The State, infrastructure investment and industrial policy since the 19th century

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Question

- Wide recognition that more investment is needed for energy transition, including in technology, construction and infrastructure (cf new Draghi report on Europe)
- also increasing consensus that State intervention (either through public investment, tax credit or subsidies) is required to spur long-term investment because long-term expected return too low for private companies. Linked to "return of industrial policy" (Evenett et al. 2024)
- can history sheds light on these current debates?

Main arguments

1. Many evidence of State "big push" in economic history but often from separate literatures (railway/infrastructure vs. industrial policy).
2. **Large variety of State interventions** (ownership, subsidies, public credit, knowledge transfers, etc.). **Credit policy rather than public expenditures**
3. Historical quantitative evidence often limited by
   - endogeneity and selection issues (states may help industries that need it the most)
   - **difficulties to consider spillovers (upstream-downstream linkages) and long-term effects**. Some new methods are promising
4. Not only "catch-up" growth (also innovation policies)
5. Still some important blind spots in the literature, especially about how decisions were taken (how to set objectives and build political support). Coordination or conflict of interests? Dialogue with political & social history may help

Not covered in this course

1. communism
2. trade protectionism
3. corruption, insider lending
4. other State function influencing investment (education, unemployment insurance, etc.)
5. short-term public spending policies (ex: New Deal Fishback 2017)
6. how (and why) industrial/infrastructure policies have changed over time and across countries
7. failed industrial policies
8. anything before mid-19th century

This course

- Focus on methodology
- How to characterize state policies that support development of infrastructure and industries?
- How to measure their effects?

Connected different kinds of literature

1. "Economic backwardness in historical perspective" (Gerschenkron 1963) + catch-up growth (Abramovitz 1986)

Connected different kinds of literature

1. "Economic backwardness in historical perspective" (Gerschenkron 1963) + catch-up growth (Abramovitz 1986)
2. " A journey through the last century may, by destroying what Bertrand Russell once called the "dogmatism of the untraveled," help in formulating a broader and more enlightened view of the pertinent problems and in replacing the absolute notions of what is "right" and what is "wrong" by a more flexible and relativistic approach." Alexander Gerschenkron , Economic Backwardness in Historical Perspective , 1962, p. 27

Connecting different kinds of literature

1. "Economic backwardness in historical perspective" (Gerschenkron 1963 on Prussia and Russia in 19th century) + catch-up growth (Abramovitz 1986)
2. infant industry, and import/export substitution (F.List ; Hirschman 1958; Chang 2003; Juhász 2018; Aiginger and Rodrik 2020
3. developmental state and industrial policy (Chang 1994; Amsden 2003; Wade 2004)
4. credit policy and industrial policy (Rota 2013; Monnet 2023; Lucas 2016)
5. business history and state intervention (O'Sullivan 2000; Mazzucato 2011; Chandler 1954; Chandler 1965
6. railroad and economic growth (Donaldson and Hornbeck 2016)

On and off the rails

1. Study of railroad as a landmark in quantitative economic history. Fogel 1964: Railroads and American Growth.
2. Giving rise to many debates (David 1969; Bogart 2024)
3. The 19th century was indeed the century of railroads , and development pushed by states (Bogart 2024).

Table 2 Sectoral Breakdown of Traded Stocks on the NYSE

	1885	1890	1895	1900	1905	1910	1915	1920	1925	1930
Total	151	264	263	296	341	331	420	670	774	1,273
Railroads	122	194	160	161	168	146	146	150	131	151
(%)	(81)	(73)	(61)	(54)	(49)	(44)	(35)	(22)	(17)	(12)
Utilities	5	15	26	32	34	34	34	11	38	89
(%)	(3)	(6)	(10)	(11)	(10)	(10)	(8)	(2)	(5)	(7)
Industrials	24	55	76	103	139	151	240	509	605	1,033
(%)	(16)	(21)	(29)	(35)	(41)	(46)	(57)	(76)	(78)	(81)
Coal & mining	11	20	19	18	22	30	36	44	29	25
(%)	(7)	(8)	(7)	(6)	(6)	(9)	(9)	(7)	(4)	(2)
Other	13	35	57	85	117	121	204	465	576	1,107
(%)	(9)	(13)	(22)	(29)	(34)	(37)	(49)	(69)	(74)	(87)

