The Plant-Level View of Korea's Growth Miracle and Slowdown

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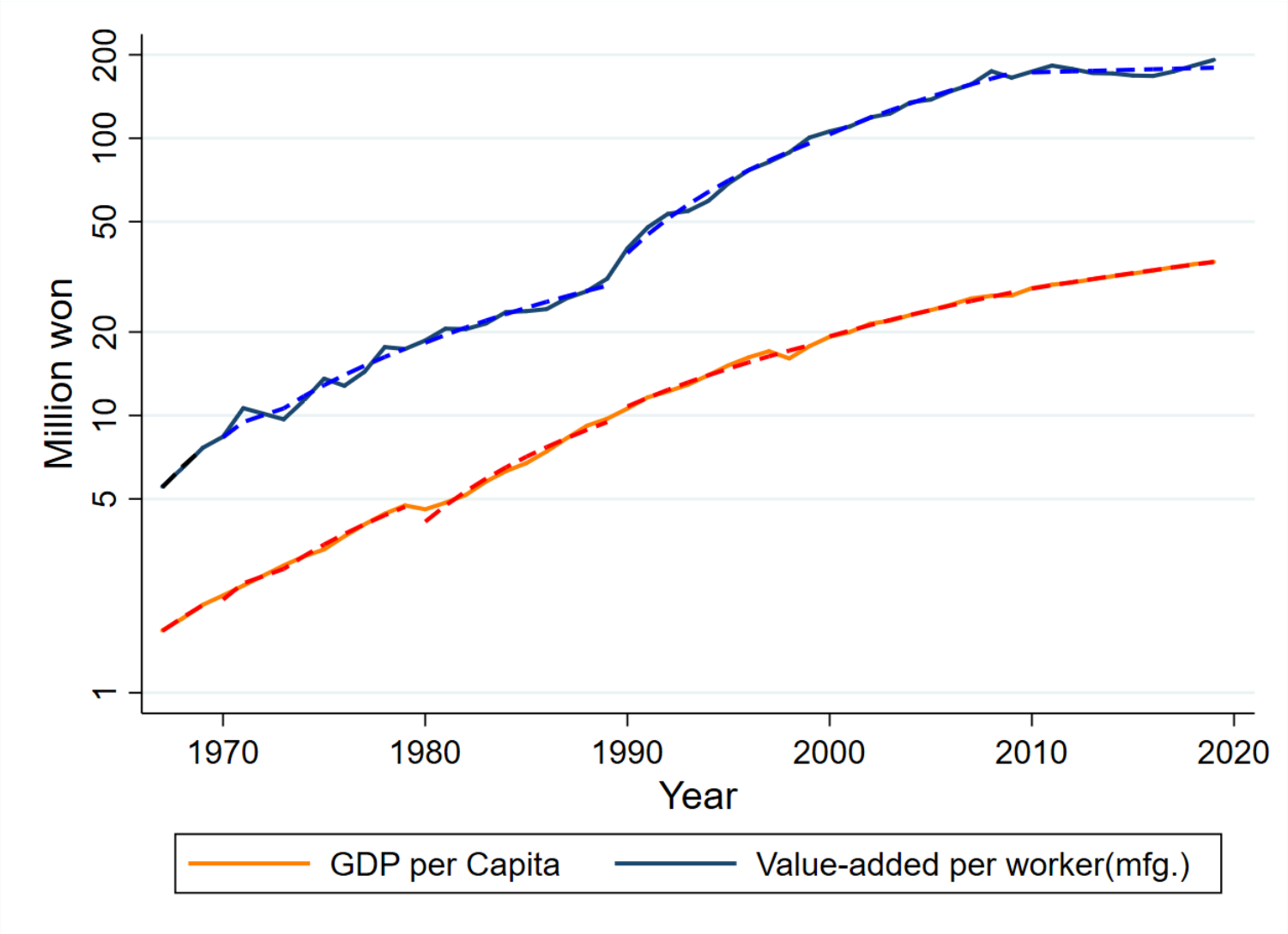
Introduction

- South Korea is one of the rare economies that went from poor to rich in one generation. Then, its growth markedly slowed down since 2000.
- Is there a systematic pattern at the micro-level behind the macro-level growth miracle and slowdown?
- Our findings
  1. No clear relationship between macro-level growth and the plant size distribution or static measures of allocative efficiency.
  2. Growth slowdown coincides with a reduction in dynamism.

Korea's Growth Miracle and Slowdown from 1967 to 2019

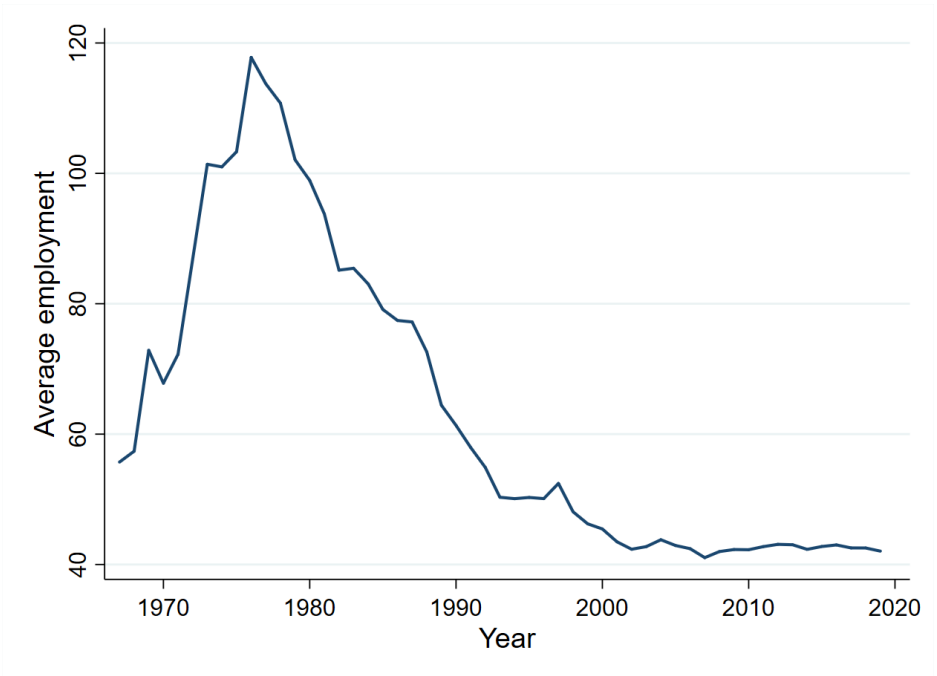


Note: GDP per capita is deflated by GDP deflator (2015=100), and value-added per worker is deflated by manufacturing industry deflator (2015=100).

