Trade, Financial Frictions, and the Missing Manufacturing Window

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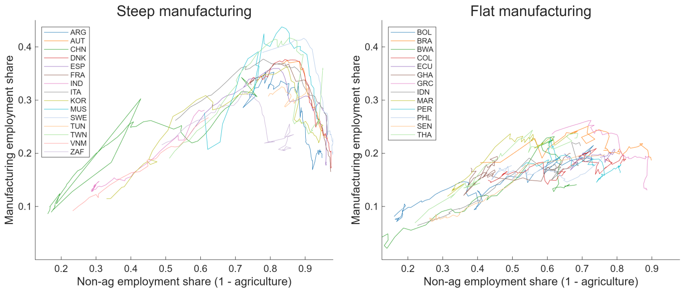
Introduction



- As countries transition from agriculture, they can be divided into:
  - *Steep-manufacturing economies*:
    - Countries with a peak manufacturing employment share $\geq$ 27.5%, or manufacturing employment share $\geq$ 25% at the end of the sample.
    - Pronounced manufacturing hump, with an average peak share of 34%;
    - followed by strong high-skilled services growth. HS Services
  - *Flat-manufacturing economies*:
    - muted manufacturing hump, with an average peak share of 22.5%
    - with labor absorbed more persistently by low-skilled services. LS services
- Flat manufacturing paths are often interpreted as premature deindustrialization – Rodrik (2016).

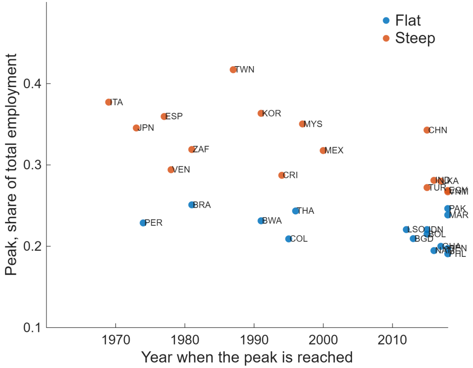
Research Question

Why do some economies experience a strong manufacturing phase, while others move more directly into low-skilled services?

- We study financial development as a force shaping structural transformation through two margins:
  - investment-demand margin: lower financing frictions raise demand for manufacturing-intensive capital goods
  - export-finance margin: lower export costs strengthen comparative advantage in finance-dependent tradables.
- Main result: financial underdevelopment is a quantitatively important driver of flat-manufacturing paths.
  - Moving flat-manufacturing economies halfway toward the financial frontier, bringing them to the average financial development of steep economies:
    - closes over one quarter of the flat–steep manufacturing peak gap
    - raises output per worker by 13–17%.
  - Lower nonfinancial trade costs amplify the manufacturing response to improved financial development.

Motivation

Fact 1: Flat manufacturing is not just late industrialization.



Maximum manufacturing share of employment

Source: GGDC 10-Sector Database, GGDC/UNU-WIDER Economic Transformation Database (ETD), EU-KLEMS, WIOD.

- Steep and flat manufacturing profiles among early and late industrializers.

Motivation

Flat and steep manufacturing countries differ in financial development

- Financial development is measured using the IMF Financial Institutions Index:
  - Composite index from 0 to 1 summarizing depth, access, and efficiency.
  - Captures bank credit, non-bank financial institutions, access, and intermediation efficiency.

Group	Mean	Median	SD
All	0.43	0.37	0.24
Flat	0.26	0.21	0.14
Steep	0.55	0.54	0.22

- The index is highly correlated with private credit to GDP, around 0.8.
- Similar differences across groups when private credit to GDP is considered: 24% vs 63%.

Motivation

Fact 2: Financial Development Matters for Sectoral Employment.

