Heterogeneous Paths of Industrialization[a]

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[a]The views and opinions expressed are those of the authors alone and do not necessarily reflect those of the Central Bank of Chile.

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  - Hump is occurring at an earlier stage of development and that the height of the hump is lower
  - Rodrik (2016) suggests that this difference is both puzzling and problematic

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- We ask to what extent heterogeneity in sectoral productivity dynamics can account for the heterogeneity in industrialization and deindustrialization patterns
- "Frontier" economies had similar productivity dynamics because they followed the same frontier
- But late developers might move toward frontier in different ways $\Rightarrow$ Have distinct patterns of structural change

Main Results

- Differential growth in agricultural productivity relative to manufacturing and services can account for a substantial amount of the heterogeneity in industrialization dynamics

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- Benchmark model is less able to reconcile heterogeneity in relative growth between manufacturing and services with observed differences in industrialization dynamics

Related Literature

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- **Structural Transformation**
  Kongsamut et al. (2001), Gollin et al. (2002, 2007), Ngai and Pissarides (2007), Buera and Kaboski (2009), Ungor (2013), Herrendorf et al. (2014, 2020), Comin et al. (2015), Gollin et al. (2016), Fujiwara and Matsuyama (2019), Garcia Santana et al (2019), Sposi et al. (2020), Wise (2020), Boppart (2014), Duarte and Restuccia (2010), Swiecki (2017), Rodrik (2016)

Outline

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  - Services: Trade, restaurants and hotels, transportation, finance insurance, real estate and business services, government and community, social and personal services

Facts

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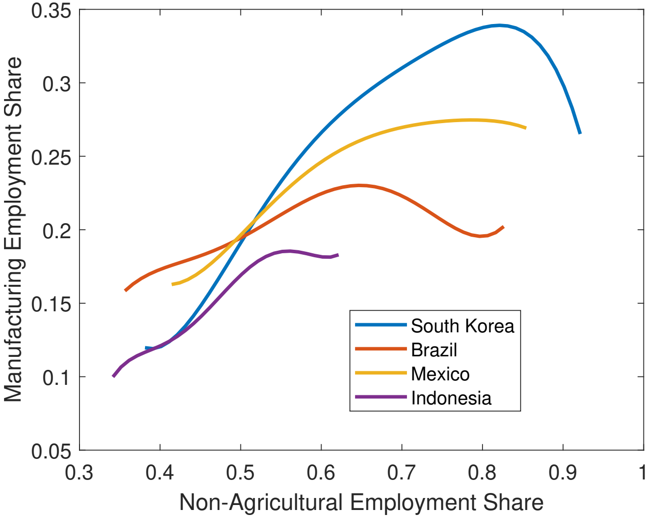
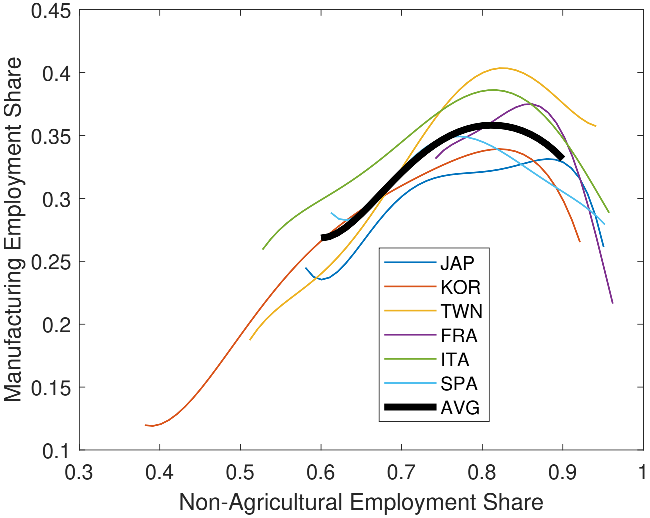
- We would like to focus on differences apart from pace
- Industrialization is essentially a process of moving workers from agriculture into "industry"
- We plot h_m vs $h_n = 1 - h_a$ as a way to characterize what happens as labor leaves agriculture