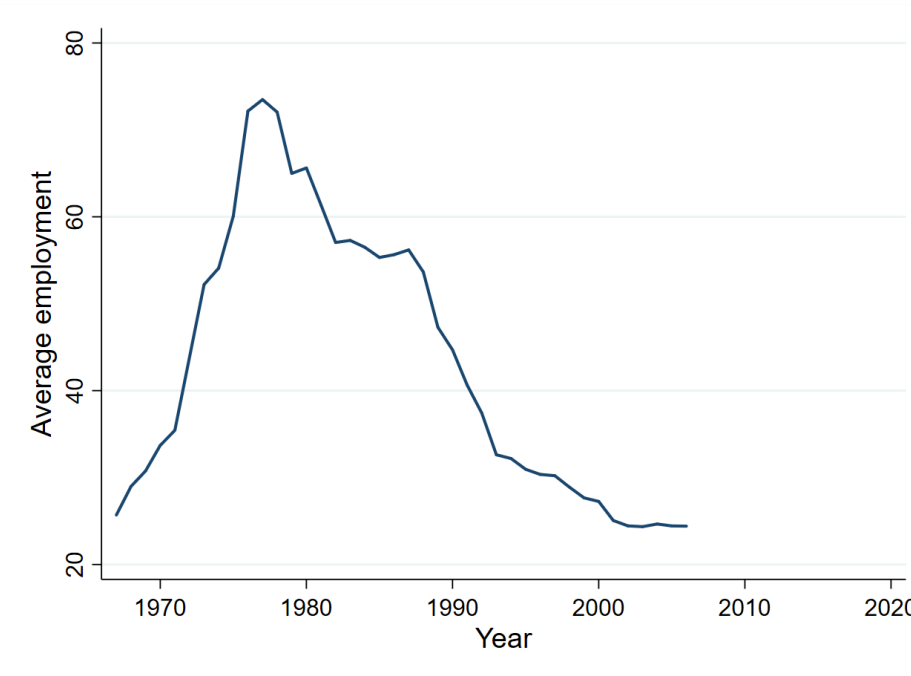
Data

- Newly digitized Mining and Manufacturing Survey (MMS), 1967-2019
- Advantages
  1. A unique source of plant-level data covering all plants with 5+ workers (10+ from 2007)
  2. Detailed information on input and output
  3. When aggregated, it replicates aggregate statistics
- Limitations
  1. Panel dimension is available only after 1981
  2. Capital stock is available only in 1968 and after 1978

