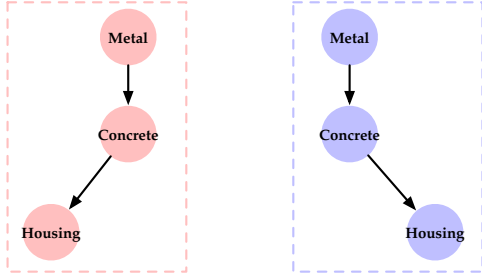
Decentralized Industrial Policy

Wei Chen[1] Ernest Liu[2] Zheng (Michael) Song[1]

[1]The Chinese University of Hong Kong

[2]Princeton University

- Industrial policy: selective government intervention into key sectors. Especially pervasive in China
  - five-year plans, special economic zones, state-owned firms, subsidies, tax incentives, priority land access, directed sectoral credit...
- Liu (2019): in a closed economy, subsidizing upstream sectors is welfare enhancing
- China is a large, multi-region economy; industrial policies are often enacted by local governments
  - cross-region trade and input-output links $\Rightarrow$ potential misalignment between local and central incentives
- This paper: theory of industrial policies in multi-region production networks & evidence from China



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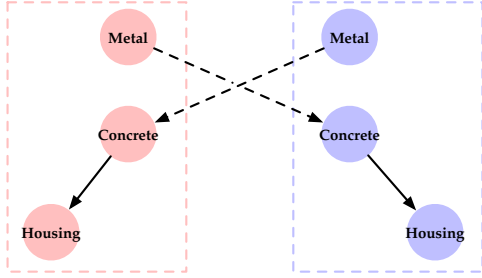

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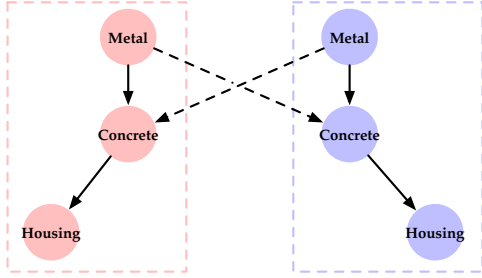


Theory: a trade model with input-output linkages (Caliendo-Parro 2015) and market imperfections (Liu 2019)

- derive formulas for first-order impact of industrial policy; build on the sufficient statistics literature Baqaee & Farhi (2019, 2020, 2021), Adão, Arkolakis & Esposito (2019), Adão, Arkolakis & Ganapati (2020), Kleinman, Liu & Redding (2020), Huo, Levchenko & Pandalai-Nayar (2019)

- two sufficient statistics at the region-by-industry level: local and central intervention indices
  1. α^L: local welfare impact per unit subsidy to region-industry financed by taxing local agents
  2. α^C: national welfare impact per unit subsidy financed by taxing nationally
  - "bang for the buck"; $\alpha^L > 0 \iff$ locally-financed subsidies raises local welfare (likewise for α^C)
  - α^C: high in *upstream* sectors. α^L: high in sectors *upstream to local production* with *little exports*

Evidence from China

- central v.s. provincial policy platforms: state-owned firms, five-year plans, special-econ-zones
- across provinces: policy more aligned with α^L in regions with higher GDP & more fiscal autonomy
- evaluate local and spillover effect of implicit subsidies to local SOEs; counterfactuals

Proposition. To first-order around the market equilibrium, the regional income and welfare response ($\{\mathrm{d}\ln\lambda_n\}$ and $\{\mathrm{d}\ln u_n\}$) to subsidies $\{\mathrm{d}\tau_{mi}\}$ and lump-sum taxes $\{\mathrm{d}x_n\}$ solve:

$$\underbrace{\mathrm{d}\ln\lambda_n}_{\substack{\text{changes in}\\ \text{factor income}}} = \underbrace{\sum_k \frac{\lambda_{nk}}{\lambda_n}\mathrm{d}\tau_{nk}}_{\text{subsidies}} + \underbrace{\theta}_{\substack{\text{trade}\\ \text{elasticity}}} \underbrace{\sum_{qs} M_n^{qs}\left(\mathrm{d}\ln\lambda_q - \mathrm{d}\tau_{qs}\right)}_{\text{cross-substitution effect}} + \underbrace{\sum_m T_m^n \left(\mathrm{d}\ln\lambda_m - \underbrace{\frac{\mathrm{d}x_m}{\lambda_m}}_{\text{lump-sum taxes}}\right)}_{\text{market size effect}}$$

$$\underbrace{\mathrm{d}\ln u_n}_{\text{changes in welfare}} = \underbrace{\mathrm{d}\ln\lambda_n - \frac{\mathrm{d}x_n}{\lambda_n}}_{\text{change in income (net of taxes)}} \underbrace{- \sum_{m,i}\beta_n^{mi}\sum_{q,s}\tilde{\Lambda}_{mi}^{qs}\left(\mathrm{d}\ln\lambda_q - \mathrm{d}\tau_{qs}^{\ell}\right)}_{\text{cost-of-living effect}}$$

Definition. **Local intervention index** α_{nk}^{L}: elasticity of region n's welfare u_n to subsidies in region n industry k financed by local lump-sum tax.