	Panel A				Panel B			
	Agric.	Manufac.	LS serv.	HS serv.	Agric.	Manufac.	LS serv.	HS serv.
ln(GDPpw)	-0.08***	0.03*	0.01	0.03**	-0.53***	0.55***	0.28***	-0.30***
	(0.018)	(0.013)	(0.009)	(0.009)	(0.091)	(0.094)	(0.055)	(0.057)
$\ln(\text{GDPpw})^2$					0.02***	-0.03***	-0.01***	0.02***
					(0.005)	(0.005)	(0.003)	(0.003)
Fin Dev	-0.42***	0.26**	0.24***	-0.08	-0.34***	0.17*	0.19***	-0.02
	(0.088)	(0.085)	(0.048)	(0.066)	(0.088)	(0.073)	(0.048)	(0.053)
Fin Dev^2	0.49***	-0.39***	-0.29***	0.19**	0.34***	-0.22***	-0.20***	0.09.
	(0.077)	(0.078)	(0.047)	(0.064)	(0.071)	(0.061)	(0.044)	(0.051)
Fixed-effects								
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics								
Adjusted R^2	0.98	0.83	0.93	0.97	0.98	0.87	0.94	0.97
Observations	3,261	3,261	3,261	3,261	3,261	3,261	3,261	3,261

Standard errors clustered at the country level are reported in parentheses.
*Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, .: 0.1*

- Conditional on GDP per worker, financial development can account for a significant part of variation in sectoral employment.
- Results are robust to alternative specifications, alternative financial-development measures, excluding China/Japan/Korea, controlling for openness, and controlling for domestic absorption.

Motivation

Fact 2: Financial Development Matters for Peak Manufacturing

$$m_i^{peak} = \alpha + \beta FD_{i,t_i^{peak}-10} + \gamma_1 \ln(\mathrm{GDPpw})_{\mathrm{init}} + \gamma_2 \ln(\mathrm{GDPpw})^2_{\mathrm{init}} + \gamma_3 m_{\mathrm{init}} + \varepsilon_i.$$

	Priv. Cred. / GDP	IMF FD	IMF institutions
FD_{init}	0.02**	0.11***	0.10*
	(0.01)	(0.03)	(0.04)
$\ln(\mathrm{GDPpw})_{\mathrm{init}}$	0.21*	0.26**	0.29**
	(0.08)	(0.08)	(0.08)
$\ln(\mathrm{GDPpw})^2_{\mathrm{init}}$	-0.01*	-0.01**	-0.02**
	(0.00)	(0.00)	(0.00)
m_{init}	0.81***	0.85***	0.79***
	(0.10)	(0.09)	(0.11)
Constant	-0.93*	-1.14**	-1.27**
	(0.39)	(0.37)	(0.39)
Observations	46	46	46
Adjusted R^2	0.86	0.87	0.86

Notes: Dependent variable is the peak manufacturing employment share, $m_i^{peak} = \max_t m_{i,t}$. Financial development and controls are measured 10 years before the peak, at $t_i^{peak} - 10$. Significance codes are ***: 0.001, **: 0.01, *: 0.05, .: 0.1.

- Countries with stronger financial development 10 years before the peak subsequently reach higher manufacturing employment shares.

Motivation

Fact 3: Financial frictions disproportionately restrict exports in financially vulnerable sectors.

- Exporting is particularly finance intensive: firms must finance market-access costs, production, inventories, shipment before foreign revenues are realized.
- A large finance-and-trade literature shows that better financial development strengthens export performance and comparative advantage, above and beyond its effect on domestic production.
- Importance of this channel varies across sectors, depending on capital intensity, working-capital requirements, and asset tangibility.
- In our data, manufacturing and high-skilled-services exports rise more strongly with financial development than agricultural exports.

Related literature: Beck (2002, 2003); Manova (2013); Paravisini et al. (2015); Leibovici (2021); Matray et al. (2024).

Related Literature and Contribution

This paper connects three literatures by introducing financial development as a force shaping structural transformation.