Plant Size Distribution

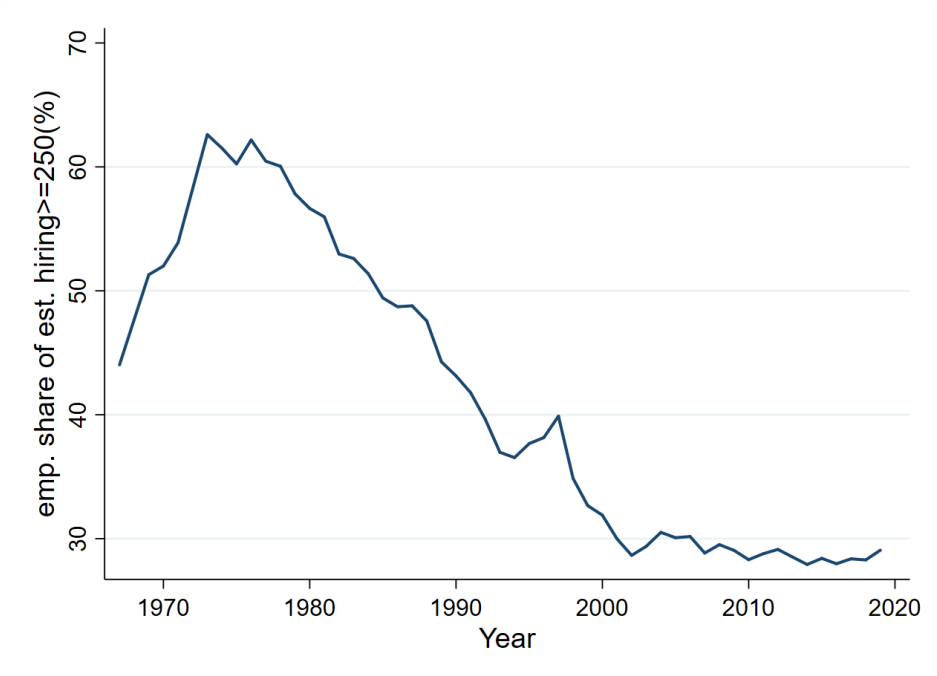


(a) Avg. of plants w/ 10+

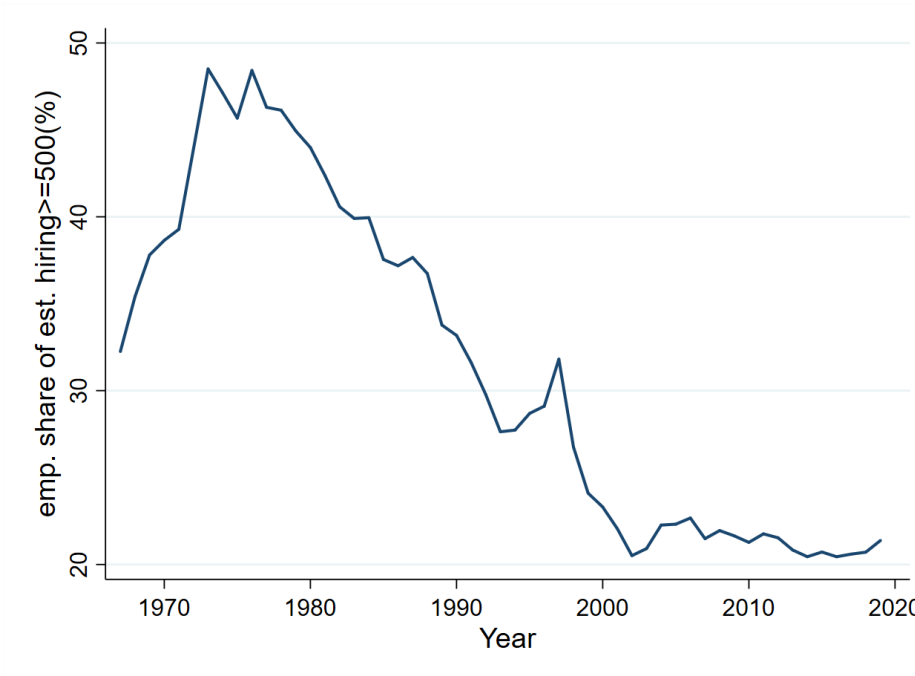


(b) Avg. of plants w/ 5+

Plant Size Distribution

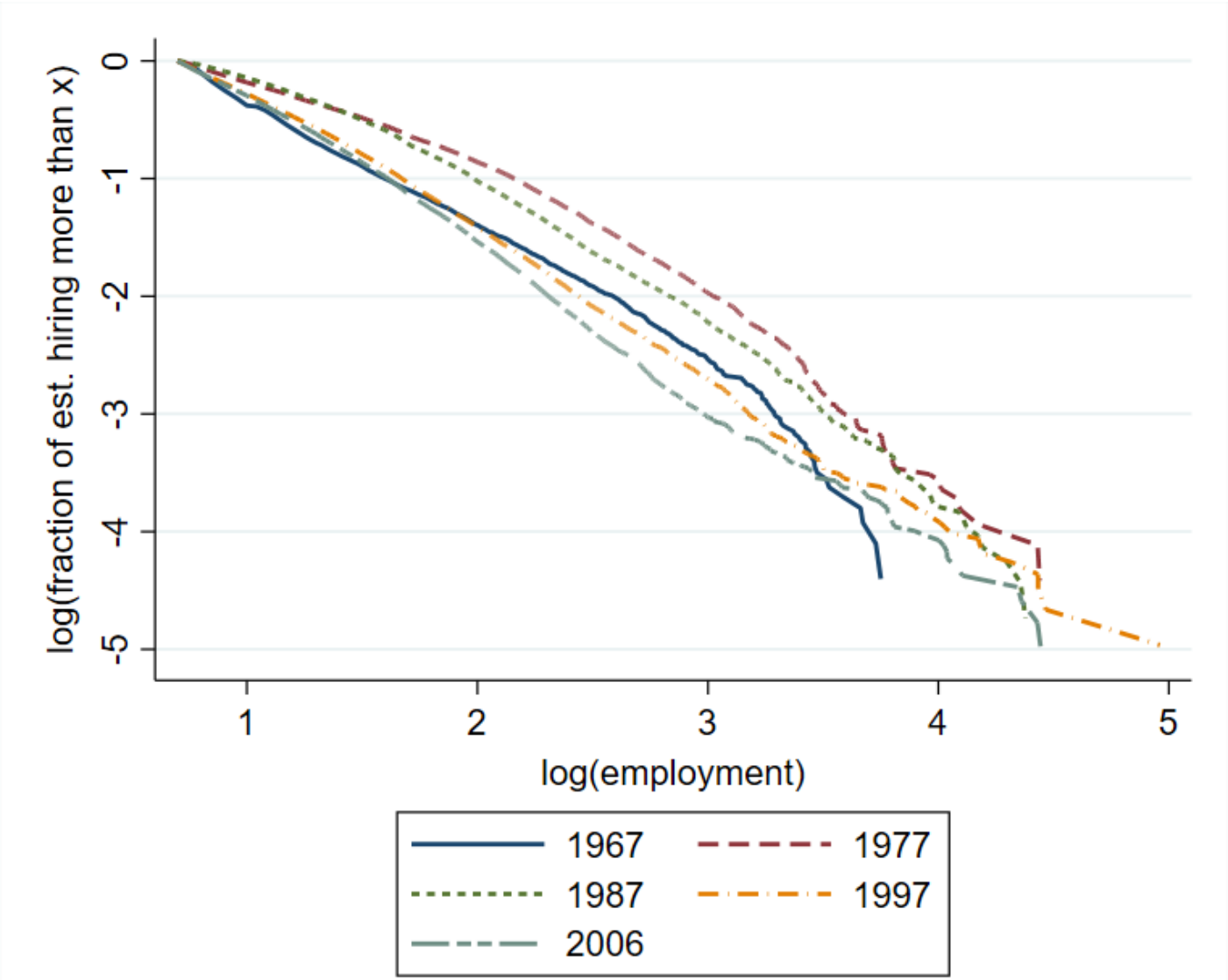


(a) Empl. share of plants w/ 250+



(b) Empl. share of plants w/ 500+

Plant Size Distribution (Log-Log Plot)



The increase and the decrease of plant sizes were broad-based.

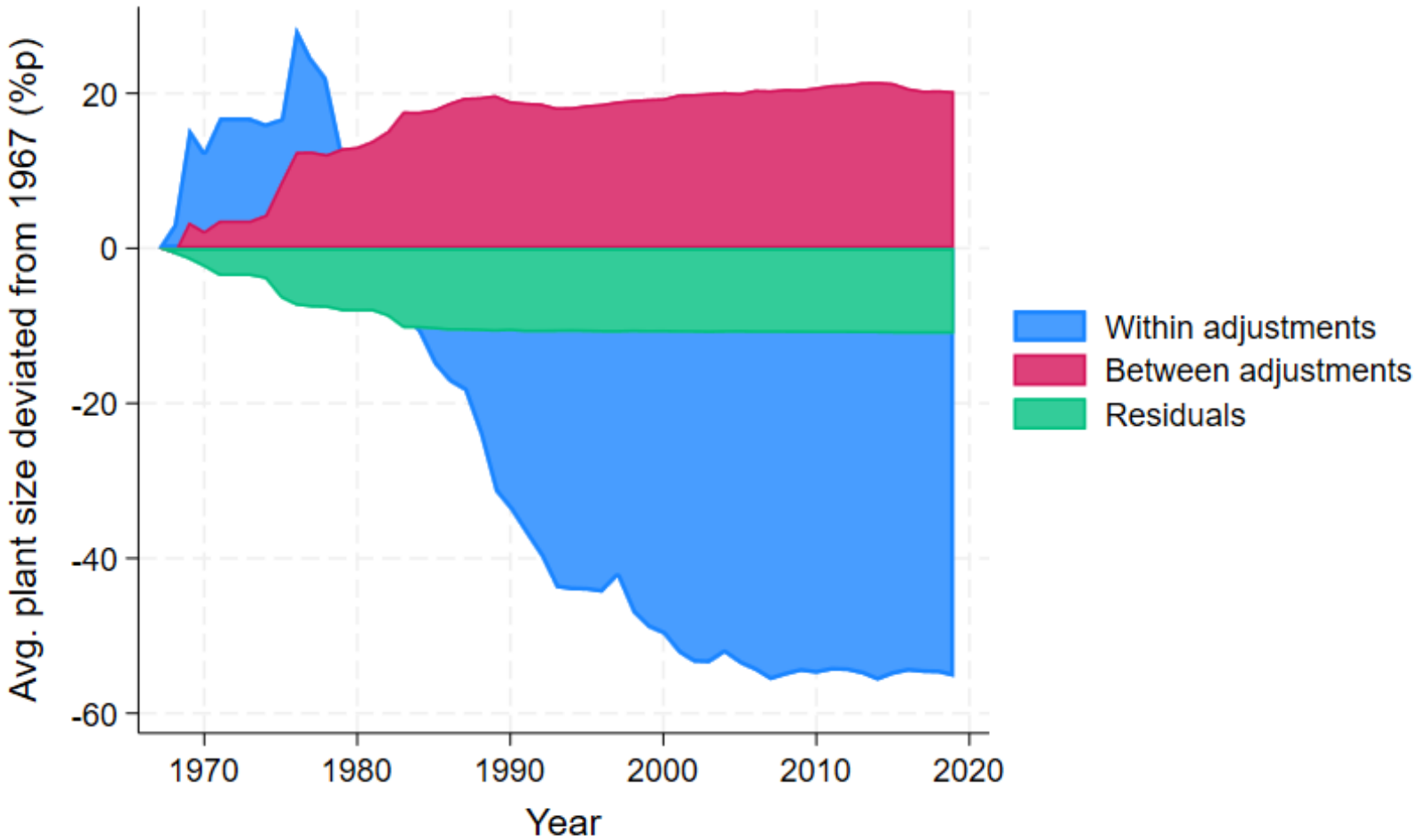
Plant Size Distribution: Three Discussions

1. Is it driven within industries or between industries?
2. Do we find similar inverse-U pattern in other countries?
3. Why do we see the inverse-U pattern in Korea?

Discussion #1: Within vs. Between Industries

- m_t is aggregate average employment defined as the weighted sum of each industry's average employment:
  - $m_t = \sum_i w_{i,t} m_{i,t}$, where w_i is the employment share of industry i
- We can decompose m_t:
  - $\Delta m_t = \sum_i w_{i,t-1} \Delta m_{i,t} + \sum_i \Delta w_{i,t} m_{i,t-1} + \sum_i \Delta w_{i,t} \Delta m_{i,t}$
  - The first term is within adjustment, and the second term is between adjustment.