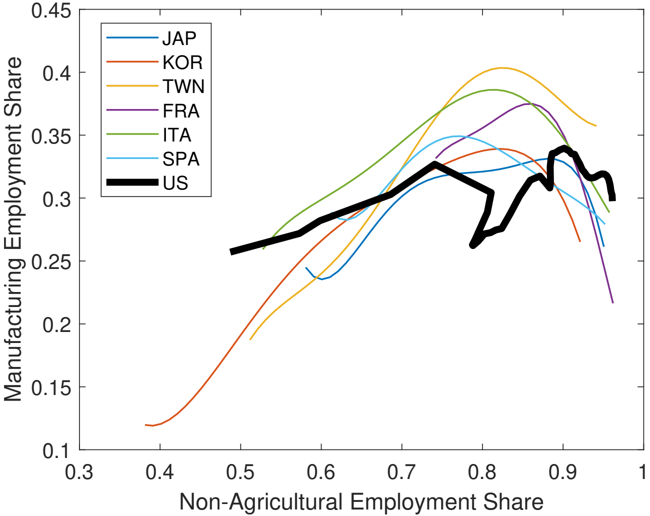
Heterogeneous Paths of Industrialization



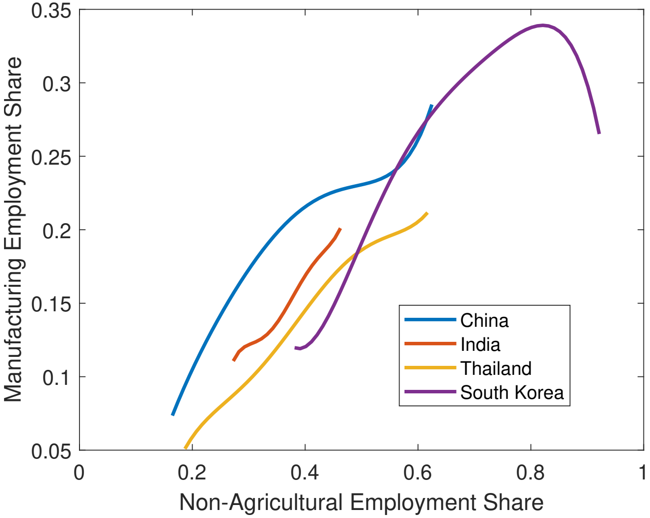
Industrialization Dynamics for Rich Countries



US Industrialization Dynamics



Still Industrializing Countries



Hump Shape Peak and Development Timing

Values of h_n^* and h_m^*

Asia			Latin America			Europe		
	h_n^*	h_m^*		h_n^*	h_m^*		h_n^*	h_m^*
IDN	0.56	0.19	ARG	0.82	0.35	FRA	0.86	0.38
JAP	0.88	0.33	BOL	0.78	0.25	ITA	0.82	0.39
KOR	0.82	0.34	BRA	0.65	0.23	SPA	0.77	0.35
MAL	0.83	0.34	CHL	0.73	0.31			
PHL	0.59	0.17	COL	0.81	0.20			
TWN	0.82	0.40	CRI	0.75	0.27			
			MEX	0.79	0.28			
			PER	0.56	0.20			
			VEN	0.83	0.27			

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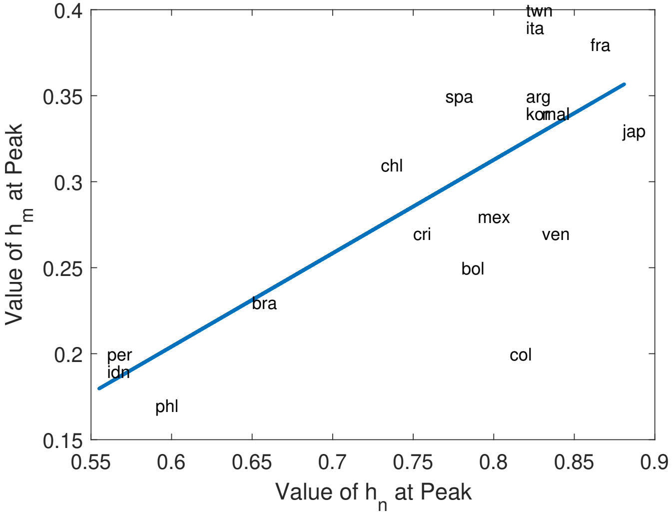