- **Structural transformation and heterogeneous industrialization paths** – Ngai and Pissarides (2007), Herrendorf et al. (2014), Rodrik (2016), García-Santana et al. (2021), Huneeus and Rogerson (2024), Sposi et al. (2026).
  Income effects, relative prices, productivity, and the timing of industrialization.

- **Trade and open-economy structural change** – Matsuyama (2009), Cravino and Sotelo (2019), Lewis et al. (2022), Sposi et al. (2026).
  Trade exposure, specialization, and the role of comparative advantage.

- **Finance, sectoral allocation, and exports** – Rajan and Zingales (1998), Beck (2002, 2003), Manova (2013), Buera et al. (2011), Leibovici (2021).
  Financial development, sectoral growth, and export performance in finance-dependent sectors.

Contribution

We quantify financial development as a force shaping heterogeneous manufacturing paths.

- In a dynamic multi-country model, finance affects both export competitiveness and domestic demand for manufacturing-intensive investment goods.
- Assess how financial underdevelopment contributes to flat-manufacturing paths.

Model – Environment

- Dynamic multi-country general-equilibrium model with perfect foresight.
- Countries indexed by destination n and origin i.
- Four sectors:

$$j \in \mathcal{J} \equiv \{a, m, ls, hs\}.$$

  - Tradable: agriculture (a), manufacturing (m), high-skill services (hs).
  - Non-tradable: low-skill services (ls).
- Sectoral composites are used for final consumption and investment.
- Labor and capital are mobile across sectors within a country, but not internationally.

Model – Main Building Blocks

- Households choose consumption, investment, and capital accumulation.
- Final consumption and investment combine sectoral composites through non-homothetic CES aggregators.
- Variety producers operate under monopolistic competition with country-sector productivity $A^j_{i,t}$.
- Sectors differ in capital intensity:

$$\alpha_j \in (0,1), \qquad j \in \mathcal{J}.$$

- Agricultural headcount employment differs from effective labor:

$$\tilde{L}^a_{i,t} = s^a_{i,t} L^a_{i,t}, \qquad \tilde{L}^j_{i,t} = L^j_{i,t} \;\text{ for } j \neq a.$$

- Financial development affects two margins: domestic investment and the cost of serving foreign markets.

Sectoral productivity + trade + non-homothetic demand + capital accumulation + financial frictions

Model - Final Consumption

- Sectoral composites ($c^j_{n,t}$) are aggregated into final consumption ($C_{n,t}$) using non-homothetic CES preferences:

$$\sum_{j \in \mathcal{J}} \gamma^j_n \left(\frac{C_{n,t}}{L_{n,t}} \right)^{\frac{1-\sigma}{\sigma} \epsilon^j} \left(\frac{c^j_{n,t}}{L_{n,t}} \right)^{\frac{\sigma-1}{\sigma}} = 1.$$

- σ governs substitution across sectoral composites.
  - With $\sigma < 1$ we have Baumol effects: a sector's budget share tends to decline as its relative price falls.
- ϵ^j governs how demand for sector j changes with consumption per worker.
  - Sectoral demand responds to both relative prices and level of consumption.
- γ^j_n captures country-specific demand weights.

Model - Investment Good

- Sectoral composites ($x^j_{n,t}$) are also used to produce aggregate investment ($X_{n,t}$).
- Investment is assembled through a non-homothetic CES aggregator:

$$\sum_{j \in \mathcal{J}} \omega^x_{n,j} \left(\frac{X_{n,t}}{L_{n,t}} \right)^{\frac{1-\sigma_x}{\sigma_x} \epsilon^j_x} \left(\frac{x^j_{n,t}}{L_{n,t}} \right)^{\frac{\sigma_x - 1}{\sigma_x}} = 1.$$

- σ_x governs substitution across sectoral composites in investment.
- ϵ^j_x governs how sector-j investment demand changes with investment per worker.
- $\omega^x_{n,j}$ captures country-specific investment weights.