Discussion #1: Within vs. Between Industries



Decomposition of Cumulative Changes in Average Plant Size

Discussion #2: Other Countries

▸ Cross-sectional Evidences

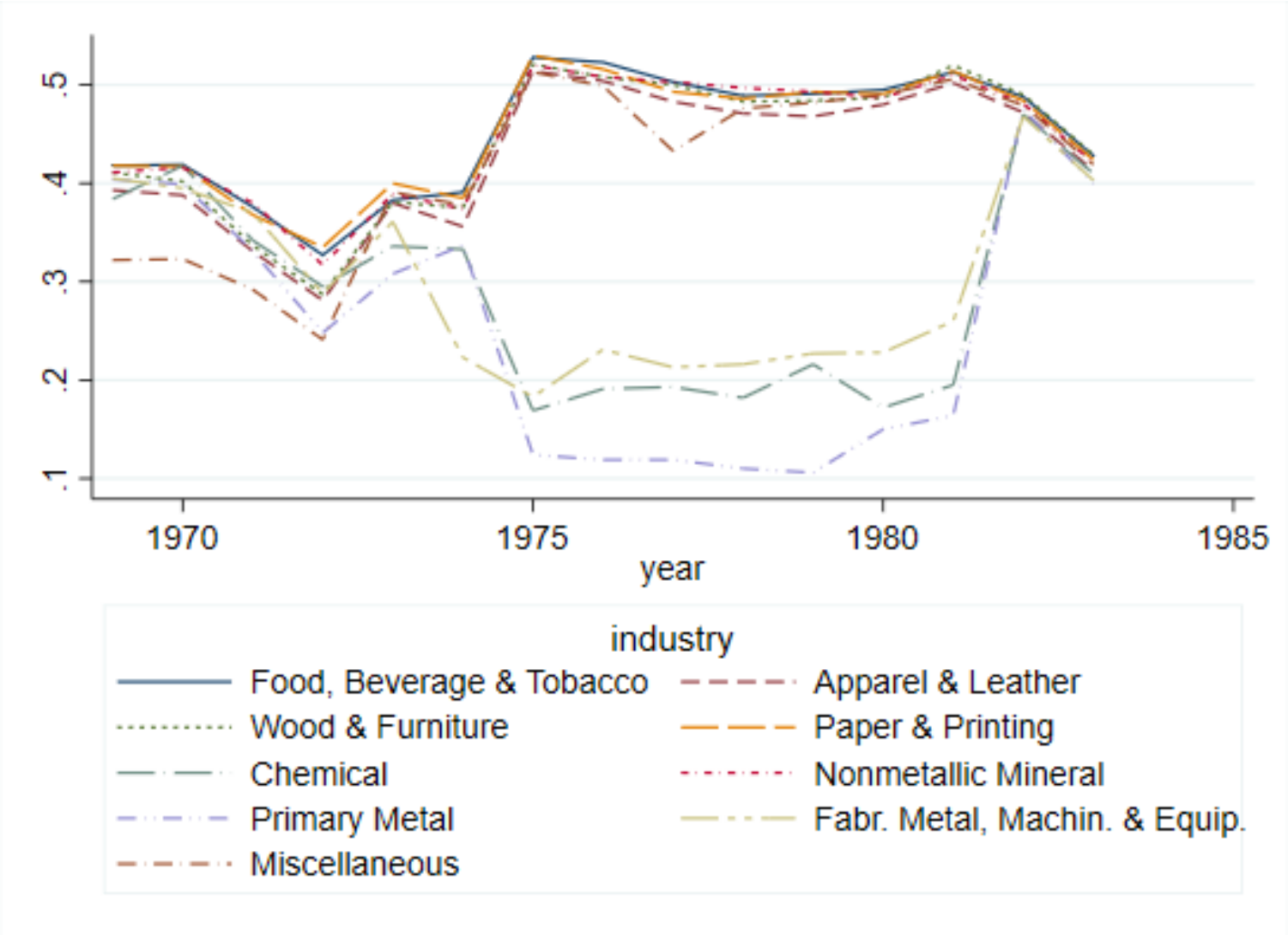
- Lucas (1978): average firm size increased over time in the U.S.
- Evidence outside the U.S. and Europe is limited.
- A special issue of Small Business Economics in February 2002
  - similar inverse-U pattern: Taiwan (manufacturing), Korea (manufacturing), Japan (manufacturing)
  - increasing: Japan (service), Thailand, Malaysia (machine tools sector)
  - stable: Indonesia
- Evidence on the relationship between plant/firm size and economic development is mixed.

Discussion #3: 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*
- Motivation
  - Export promotion with the target annual export of 10 billion US dollars
- Beneficiaries
  1. Industries (e.g. tax incentives, subsidized long-term loans)
  2. Regions (e.g. constructing industrial complexes)

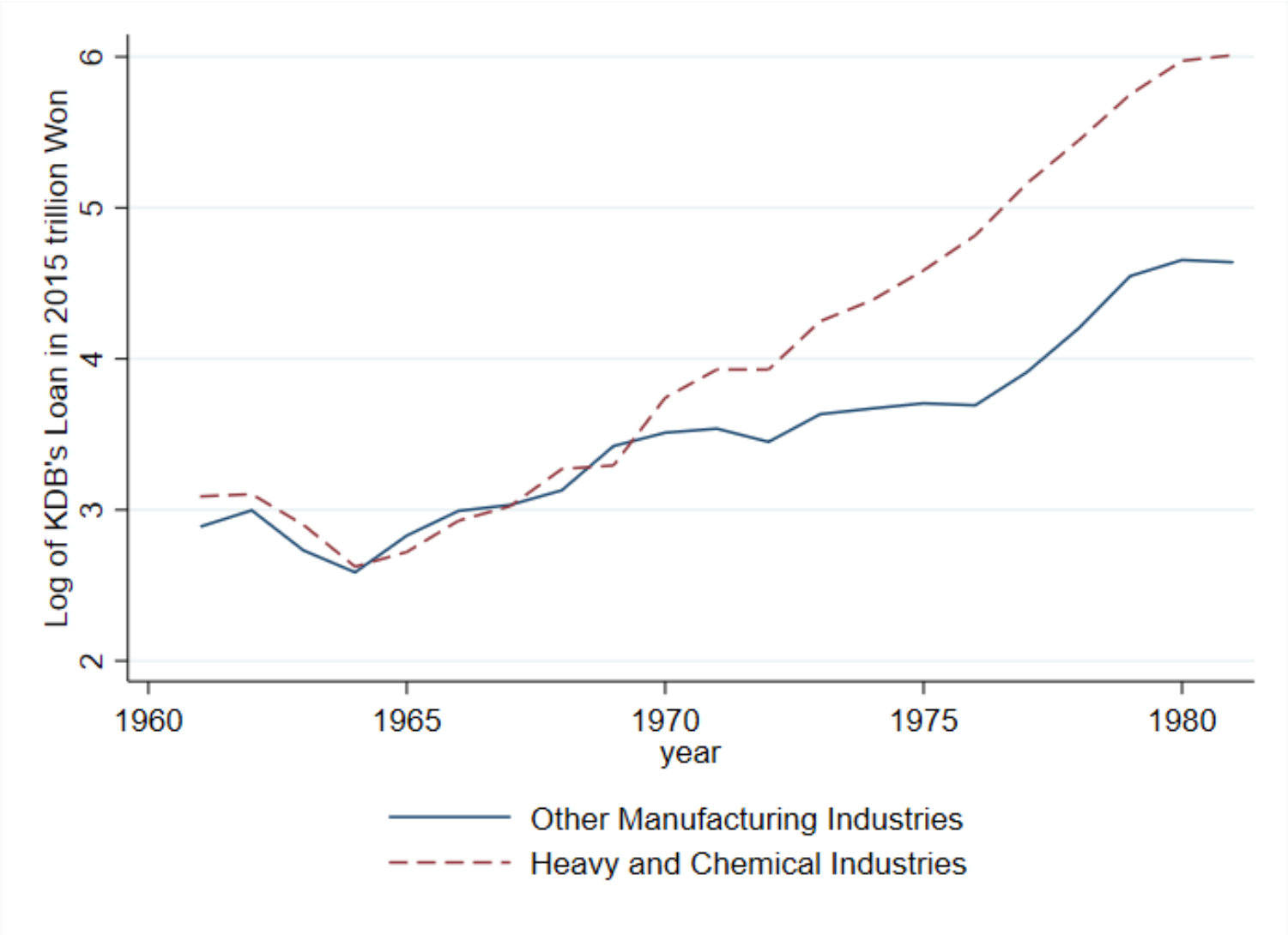
Discussion #3: Korean Heavy Industry Drive of 1973

- Effective tax rates by industries (calculated by Kwack, 1985)