Source: Author's analysis based on data from *Manual of Statistics, Financial Review, The Annalist, Bank & Quotation Record.*

Figure: USA. O'Sullivan 2016

On and off the rails

Figure 1 *GDP, machinery investment and infrastructure investment in the Netherlands, 1853–1913*

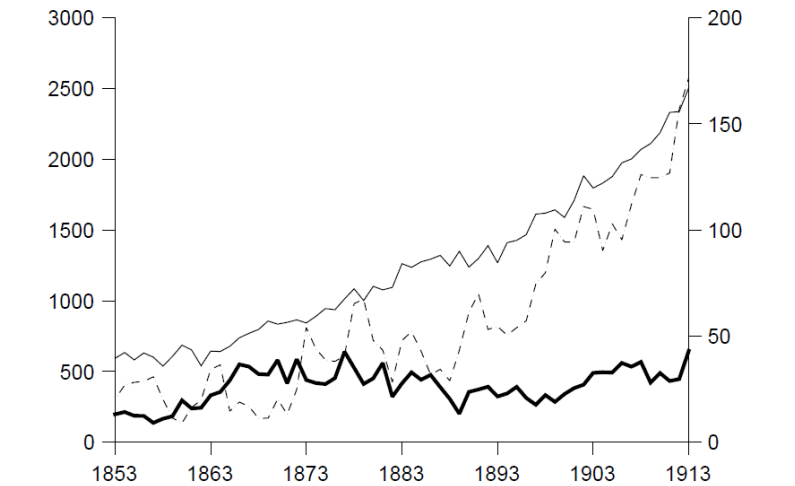


Figure: Groote, Jacobs, and Sturm 1999

4 generations of railway studies

- N°1. Fogel 1964 and "social savings"
- $$SS = (P_a - P_r) * Q_r$$

  P_r, Q_r: price & quantities of implemented technology.
  P_a: price of alternative technology.
- upper-bound measure, as if demand for transport was perfectly price inelastic. Correspond to TFP gains, not capital accumulation. (Crafts 2004)
- Fogel found that very small contribution to US growth
- Estimates for other countries (and periods) vary enormously depending on "alternatives" (Crafts 2004)
- what kind of counterfactual is it really? (David 1969)
- also look at productivity of railways (Bogart and Chaudhary 2013)

4 generations of railway studies

- N°2. Correlation between investment and growth Groote, Jacobs, and Sturm 1999; Herranz-Loncán 2007; Jedwab and Storeygard 2019
- Capital accumulation causes growth, not only Solow residual (De Long and Summers 1991)
- Other way: growth accounting (Bogart, Chaudhary, and Herranz-Loncán 2015).
- Effects are stronger than with "social saving" method
  - Pros: show the enormous share in total investment and deals with capital accumulation
  - Cons: endogenous. (Usually) no distinction between private and state initiatives. No consideration of spillover effects.

4 generations of railway studies

- N°3. Instrumental variables/ Diff-diff. (See Bogart 2024 for survey). Usually look at growth of cities "randomly" affected by new line opening (a small city between two large ones targeted by important policy reform). Berger 2019; Lenoir 2020 etc.
- Other possible outcomes: innovation, banks etc.
  - Pros: exogenous impact and isolate effect of State policies
  - Cons: no general eq. effect; usually only impact on population; local effect and no evolution over time of network's effects

4 generations of railway studies

- N°4. Market access Donaldson and Hornbeck 2016; Donaldson 2022
- Taking network effects (spatial) into account