Central intervention index α_{nk}^{C}: elasticity of national welfare u^C to subsidies in nk financed by taxing all regions in proportion to their income.

Proposition. 1) α^L averages to zero across industries; α^C averages to zero across region-industries (i.e., uniformly promoting all sectors has no welfare impact);

2) first-order welfare impact of industrial policies:

$$\Delta \ln u_n \approx Cov_k \left(\alpha_{nk}^{L}, \text{local policy spending}_{nk}\right);$$

$$\Delta \ln u^C \approx Cov_{nk} \left(\alpha_{nk}^{C}, \text{central policy spending}_{nk}\right).$$

- We also derive local policies' cross-region spillover effects
- First-order effects are additively separable $\Longrightarrow$ can separately evaluate different policy platforms

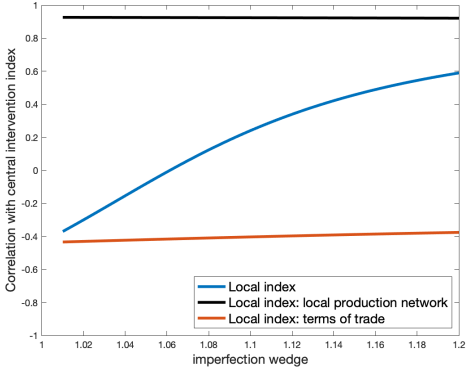
Construct intervention indices from: 1) region-industry input-output tables; 2) market imperfections χ

- 31-province-by-42-industry input-output table of China in year 2012: 1302×1302 matrix
- Baseline χ: firm-level wedges estimated from production data (De Loecker and Warzynski, 2012)
  - intervention indices almost perfectly correlated under many alternative specifications of χ
  - α^C correlates strongly with "upstreamness" (Antras et al. 2012) and "distortion centrality" (Liu 2019)

	Pearson's r		Spearman's ρ	
Specifications	Central	Local	Central	Local
Using profit share as χ's	0.91	0.89	0.95	0.90
Simulated χ's under many distributions	~0.9	~0.9	~0.9	~0.9
"Upstreamness" by Antras et al (2012)	0.88	0.44	0.90	0.47
"Distortion centrality" by Liu (2019)	0.92	0.45	0.94	0.48

The local index can be written as sum of two components: $\alpha^L = \alpha^L_{Net} + \alpha^L_{ToT}$

- α^L_{Net}: to correct for market imperfections in the local production network
  - correlates with α^C and "upstreamness"; equals to "distortion centrality" (Liu 2019) in closed economy
- α^L_{ToT}: to manipulate the terms of trade; tax export-intensive (subsidize import-competing) sectors
- Both terms are rank-stable w.r.t χ; relative importance of α^L_{Net} increases in the magnitude of imperfections



- α^C: higher in sectors that are upstream (most variation is industry-specific)
- α^L: higher in sectors that are upstream to local production and export little
  - share of output sold as inputs to other regions negatively predicts α^L

	α^C	α^L
Share sold as local input	0.282***	0.233***
	(0.00776)	(0.0100)
Share sold as non-local input	0.397***	-0.457***
	(0.0235)	(0.0345)
Province Dummy	Yes	Yes
Industry Dummy	No	No

- Example: steel (highly tradable, upstream) v.s. concrete (low tradability)

	Metal products				Non-metallic mineral products			
	α^C	α^L	share sold as local input	share sold as non-local input	α^C	α^L	share sold as local input	share sold as non-local input
Beijing	0.10	-0.31	19%	80%	0.00	0.15	80%	20%
Shanghai	0.09	0.01	84%	16%	0.02	0.22	82%	17%

State-Owned Share of Registered Capital

State Administration for Market Regulation's firm registration records (2015)