Model and Estimation

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- Preferences: Representative household with one unit of time and preferences:

$$U(c_a, c_m, c_s) = c_a,\ if\ c_a < \bar{c}_a \quad (1)$$

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- Represent $\tilde{U}(c_m, c_s)$ with indirect utility function (Boppart, 2014):

$$
v(E, p_m, p_s) = \underbrace{\frac{1}{\chi}\left(\frac{E}{p_s}\right)^{\chi}}_{Income \ \ Effect} - \underbrace{\frac{\alpha}{\epsilon}\left(\frac{p_m}{p_s}\right)^{\epsilon}}_{Substitution \ \ Effect} - \frac{1}{\chi} + \frac{\alpha}{\epsilon}, \qquad (3)
$$

where $\alpha > 0$ and $0 < \chi < \epsilon < 1$

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$$h_a = \frac{\bar{c}_a}{A_a} \tag{4}$$

$$\frac{p_m c_m}{E} = \frac{h_m}{E} = \alpha \left(\frac{E}{p_s}\right)^{-\chi} \left(\frac{p_m}{p_s}\right)^{-\epsilon}, \text{ where } E = 1 - h_a = h_n \tag{5}$$

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- Unique Pareto efficient allocation

Dynamics of Industrialization

$$h_{mt} = h_{nt}\frac{h_{mt}}{h_{nt}} = h_{nt} f_{mt} \quad (6)$$

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    2. Outflow to services: $\Rightarrow \downarrow h_{mt}/h_{nt} \Rightarrow \uparrow h_{st}$

Hump-Shaped Dynamics: Analytics

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  - Higher values of g_s and lower values of g_m serve to decrease the flow of workers out of manufacturing

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  - Note: Calibrated US profile corresponds to $\lambda(t) = t$
- An economy identical to the US but with a different $\lambda(t)$ will have the same (h_m, h_n) profile

Invariance of the (h_m, h_n) Profile to Pace of Development

- Let $\lambda(t) : \mathbb{R}^+ \rightarrow \mathbb{R}^+$: Describes how quickly a country moves along the development path
- Define the following time series for sectoral productivities: $A_i(t) = e^{g_i \lambda(t)}$
  - Note: Calibrated US profile corresponds to $\lambda(t) = t$
- An economy identical to the US but with a different $\lambda(t)$ will have the same (h_m, h_n) profile
- $\Rightarrow$ Pace of development does not matter for (h_m, h_n) profile

Estimation: Strategy and Result

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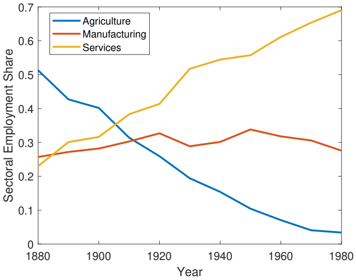

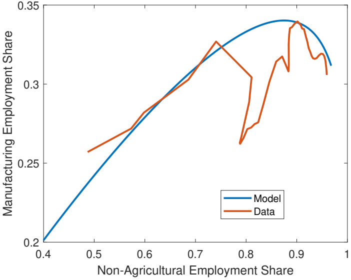

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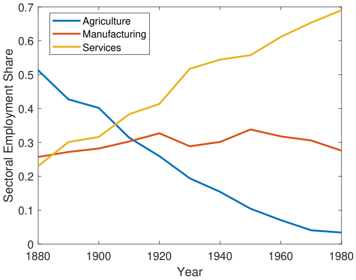

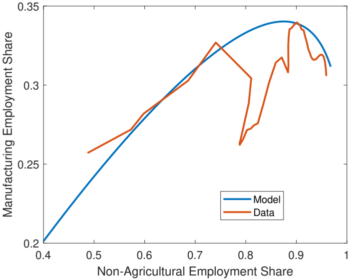

Benchmark Calibration

g_a	g_m	g_s	$\bar{c}_a$	ε	χ	α_m
1.0239	1.0225	1.0147	.60	0.30	0.06	0.4762

Counterfactuals and Quantification

Main Quantification: Illustrative Counterfactual of Agricultural Productivity

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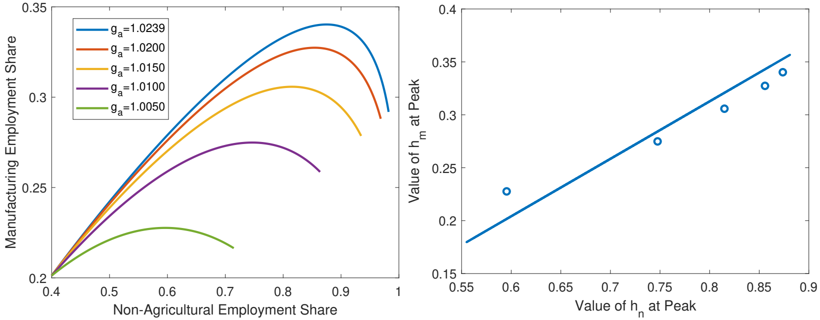