Model - Households

- In each country n, a representative household of size $L_{n,t}$ supplies labor, owns capital, and firms, and chooses $\{c^j_{n,t}\}_{j\in\mathcal{J}}$, $X_{n,t}$, and $K_{n,t+1}$ to maximize:

$$\sum_{t=0}^{\infty} \beta^t L_{n,t} \log\left(\frac{C_{n,t}}{L_{n,t}}\right),$$

subject to the period budget constraint

$$\sum_{j\in\mathcal{J}} P^j_{n,t} c^j_{n,t} + (1+\psi_{n,t}) P^x_{n,t} X_{n,t} = w_{n,t}\widetilde{L}_{n,t} + r_{n,t} K_{n,t} + \Pi_{n,t} + T^I_{n,t},$$

and a capital–adjustment technology,

$$X_{n,t} = \Phi\big(K_{n,t+1}, K_{n,t}\big) \equiv \delta^{1-\frac{1}{\nu}} \left(\frac{K_{n,t+1}}{K_{n,t}} - (1-\delta)\right)^{\frac{1}{\nu}} K_{n,t},$$

where $\psi_{n,t}$ **is an investment-finance friction**, δ is the depreciation rate and ν governs the curvature of the capital-adjustment technology.

Model - Households

Household's intertemporal optimality condition is given by

$$(1+\omega_{n,t})(1+\psi_{n,t})\frac{P^x_{n,t}}{P^c_{n,t}} = \beta\left[\frac{L_{n,t+1}}{L_{n,t}}\frac{C_{n,t}}{C_{n,t+1}}\frac{P^x_{n,t+1}}{P^c_{n,t+1}}\left(\frac{r_{n,t+1}/P^x_{n,t+1}-(1+\psi_{n,t+1})\Phi_2(K_{n,t+2},K_{n,t+1})}{\Phi_1(K_{n,t+1},K_{n,t})}\right)\right],$$

$\omega_{n,t}$ is a is a residual wedge rationalizing remaining investment dynamics.

- Left-hand side captures the distorted marginal cost of installing additional capital today, relative to consumption.
- $\psi_{n,t+1}$ appears in the continuation term because installing more capital today changes the investment required in the following period.

Model - Variety Producers

- In each country i, sector j, and period t, a unit mass of firms produces differentiated varieties.
- A firm with productivity ϕ produces:

$$q^j_{i,t}(\phi) = A^j_{i,t}\phi \left(K^j_{i,t}(\phi)\right)^{\alpha_j} \left(\tilde{L}^j_{i,t}(\phi)\right)^{1-\alpha_j},$$

- $A^j_{i,t}$ is country-sector productivity.
- Firm productivity is Pareto distributed:

$$G(\phi) = 1 - \left(\frac{\phi_0}{\phi}\right)^{\theta}, \qquad \phi \geq \phi_0, \qquad \theta > \eta - 1.$$

Model - Unit Costs and Markups

- Cost minimization gives the unit cost before trade and financial frictions:

$$u^j_{i,t}(\phi) = \frac{\kappa_j w_{i,t}^{1-\alpha_j} r_{i,t}^{\alpha_j}}{A^j_{i,t}\phi}, \qquad \kappa_j \equiv \alpha_j^{-\alpha_j}(1-\alpha_j)^{-(1-\alpha_j)}.$$

- A variety produced in origin i and sold in destination n has delivered marginal cost:

$$mc^j_{ni,t}(\phi) = \widetilde{\tau}^j_{ni,t} u^j_{i,t}(\phi).$$

  - $\widetilde{\tau}^j_{ni,t}$ captures both nonfinancial iceberg trade costs and the financial cost of serving foreign markets.