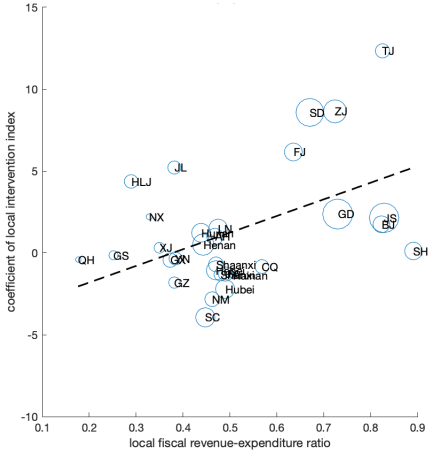
- recover region-industry share of registered capital by local and central state-owned firms (SOEs)
- central (local) SOE's share of capital correlates with the central (local) intervention index

	central state share	local state share
central index	3.659***	0.125
	(0.690)	(0.728)
local index	0.559	1.509***
	(0.682)	(0.580)
Province Dummy	YES	YES
Industry Dummy	NO	NO
N	1118	1209
R-squared	0.232	0.120

Provinces with greater fiscal autonomy have higher correlation between α^L and local state share

	central state share	local state share
	Panel A: Eastern Provinces	
central index	1.793	-2.173
	(1.279)	(1.379)
local index	2.889***	3.839***
	(1.356)	(1.249)
	Panel B: Central Provinces	
central index	4.273***	2.336**
	(1.239)	(0.917)
local index	-0.903	-0.132
	(0.779)	(0.574)
	Panel C: West & Northeast	
central index	4.870***	1.072
	(0.965)	(0.881)
local index	-0.625	0.670
	(0.895)	(0.721)
Province FE	Yes	Yes
Industry FE	No	No

Provinces with greater fiscal autonomy
$\iff$ higher Corr(SOEshr, α^L)
$\iff$ higher GDP per capita



Summary of Findings: Five-Year Plans and Special Economic Zones

The 12th (central and provincial) Five-Year Plan (FYP) for priority industries in years 2011–2015

- "strategic industries" in central 5YP have high central intervention index α^C
- "strategic industries" in provincial 5YPs have
  - high local index α^L in the 10 Eastern provinces
  - high central index α^C in the West and North East (15 provinces)

China's Development Zones: all active special economic zones (SEZ) as of 2018

- both central- and provincial-approved SEZs tend to include industries with higher central index

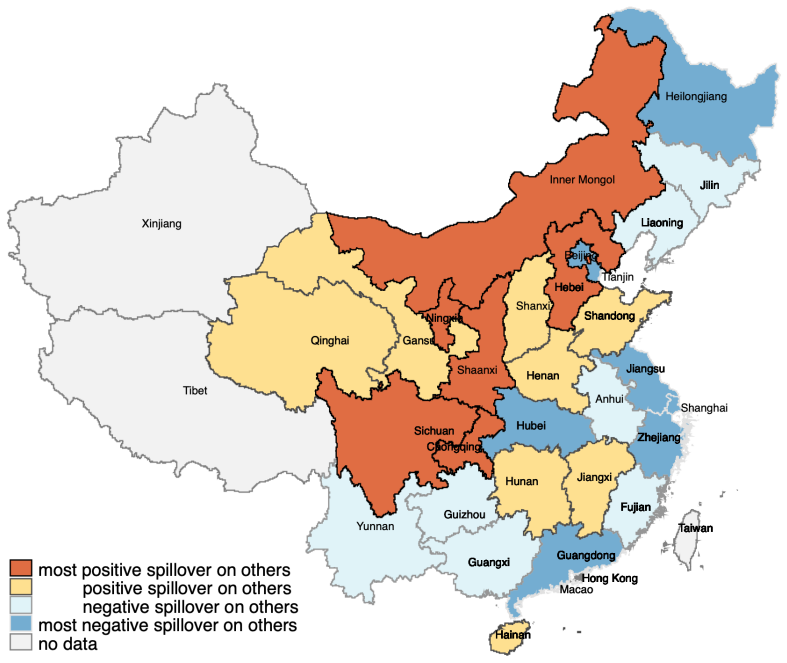
Region-Industry-Ownership-Specific Wedges

- State Administration of Taxation (SAT)'s tax survey (2011–2015):
  - covers both manufacturing and service sectors
  - we merge with firm registration data to identify state ownership
- Relative to private firms, local SOEs in high-α^L sectors have lower capital/labor/land productivity