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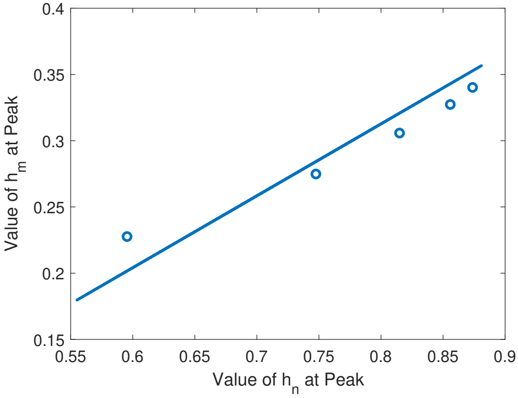
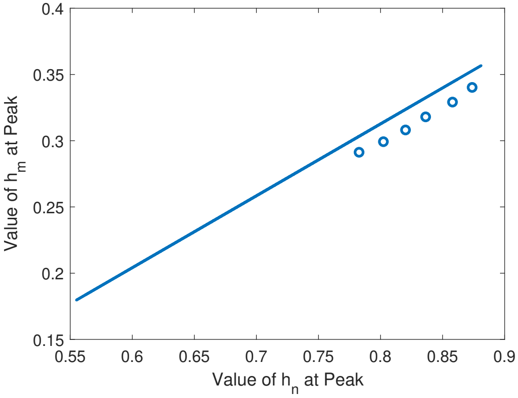


(c) Agricultural Productivity Counterfactuals



(d) Services Productivity Counterfactuals

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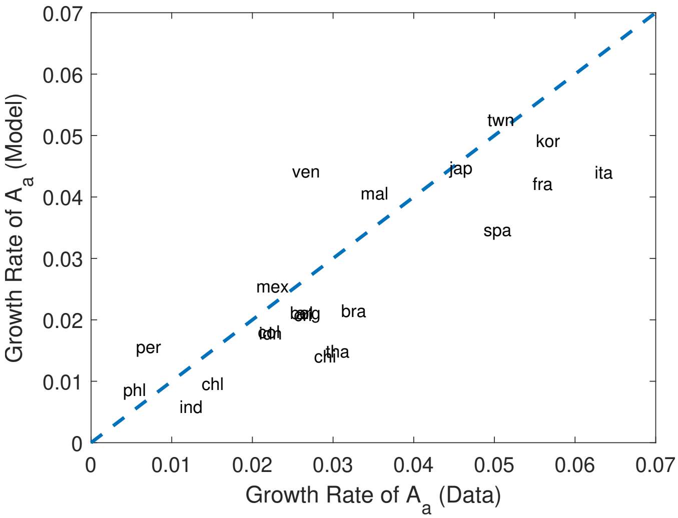
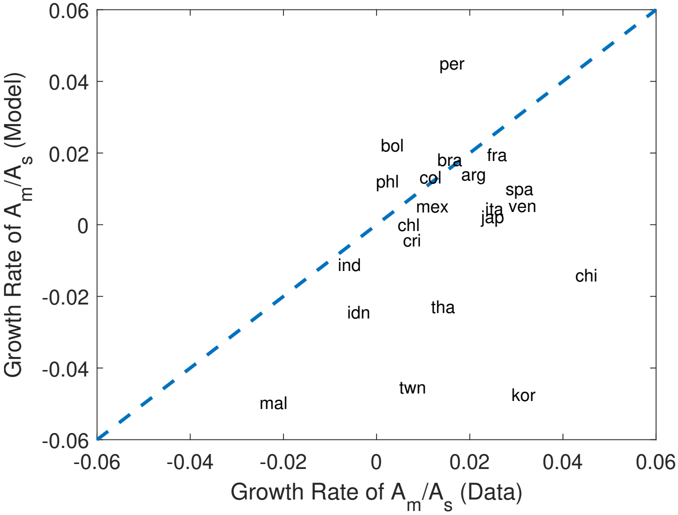
$$h_{at} = \frac{\bar{c}_a}{A_{at}} \tag{13}$$

$$h_{mt} = \alpha \left(1 - h_{at}\right)^{1-\chi} A_{st}^{-\chi} \left(\frac{A_{st}}{A_{mt}}\right)^{\epsilon} \tag{14}$$