B. Natural Waterways and Canals

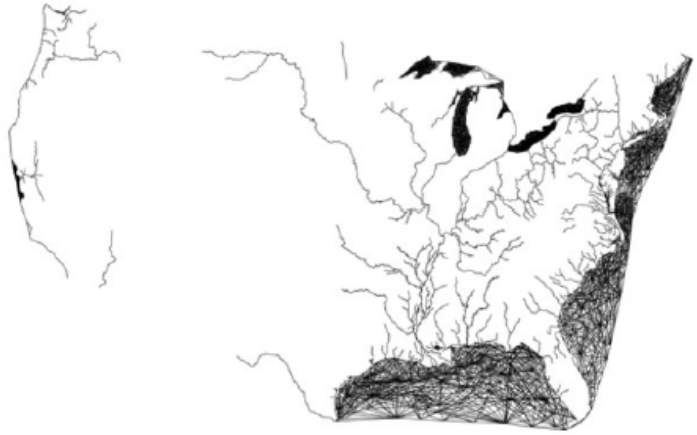


FIGURE II

Constructed Network Database (Partial)

Panel A shows all natural waterways, including navigable rivers and routes across lakes and oceans. Panel B adds the canal network (as actually constructed in 1870 and 1890). Panel C adds railroads constructed in 1870, and then Panel D adds railroads constructed between 1870 and 1890.

D. Natural Waterways, Canals, and 1890 Railroads

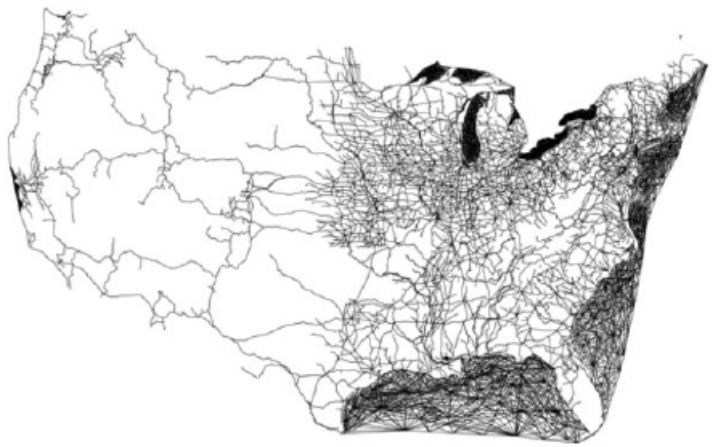


FIGURE II

Donaldson and Hornbeck 2016

$$MA_o \approx \sum_d \tau_{od}^{-\theta} N_d. \quad (12)$$

N_d is population in counties connected through transports. τ is the transport cost. θ is trade elasticity.

IV.E. Main Empirical Specification

Summarizing the foregoing discussion, we begin by regressing the log value of agricultural land in county o and year t on log market access (MA_{ot}), a county fixed effect (δ_o), state-by-year fixed effects (δ_{st}), and a cubic polynomial in county latitude and longitude interacted with year effects ($f(x_o, y_o)\delta_t$):

$$\ln V_{ot} = \beta \ln (MA_{ot}) + \delta_o + \delta_{st} + f(x_o, y_o)\delta_t + \epsilon_{ot}. \quad (13)$$

Based on these estimations, they can build counterfactuals. What does happen without railroads, or if railroad replaced by canals in "feasible" areas: MA decreases by 80%, agricultural price lower by 60%.