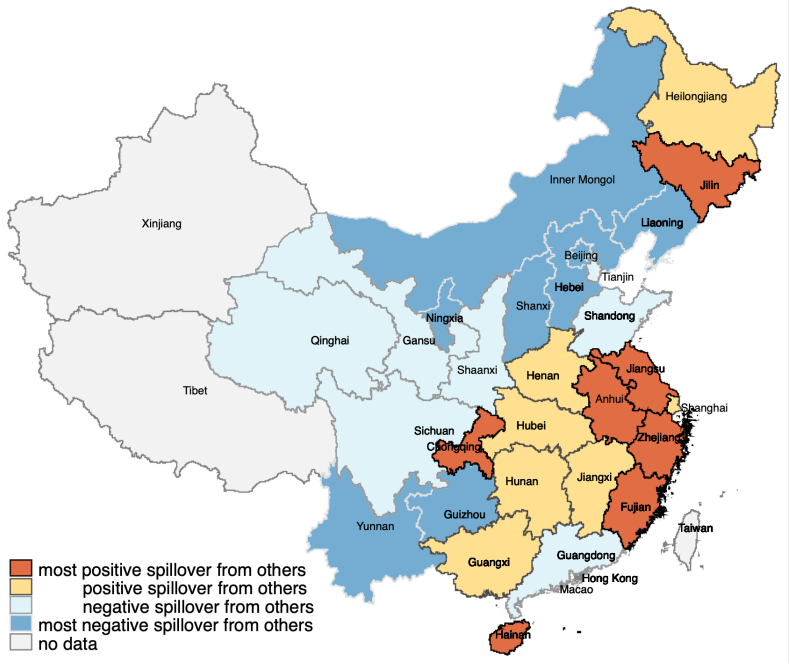
	Sales/Capital	Sales/Labor	Sales/Land
	(1)	(2)	(3)
Local SOE	-0.631***	0.0108	-0.108**
	(0.0478)	(0.0467)	(0.0538)
α^L	-0.0750	-0.230**	-0.249**
	(0.0924)	(0.0917)	(0.119)
Local SOE $\times$ α^L	-0.992***	-0.715***	-0.757**
	(0.331)	(0.226)	(0.356)
Region + Industry FEs	YES	YES	YES
N	3299	3299	3299

- Recover implicit subsidies $\{\tau_{nk}\}$ to local SOEs as wedges on value-added inputs

Which provinces *generate positive spillover to others* through local SOEs?



Which provinces *receive positive spillover from others* through local SOEs?



Policy evaluation

- Policy evaluation:

$$\Delta \ln u_n \approx Cov\left(\alpha_{nk}^{L}, \underbrace{\frac{VA_{nk}^{SOE}\tau_{nk}}{VA_{nk}}}_{\text{implicit subsidies to local SOEs}}\right) = \underbrace{Cov\left(\alpha_{nk}^{L}, \frac{VA_{nk}^{SOE}\bar{\tau}_n}{VA_{nk}}\right)}_{\text{extensive margin}} + \underbrace{Cov\left(\alpha_{nk}^{L}, \frac{VA_{nk}^{SOE}(\tau_{nk}-\bar{\tau}_n)}{VA_{nk}}\right)}_{\text{intensive margin}}$$

  - "bang for the buck" of local subsidies on local welfare is between 2.8% and 5%
  - extensive margin accounts for between 54 and 67 percents of the welfare effect

	Total subsidy	Welfare impact				
	(% local GDP)	Local	(return)	(extensive margin)	National	Spillover
East	2.8%	0.13%	(5.0%)	(62%)	0.06%	-0.01%
Central	3.0%	0.14%	(4.7%)	(67%)	0.04%	0.01%
West & Northeast	3.7%	0.14%	(2.8%)	(54%)	0.06%	0.03%

- "Bang for the buck" of central subsidies on national welfare is 11.5%

- Policy evaluation can also be done through a regression:

$$\text{Local Policy Spending}_{nk} = \text{const} + \hat{\beta}_n \cdot \alpha^L_{nk} + \epsilon_{nk} \quad \Longleftrightarrow \quad \Delta \ln u_n = \hat{\beta}_n \cdot Var\left(\alpha^L_{nk}\right)$$

- We perform policy counterfactuals using alternative policy targets:

What if local policies target [the central index α^C] with coefficient $\hat{\beta}_n$?

	Welfare impact (relative to actual subsidies)	
Alternative policy targets	Local	National
α^C	85%	221%
Domar weight	-28%	18%
sectoral value added	-14%	16%
interm. exp. share	-6%	20%
non-local sales share	-30%	36%
sales share as interm	75%	110%
sales share as local interm	92%	99%
local consumption share	-30%	-59%

Conclusion

- A positive theory of industrial policy in multi-region production networks
  - two sufficient statistics α^C and α^L for central and local welfare impacts of policy subsidies

- Local planner's incentive may diverge from central planner's due to terms of trade considerations
  - α^L tends to be high in industries upstream to local production with little exports

- In China, provincial-level intervention index α^L predicts
  - strategic industries in provincial Five-Year Plans
  - sectoral share of local state-owned firms and their implicit subsidies

  especially in regions with greater fiscal autonomy

- National welfare gain from local policies could more than double if local policies target α^C instead