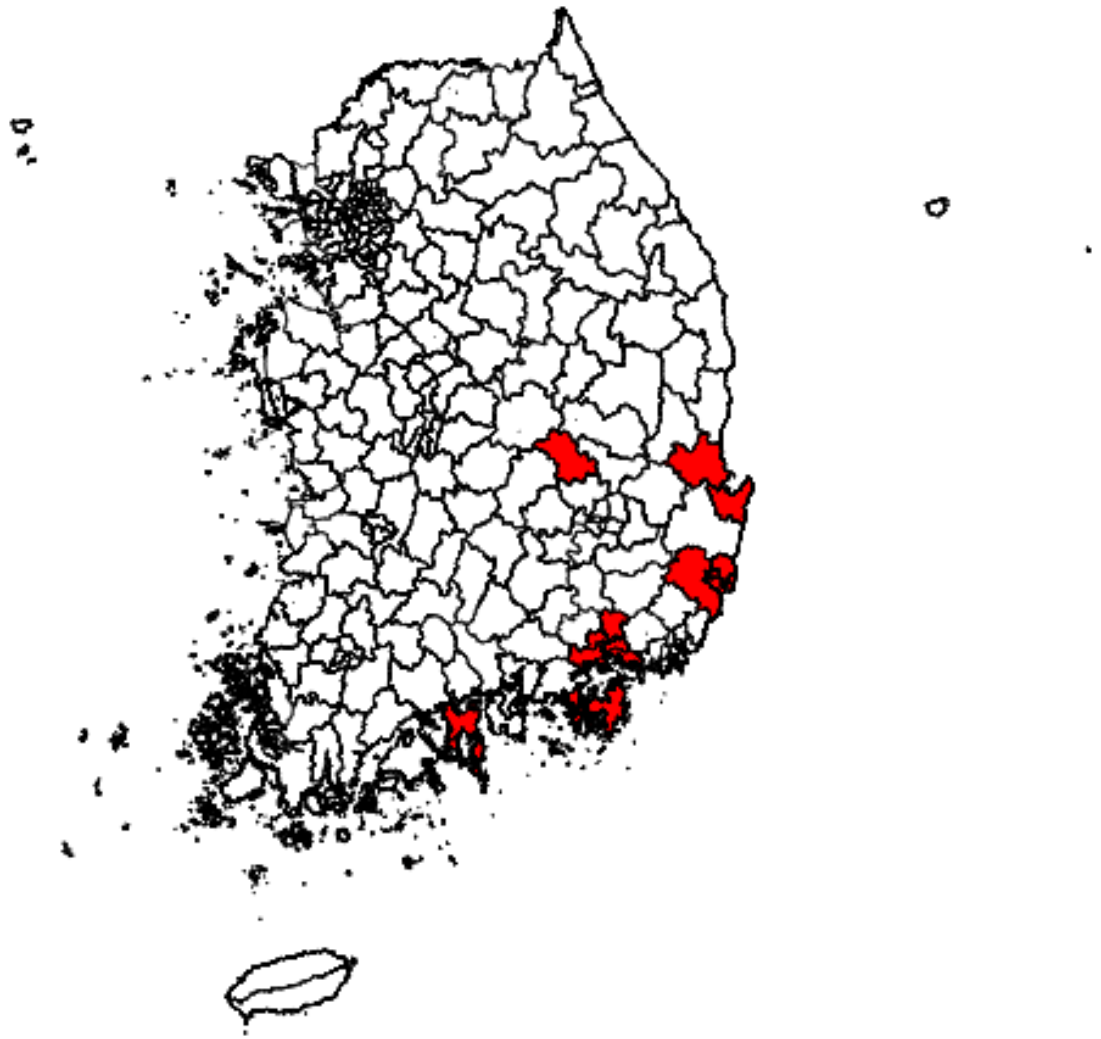
Discussion #3: Korean Heavy Industry Drive of 1973

- Loan by the Korea Development Bank



Discussion #3: Korean Heavy Industry Drive of 1973

- Construction of industrial complexes in Korea: 9 locations



Discussion #3: 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

Discussion #3: Korean Heavy Industry Drive of 1973

- Abrupt end with the assassination of President Park in October 1979
- "Rationalization" by the new military junta in 1980, to distance themselves from the Park regime and to blame the economic contraction (first negative growth since the Korean War) on Park's HCI policy and low utilization.
- As an outcome, new establishments entered at a faster rate in 1980s, driving down the average plant size, while the aggregate economy grew steadily.

Allocative Efficiency

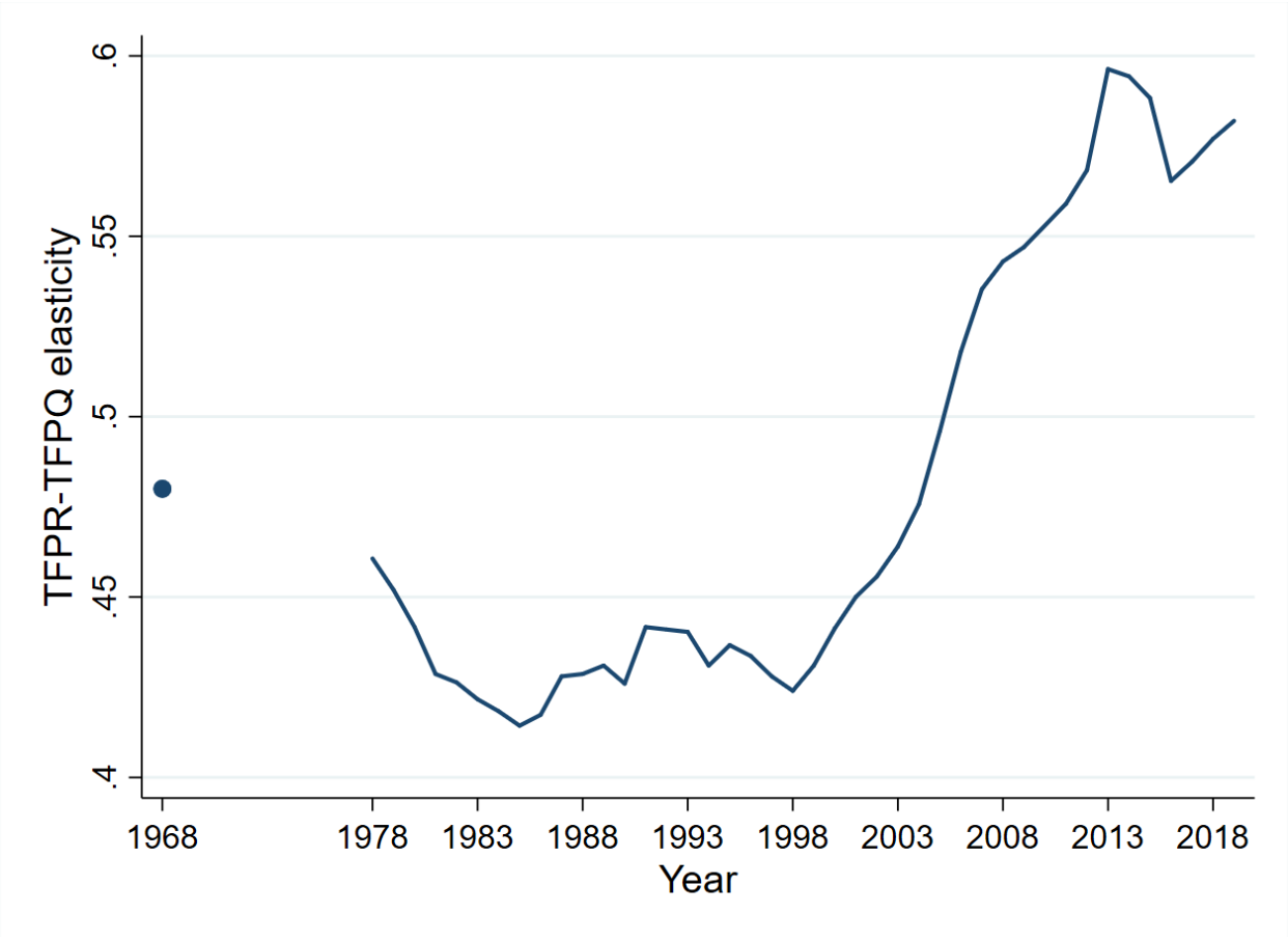
- Hsieh and Klenow (2009)'s methodology of measuring misallocation:

$$TFPQ_{si} = A_{si} = \frac{(P_{si}Y_{si})^{\frac{\sigma}{1-\sigma}}}{K_{si}^{\alpha_s} L_{si}^{1-\alpha_s}}$$

$$TFPR_{si} = P_{si}A_{si} = \frac{P_{si}Y_{si}}{K_{si}^{\alpha_s} L_{si}^{1-\alpha_s}}$$

- 4-digit level industries. Plants winsorized at 1 percent.