Donaldson and Hornbeck 2016

- Main advantage of this method is to take into account all spillovers, coming from all network connections, *over time*.
- Also a way to consider endogeneity

> A useful feature of our definition of market access is that much variation in a county's market access is not determined solely by that county's own railroad track or even nearby railroad track. Thus, we can examine changes in counties' market access that are orthogonal to changes in counties' own railroads or nearby railroads. We report these estimates in Table II, where

4 generations of railway studies

- N°4. Market access (Donaldson and Hornbeck 2016; Donaldson 2022
  - Pros: consider general equilibrium and spillovers. Compatible with IV or exogenous shocks.
  - Cons: relies on many assumptions whose effects are difficult to estimate (as in Fogel 1964): average freight rate, volume of transported goods, speed, trade elasticity. Choice of dependent variable remains limited by historical data (agricultural land price, population). Counterfactual remains not fully specified.

Various means of State intervention

- Construction of the rails.
- Nationalization of the companies. Problem: strongly endogenous, especially to profit (so not surprising that Bogart 2010 finds that construction - but not nationalization - increases efficiency
- Land sales or grant (cf. Australia, US)
- Subsidies or loans (Goodrich 1956; Berger 2019)
- State-guarantee of railway bonds and stocks. This became the norm in all countries, when railroad companies were not nationalized, except in the UK (Eichengreen 1995).
- France: 2/3 of value on the stock & private bond market in 1900 were **state-guaranteed railway securities**
- Regulation prices and dividends (Maggor 2024)
- Ex: reconstruction in US South (Goodrich 1956). A developmental state and industrial policy? (Maggor 2024)
- Analogy to industrial policy ? Fogel 1966: distinguish "disembodied" (effect on transport cost) and "embodied" (effect of the technology per se) consequences

State intervention (construction vs. nationalization; Bogart 2010

Table 1. Ownership patterns across countries: 1880 and 1910.

Country	1880		1910		
	Fraction miles nationalized	Fraction miles constructed by State	Fraction miles nationalized	Fraction miles constructed by State	Fraction miles privatized
Russia	0	0.04	0.19	0.44	0.01
Norway	0	0.94	0	0.84	0
Sweden	0	0.33	0.02	0.3	0
The Netherlands	0.01	0.57	0.07	0.52	0.04
Belgium	0.24	0.44	0.43	0.5	0.01
France	0.02	0.07	0.12	0.1	0.04
Switzerland	0	0	0.53	0.06	0
Spain	0	0	0	0	0
Italy	0.22	0.22	0.35	0.45	0.01
Japan	0	1	0.55	0.35	0
US	0	0	0	0	0
Argentina	0.01	0.48	0.01	0.24	0.12
Britain	0	0	0	0	0
Germany	0.13	0.51	0.26	0.68	0
India	0.17	0.34	0.22	0.67	0
Canada	0	0.16	0	0.07	0
Austria	0.01	0.07	0.55	0.31	0.03

