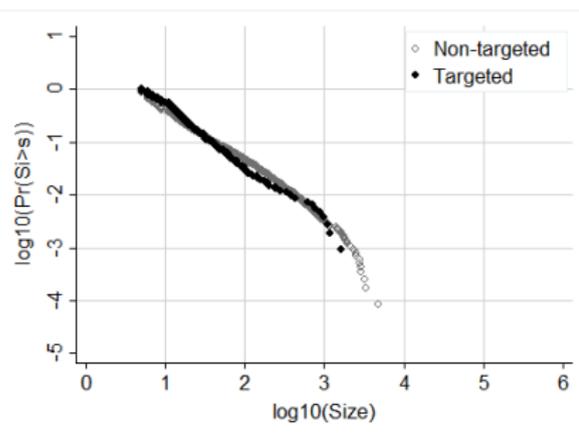
(a) Size in 1967
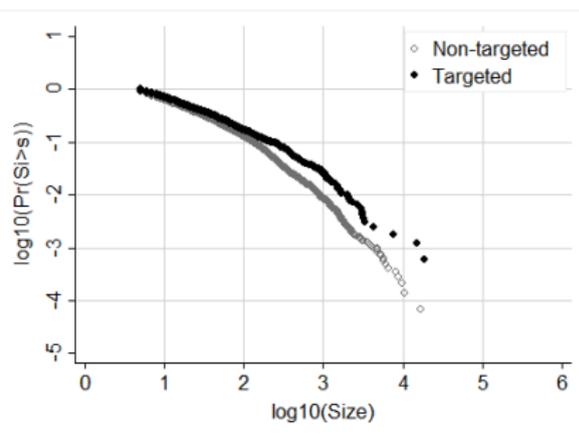
(b) Size in 1980

- The right tail became fatter, with a disproportionate increase in the number of very large establishments in the target industries/regions.
- Caveat: The largest establishment in 1980 may not have been the most productive ones.

Establishment Size Distribution
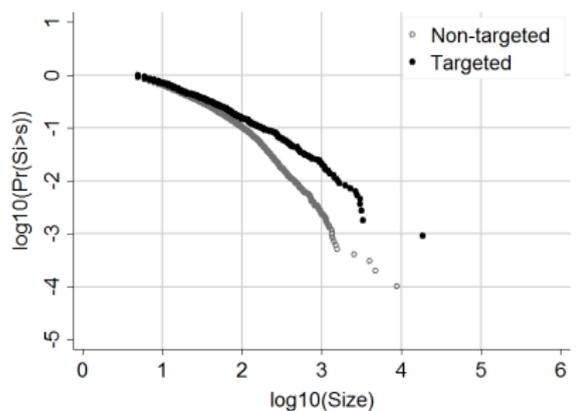
(a) Size in 1980 (age 0-7 plants) (b) Size in 1980 (age 8+ plants)
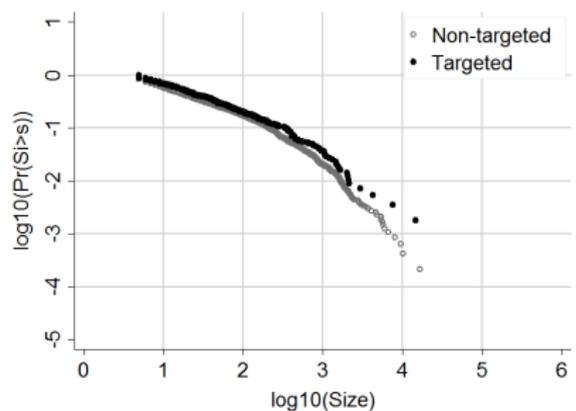
- Target vs. non-target size distribution differs starkly among entrants.
- Little difference in size distribution between entrants and incumbents in the target industries/regions.
- Entry margin was an important channel for the policy's effects.

Change in Input-Output Networks

- Sectoral multiplier following Fadinger et al. (2021)

$$\mu = [I - \Gamma]^{-1}\beta. \tag{1}$$

where $[I - \Gamma]^{-1}$ is the Leontief inverse and β is the vector of expenditure shares.