Allocative Efficiency



TFPR-TFPQ elasticity

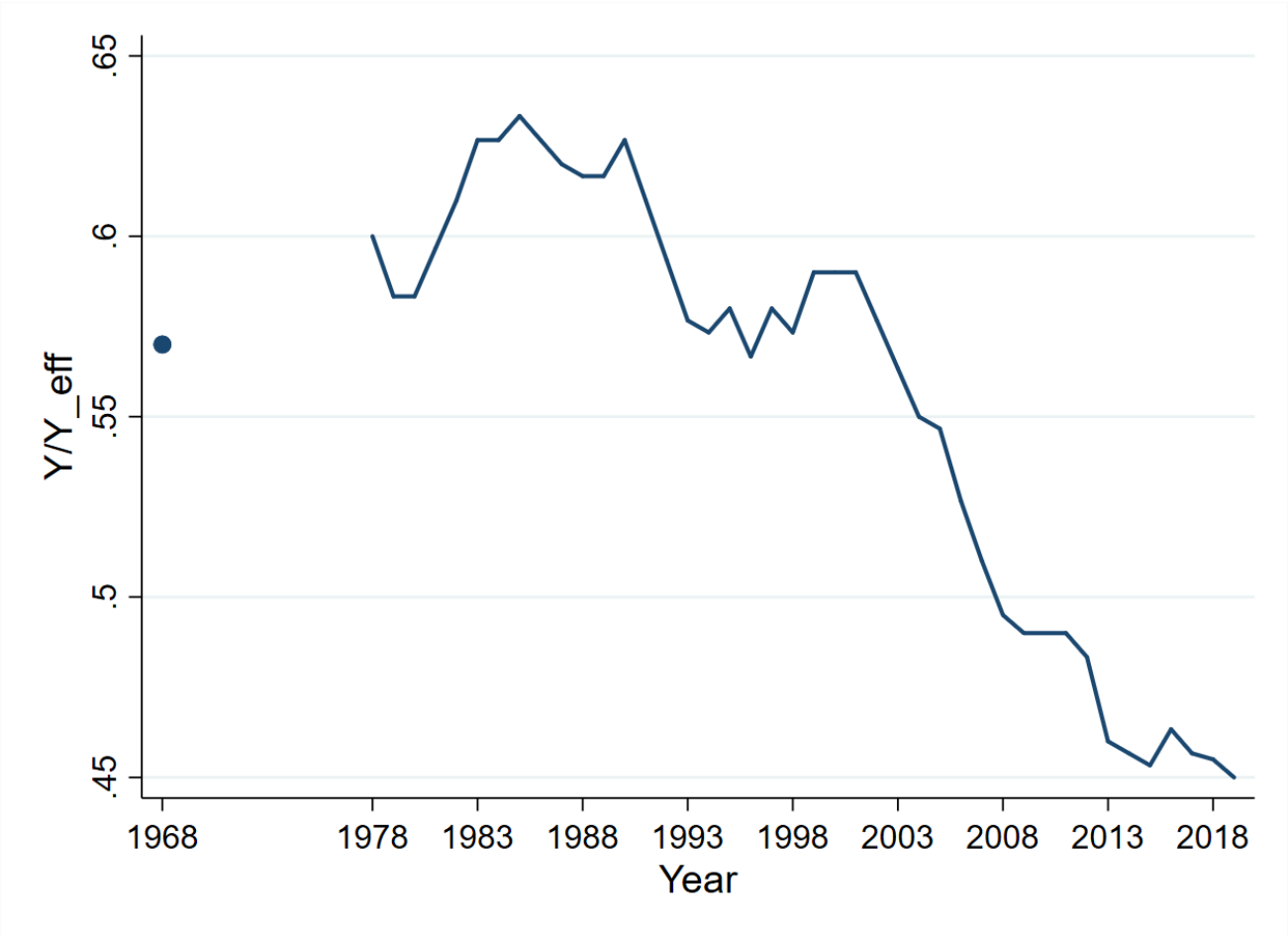
Allocative Efficiency

- The ratio between the amount of final goods that will be produced with and without idiosyncratic distortions (respectively, Y and Y_{eff}) can be written as:

$$\frac{Y}{Y_{eff}} = \Pi_{s=1}^{S} \left(\sum_{i=1}^{N_s} \left(\frac{A_{si}}{\overline{A_s}} \frac{\overline{TFPR_s}}{TFPR_{si}} \right)^{\sigma-1} \right)^{\frac{\theta_s}{\sigma-1}}$$

where θ_s is the value-added share of industry s.

Allocative Efficiency



Y / Y_{eff}

Dynamism

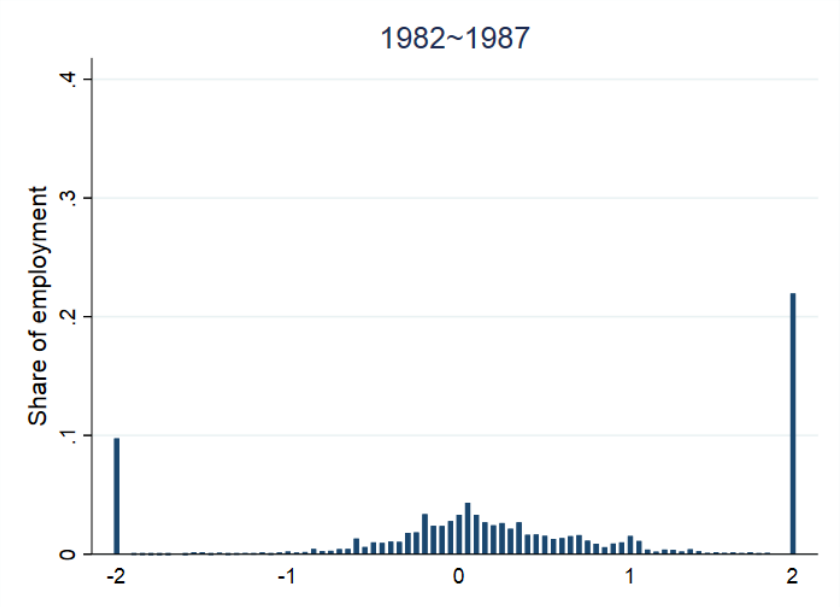
- The average growth rate of value-added per worker in manufacturing was 8.4% in 1970s, 5.3% in 1980s, 9.6% in 1990s, 4.6% in 2000s, and 1.0% in 2010s.
- In the sample with anonymized plant IDs (1982-2019), we study the change in business dynamism.
  1. Job Creation and Destruction
  2. Responsiveness to Productivity