State intervention. Nationalizations pre 1914. Bogart 2010

Country	Year	Description
Russia	1889, 1891, 1893, 1894, 1895, 1901	State purchased the Ekaterinenskaia, Trans-Caucasian, Moscow Brest, Vistula, Riga-Orel Samara-Zlatonst, SizranViazma, Northern Northwestern, and Southwestern.
Sweden	1896	State purchased the West Coast Railway.
Denmark	1878, 1879, 1880, 1882	Nationalizations followed plan to provide construction subsidies.
Holland	1880, 1890	State purchased the Netherland Rhenish Railway.
Belgium	1871, 1875, 1878, 1880, 1898, 1908	State purchased 19 private lines. The biggest were the Bassina Houillers, Luxemburg, Dendre-Waes, Belgian Great Central and Western Flanders.
France	1878, 1909	The state purchased some lines that failed to merge in 1878. State purchased the West Company in 1909.
Switzerland	1902, 1903, 1909	Nationalization was approved by a referendum in 1898. The state purchased the Swiss Central, North Eastern, Swiss Union, Jura Simplon, and St. Gothard.
Italy	1876, 1882, 1905	State purchased the Upper Italian, Roman, and Calabrian-Sicilian lines before 1882. In 1905 the state purchased the Adriatic.
Austria	1884, 1888, 1892, 1906, 1908, 1909	State purchased 32 private lines. The biggest were Kaiserin Elisabeth-Bahn, Kronprinz Rudolf-Bahn, Gahzische Karl Ludwig-Bahn, Kaiser Ferdinands Nord Bahn, and Oesterreich-Unger-Statsbahn.
Hungary	1877, 1880, 1884, 1890, 1891	
Bulgaria	1908	State purchased the Vacarel-Bellovo, Belloost-Lubimetz, and Tyrnovo-Seemen-Jamboli lines as a consequence of Bulgarian Independence.
Serbia	1907	
Japan	1907, 1908	State purchased 17 companies by a 1906 law.
Mexico	1903, 1906	State purchased the Interoceanic, Mexican Central, Ilidalgo, and Northeastern.
Costa Rica	1901	
Brazil	1865, 1901, 1902, 1903, 1909	The state purchased the West of Minas Railway in 1903.
Argentina	1863	The state purchased the FC Oeste after it had difficulties raising private capital.
Germany	1879, 1880, 1882, 1883, 1884, 1890,	State railways of Prussia-Hesse purchased 8400 miles between 1879 and 1885. Saxony purchased over 780 miles between 1871 and 1907.
India	1873, 1880, 1886, 1889, 1892, 1900, 1908	Nationalizations after 1879 coincided with a policy to have state-owned but privately operated railways.
Australia	1872	
New Zealand	1886, 1900, 1908	

Note: Major nationalizations exceed 2 percent of the total railroad network.
Sources: Board of Trade, *State Railways*; Thorner, "Pattern"; and Lewis, *British Railways*.

Conclusion (railroads)

- Recent studies find a much bigger impact than Fogel
- New wave of quantitative studies highlight spillovers: key to think about any large scale investment
- Quantitative studies on impact of railroad neglect issues of financing (while crowding out or crowdin in should be part of the counterfactual) and decision-making
- The literature (especially "market access") does not deal directly with issue of state intervention.
- but **no evaluation of all forms of state interventions (guarantee of bonds, regulation of dividends and prices, etc.)**
- Still, informative literature on i) importance of spillovers, ii) magnitude of infrastructure investment for other sectors; iii) variety of state interventions; iv) positive effect on aggregate economic growth might not have been contradictory with rent seeking, and capture of private interests (typical of 19th century), for example in colonial context Herranz-Loncán and Fourie 2018; Bogart and Chaudhary 2013; Jedwab and Storeygard 2019

Other state-led investment and industrial policies

- Large literature in political sciences and business history (Amsden 2003 etc.), but little quantitative history and economic studies.
- Similar methodological issues as with railroads: diff-diff too limited to capture spillovers (spatial and - even more - knowledge & long-term effects); very few "natural experiments", state intervention is deeply endogenous (Juhász, Lane, and Rodrik 2023 etc.)

Selective credit allocation is the single discretion necessary to all state-led industrial strategies (J.Zysman 1983, *Gov, Markets and Growth*

- Quantitative importance of public credit in history (Amsden 2003; Monnet 2018; Degorce and Monnet 2024) but little studied.
- Rota 2013 on 1950 1980 Italy using correlations.
- Monnet 2018 on France 1950-1973, comparing credit flows and marginal productivity of capital across sectors. (see Hsieh and Klenow 2009 for recent period with micro data)
- Burgess and Pande 2005 on Indian state banks 1960-1970s using diff-diff.
- Lehmann-Hasemeyer and Wahl 2021 on "public" banks in 19th century Germany.
- Degorce and Monnet 2024 on countercyclical effect only.