- The impact of a one-percent increase in the productivity of a given industry on the overall value-added of the economy
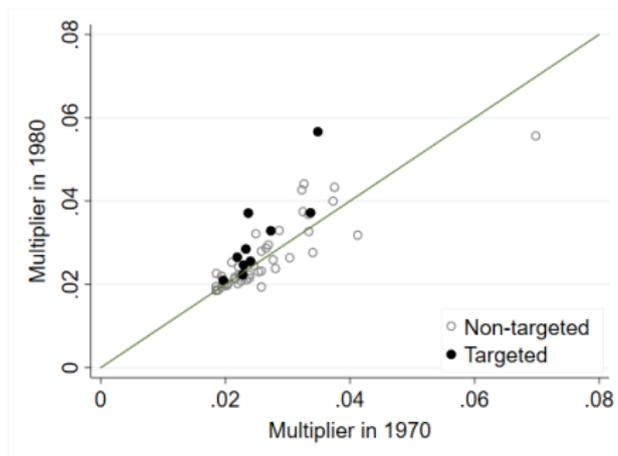
(a) Sectoral IO Multipliers

	Non-target	Target
1970	0.0264	0.0254
1980	0.0266	0.0312

(b) Average Multipliers

Conclusion

- What does industrial policy do? Based on our evidence from Korea,
  - Plant-level outcome: the targeted industry-region pairs grew significantly faster in terms of output, input use, and labor productivity.
  - Allocative efficiency: No significant impact on the TFP, due to worsened misallocation within the targeted industries and regions. (positive plant-level effect $\neq$ positive aggregate effect)
  - Economic structure: Establishment size distribution shifted to the right (possibly due to technology adoption), and the targeted industries became more important in the IO structure of the economy (also benefiting non-targeted industries).

List of Treated Industries

Industry Code	Industry Name	Treatment
311	Food	N
313	Beverage	N
321	Textiles	N
322	Apparel	N
323	Leather	N
324	Footwear	N
331	Wood	N
332	Wood furniture	N
341	Paper, paper products	N
342	Publishing, printing	N
351	Chemicals	Y*
352	Other Chemical products	N
353	Refined petroleum	Y*
355	Rubber and plastics	N
36	Other non-metallic mineral products, except cement	N
3692	Manufacture of cement, lime and plaster	Y*
371	Manufacture of basic iron and steel	Y
372	Manufacture of basic precious and other non-ferrous metals	Y
381	Manufacture of fabricated metal products, except machinery and equipment	Y
382	Manufacture of machinery and equipment n.e.c.	Y
3825	Manufacture of office, accounting and computing machinery	Y
3831	Manufacture of electrical machinery and apparatus n.e.c.	Y
3832	Manufacture of radio, television and communication equipment and apparatus	Y
384	Other transport equipment	N
3841	Building of ships, boats, and floating structures	Y
3843	Manufacture of motor vehicles and parts	Y
385	Manufacture of medical, precision and optical instruments, watches and clocks	N
390	Manufacturing n.e.c.	N

List of Treated Regions

Region Code	Region Name	Treatment Status
11	Seoul	N
21	Busan	N
31	Gyeonggi-do, Incheon	N
32	Gangwon-do	N
33	Chungcheongbuk-do	N
34	Chungcheongnam-do, Daejeon	N
35	Jeollabuk-do	N
36	Jeollanam-do, Gwangju	Y
37	Gyeonngsangbuk-do, Daegu	Y
38	Gyeonngsangnam-do, Ulsan	Y
39	Jeju-do	N

Change in Input-Output Networks

(a) IO Matrix in 1970

(b) IO Matrix in 1980

		supplying	
		Non-target	Target
using	Non-target	80.38%	10.34%
	Target	4.52%	4.76%

(c) Two-sector IO Matrix in 1970

		supplying	
		Non-target	Target
using	Non-target	64.44%	15.14%
	Target	6.86%	13.57%

(d) Two-sector IO Matrix in 1980