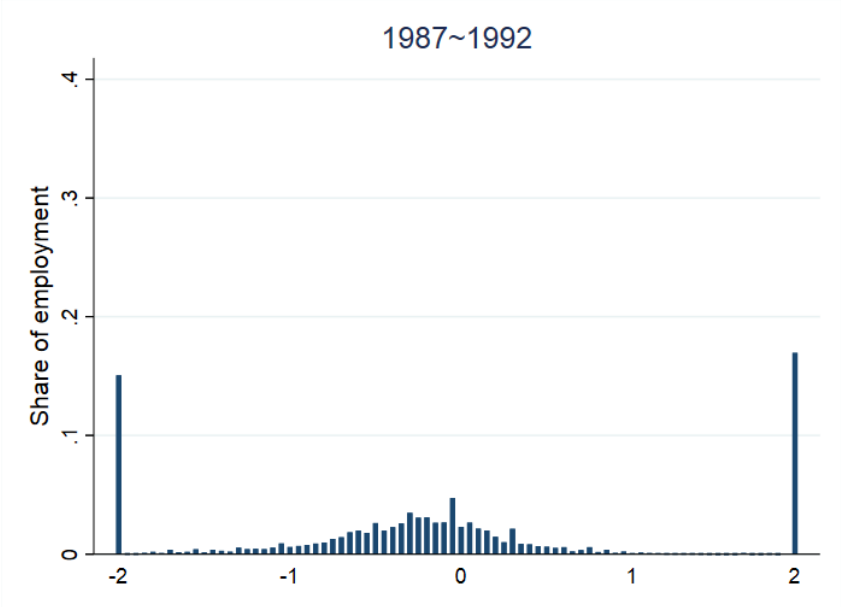
Dynamism #1: Job Creation and Destruction

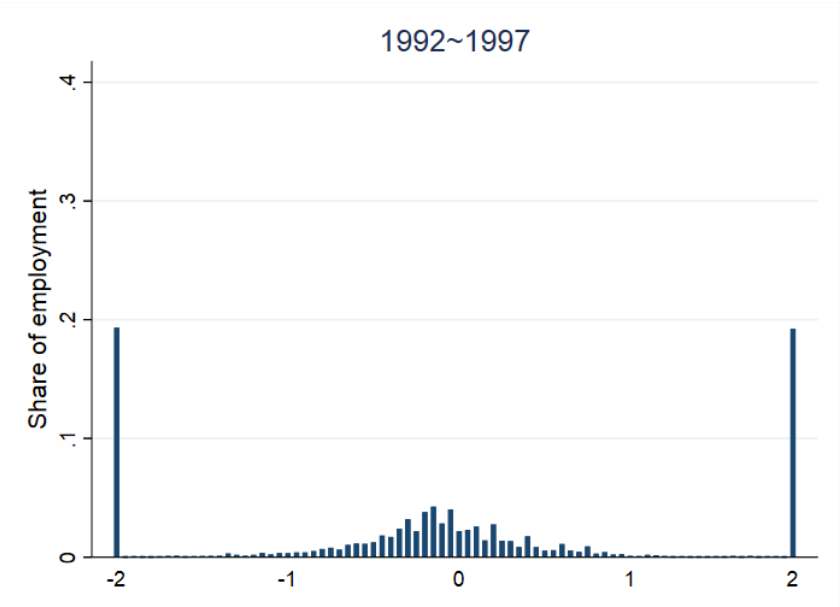
- Note that panel dimension is available from 1982.
- We calculate the Davis/Haltiwanger/Schuh growth rates of employment (5 years windows)
  - DHS growth rates: $g_{i,t1} = \frac{emp_{i,t1} - emp_{i,t0}}{0.5 \times emp_{i,t1} + 0.5 \times emp_{i,t0}}$
  - From the above definition, the entry is 2 while the exit is -2

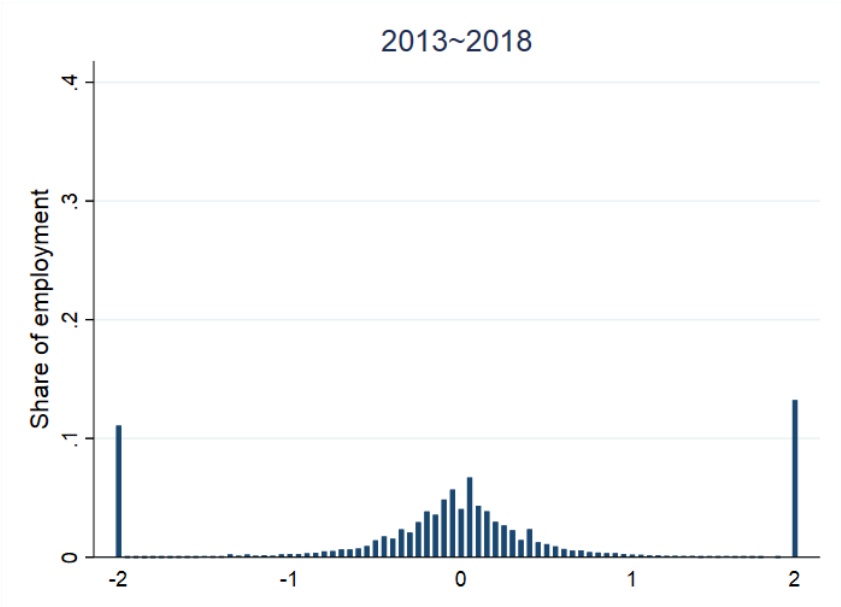
Dynamism #1: Job Creation and Destruction

▸ Other years









Dynamism #2: Responsiveness to Productivity

- We estimate the responsiveness of businesses to shocks following Decker, Haltiwanger, Jarmin and Miranda (2020).
- $g_{jt+1} = \beta_0 + \beta_1 a_{jt} + T(a_{jt}, t) + \beta_2 e_{jt} + T(e_{jt}, t) + X'_{jt}\Theta + \varepsilon_{jt+1}$
  - g is DHS employment growth, a is log productivity, e is log employment, and X is other controls
- We also used investment as a dependent variable.

Dynamism #2: Responsiveness to Productivity

	Employment growth		Capital growth	
Productivity: β_1	0.0274^{***}		0.2000^{***}	
	(0.0047)		(0.0082)	
prod$\times$trend: δ	-0.0003		-0.0038^{***}	
	(0.0002)		(0.0003)	
prod$\times$1980s: λ_{80s}		0.0199^{***}		0.1835^{***}
		(0.0046)		(0.0087)
prod$\times$1990s: λ_{90s}		0.0278^{***}		0.1508^{***}
		(0.0057)		(0.0097)
prod$\times$2000s: λ_{00s}		0.0239^{***}		0.1069^{***}
		(0.0051)		(0.0064)
prod$\times$2010s: λ_{10s}		0.0135^{***}		0.0758^{***}
		(0.0056)		(0.0051)

Taking Stock

1. No clear correlation between macro-level growth and the plant size distribution or static measures of allocative efficiency.

2. Growth slowdown coincides with a reduction in dynamism.
   - More empirical research on business dynamism over time and across countries is needed (one needs micro panel data for this purpose).
   - Identifying frictions (e.g., adjustment costs, credit constraints) is needed.