Challenges and ways ahead

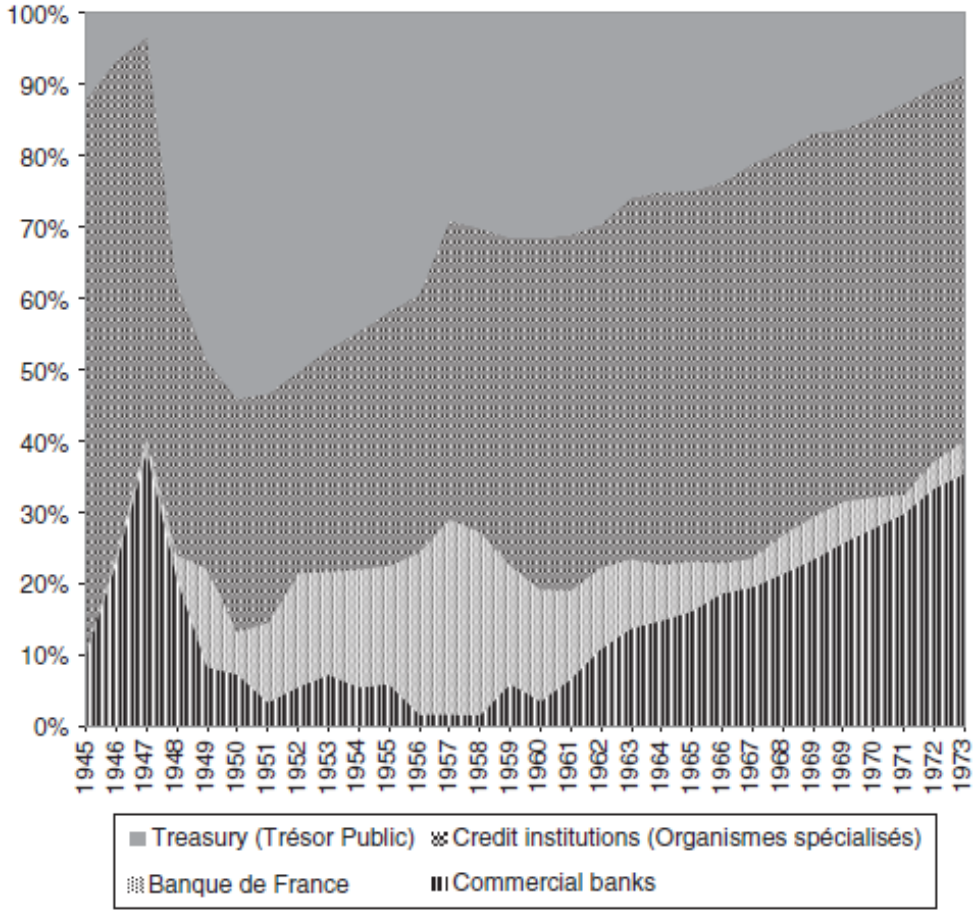


Figure 25 Who provided investment credit? Breakdown by lender (share in %), 1945–1973