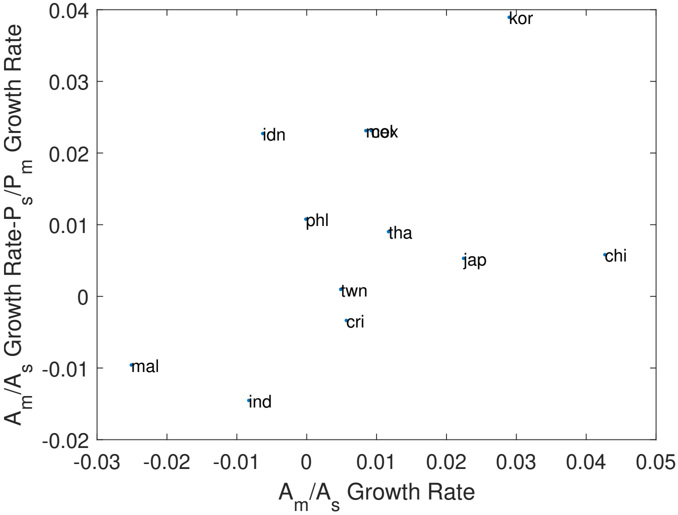
Fit: Data vs Model Inferred Agricultural Productivity g_a



Fit: Data vs Model Inferred $g = g_m - g_s$



Alternative Measure of $g = g_m - g_s$



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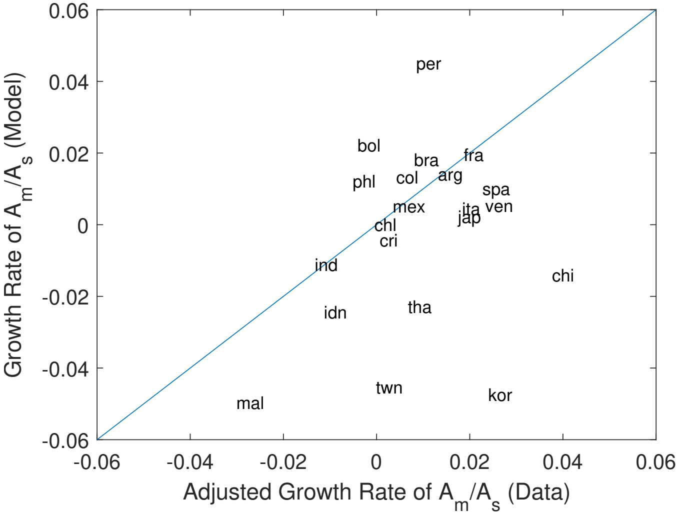

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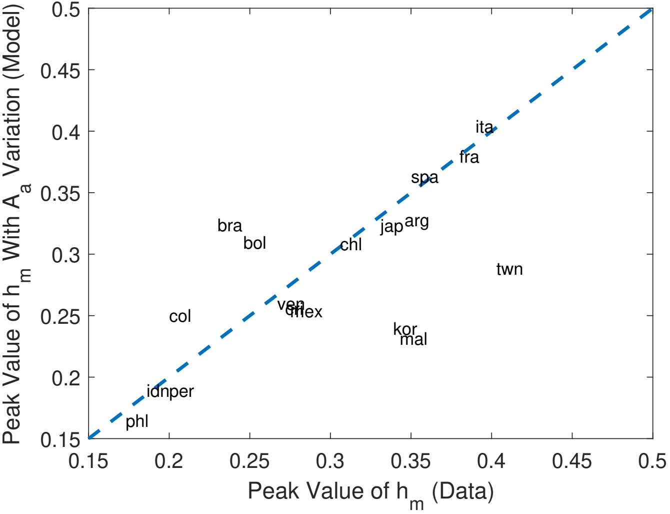

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  - $\Rightarrow$ Role of distortions, eg, services that are provided by governments

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Thanks!

Paths of Industrialization and Trade Imbalances

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