Plant Size: Comparison with Other Countries

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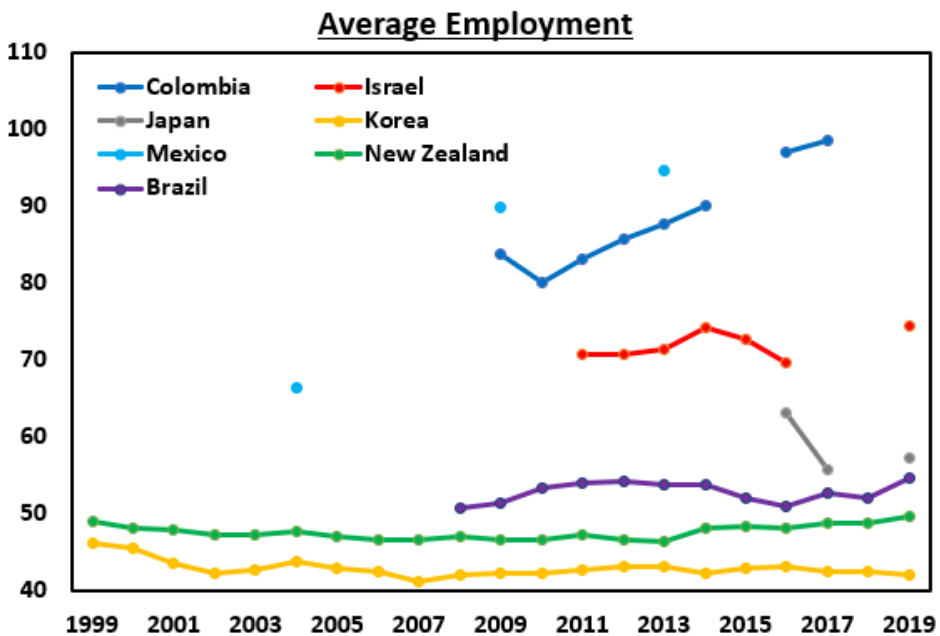

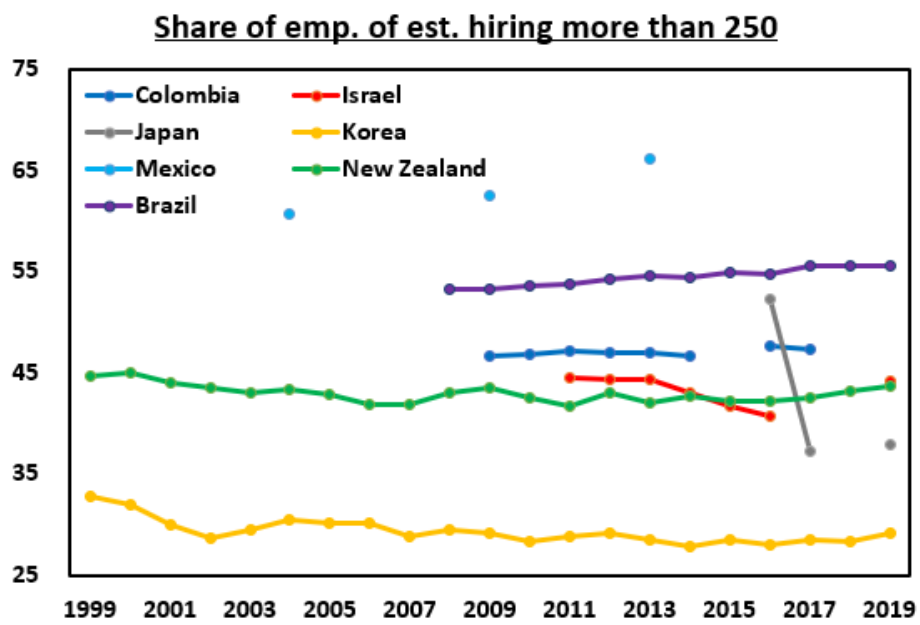

Source: Structural and Demographic Business Statistics (SDBS), OECD
Only plants hiring 10+ included for comparability

Plant Size: Comparison with Other Countries

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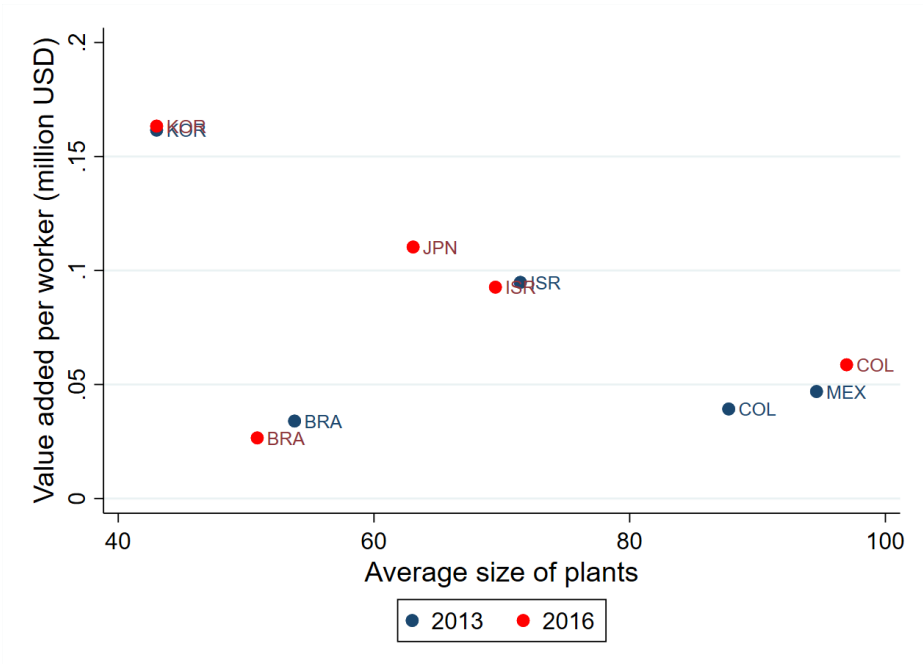

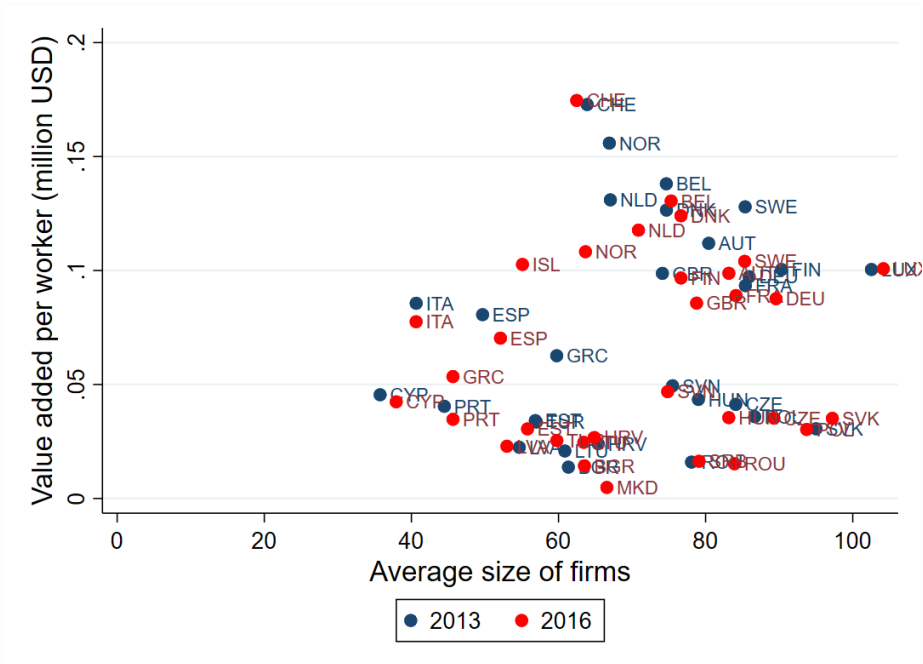

Source: Structural and Demographic Business Statistics (SDBS), OECD
Original data in local currency deflated by their own manufacturing deflator and converted into USD using the period-average exchange rate.

Churning

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