Figure: Monnet 2018

The financing of Japanese industrial policy until the 1980s

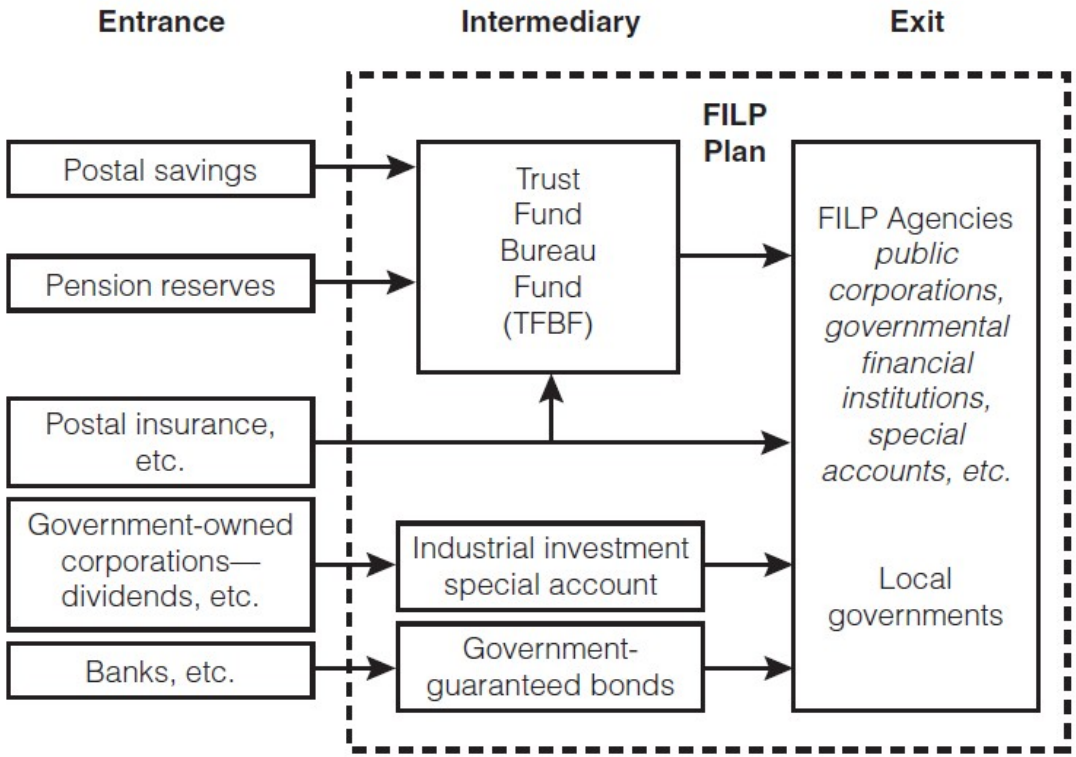
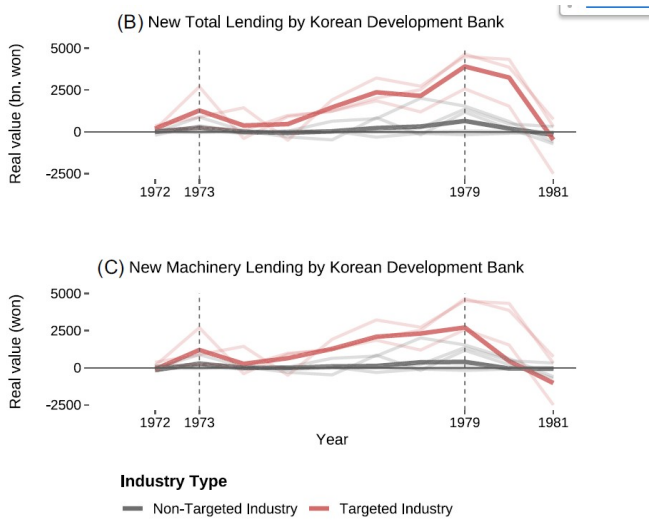


FIGURE 2.1. The old FILP system.

Figure: Park, G. (2020). *Spending without taxation: FILP and the politics of public finance in Japan*. Stanford Univ. Press.

Lane, Industrialisation in South Korea, QJE 2025

- Study of South Korean policy to promote high chemical industries from 1973 (Nixon shock) to 1979 (assassination of Park Chung-hee)
- Two key features of the sectoral policy: directed credit (through Development Bank and central bank) + exemption of import duties



Lane, Industrialisation in South Korea, QJE 2025

- Show a direct positive effect (using diff-diff). HCI sectors enjoyed higher productivity growth
- Main contribution: capture spillovers through input-output matrix. See Hirschman 1958

I measure an industry's linkage exposure to industrial policy using South Korea's 1970 IO accounts, which predate the HCI drive. Specifically, I calculate industry i's exposure to industrial policy through backward and forward linkages as follows:

$$\text{Backward Linkage}_i = \sum_{j \in \text{HCI}} \alpha_{ij}, \tag{6a}$$

$$\text{Forward Linkage}_i = \sum_{j \in \text{HCI}} \alpha_{ji}, \tag{6b}$$

where j represents the treated HCIs. For industry i, its Backward Linkage$_i$ (equation (6a)) equals the weighted sum of output supplied to treated industries j. The weight α_{ij} denotes the value of i's output used by j as a share of j's total output and comes from the IO accounts. For industry i, Forward Linkage$_i$ (equation (6b)) equals the weighted sum of inputs sourced from treated industries j. The weights α_{ji} denote the value of j's output sold to i as a share of i's total value of output in the IO accounts. For further details on these calculations, refer to Online

TABLE VII

LINKAGE EXPOSURE AND VALUE ADDED, BEFORE AND AFTER 1973

	Outcome: Value added (log)			
	Five-digit panel (1970–1986)		Four-digit panel (1967–1986)	
	Full sample (1)	Non-HCI sample (2)	Full sample (3)	Non-HCI sample (4)
Post × forward linkage	2.832***	4.405***	2.095**	2.906**
	(0.914)	(1.504)	(0.802)	(1.174)
Post × backward linkage	−0.0167	0.176	−0.693	−2.163*
	(0.334)	(0.375)	(0.559)	(1.279)
Industry effects	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Targeted × year	Yes	No	Yes	No
R^2	0.776	0.763	0.847	0.819
Observations	4,720	2,986	1,750	1,096
Clusters	278	176	88	55

Notes. Average DD estimates, before and after 1973. Estimates correspond to equation (7). Regressions interact linkage measures with a Post indicator. The outcome is real log value added. Both linkage interactions (forward and backward) are shown. Analysis is performed for the sample of only non-treated industries and the full sample of industries. Estimates for the full sample separately control for the Targeted × Year effects to account for the main effect of policy. Standard errors, clustered at the industry level, are in parentheses. * $p < .10$; ** $p < .05$; *** $p < .01$.

Questions unanswered

- A specific case of clear direct positive effect on productivity. Still spillover in other cases?
- what about policies to save employment and restructure industries?
- how did a specific credit system make this policy possible? (a more cost-efficient way to do it?)
- does credit policy require sufficient domestic savings? (Amsden) low real rates? possible with foreign capital?

Challenges and ways ahead

- Reconcile study of decision-making and corporate management with quantitative studies on impact of state intervention.
- Understanding why and how state intervention was decided is key for policy lessons
- Understanding differences between objectives and outcomes.
- What makes industrial policy effective? Amsden 2003: *control mechanisms* ("a set of institutions that imposes discipline on economic behavior"). In particular, *reciprocity* ("monitorable performance standards that were redistributive in nature and results-oriented.") and a "*sensor*, to detect the "givens" in the process to be controlled; an *assessor*, to compare what is happening with what should happen; an *effector*, to change behavior; and a *communications network*, to transmit information between all functions."

Challenges and ways ahead

- In what extent does the feasibility and impact of industrial policy depends on other features of the State and public policies?
  - state-owned companies (ex: private railway companies with state guarantee vs. state-owned energy company). Only a matter of profit and wealth inequality?
  - competition policy (Alayrac and Thyrard 2024 on EU investment policy since 1950s)
  - globalization (protectionism, import-substitution, financial dependence, etc.) Ex: Bignon, Esteves, and Herranz-Loncán 2015 on Lat.Am. railroads in 19th century

Conclusion

- Many historical evidence of state-intervention to promote long-term investment in infrastructures and equipment since 19th century.
- Interventions take many forms: state-owned companies, loans, public investments, tax credit, regulation, debt guarantee
- Little quantitative evidence of the impact of state intervention because many empirical evidence
- Exception is literature on railroads, but only recently able to take into account spillovers and GE effects
- Need to integrate more quantitative economic history with history of decision making and management (corporate and state).
- Need to highlight how impact and forms of state intervention depend on the context (especially financial liberalization, globalization and competition policy)

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