- Varieties are aggregated with a CES demand with elasticity $\eta > 1$.
- Under monopolistic competition, firms charge a constant markup:

$$\mu = \frac{\eta}{\eta - 1}, \qquad p^j_{ni,t}(\phi) = \mu \widetilde{\tau}^j_{ni,t} u^j_{i,t}(\phi).$$

- Differences in productivity, factor prices, trade costs, and financial frictions jointly determine competitiveness and bilateral trade shares.

Model - Financial Frictions: Two Margins

- The model links financial development to structural transformation through two margins.
- **Investment channel:**
  - lower financial development raises the effective cost of investment;
  - weaker investment demand lowers demand for manufacturing-intensive capital goods.
- **Export channel:**
  - lower financial development raises export costs in finance-dependent sectors;
  - this weakens competitiveness and changes comparative advantage.

Model - Investment Friction

- The household behaves as if investment goods are more costly at the margin:

$$(1+\omega_{n,t})\ \underbrace{(1+\psi_{n,t})\frac{P^x_{n,t}}{P^c_{n,t}}}_{\text{distorted marginal cost}}$$
$$= \beta\left[\frac{L_{n,t+1}}{L_{n,t}}\frac{C_{n,t}}{C_{n,t+1}}\frac{P^x_{n,t+1}}{P^c_{n,t+1}}\left(\frac{r_{n,t+1}/P^x_{n,t+1} - (1+\psi_{n,t+1})\Phi_2(K_{n,t+2},K_{n,t+1})}{\Phi_1(K_{n,t+1},K_{n,t})}\right)\right].$$

- Link between financial development and investment wedge:

$$\psi_{n,t} = \bar{\psi}\left(\frac{1}{\lambda_{n,t}} - 1\right), \qquad \bar{\psi} > 0.$$

  - $\lambda_{n,t}$ is a country-specific and time-varying measure of financial development (IMF index):
$$\lambda_{n,t} \in (0,1],$$
  - The wedge is zero under full financial development and increases as $\lambda_{n,t}$ falls.

Model - Export Friction

- For tradable sectors $j \in \mathcal{T} \equiv \{a, m, hs\}$, the effective bilateral trade cost is:

$$\widetilde{\tau}^{j}_{ni,t} = \begin{cases} 1, & n = i, \\ \tau^{j}_{ni,t}\zeta^{j}_{i,t}, & n \neq i. \end{cases}$$

- $\tau^{j}_{ni,t}$ captures nonfinancial iceberg trade costs.
- $\zeta^{j}_{i,t}$ captures the exporter-side, sector-specific financial component.

$$\zeta^{j}_{i,t} = \lambda_{i,t}^{-\chi^{j}},$$

  - $\lambda_{i,t}$ is the same country-specific and time-varying measure of financial development (IMF index), that enters the investment-finance wedge.
  - χ^{j} governs how strongly financial frictions affect each sector.

From Model Structure to Quantification

The model jointly determines

- sectoral employment and expenditure shares;
- relative prices and bilateral trade shares;
- investment and capital accumulation;
- output, consumption, and exports.

Calibration roadmap

1. Discipline standard parameters and observed country-level paths.
2. Estimate demand parameters and the strength of the two financial margins.

Data

- Annual panel of 44 economies plus a rest-of-the-world aggregate, covering 1970–2018.
- Aggregate output, capital and employment come from Penn World Table 11.0.
- Sectoral employment and value added are assembled from GGDC, ETD, WIOD, EU KLEMS, and OECD data.
- Sectoral final demand is constructed from OECD Input-Output Tables and historical WIOD data:
  - household final consumption;
  - gross fixed capital formation.
- Bilateral trade shares:
  - agriculture and manufacturing: UN COMTRADE, BACI and WIOD;
  - high-skilled services: WTO BaTIS and WIOD.
- Financial development: IMF Financial Institutions Index.

Calibration – Parameters and Processes

Taken from the literature

- Preferences and capital accumulation
  - $\beta = 0.96$: annual discount factor.
  - $\delta = 0.10$: annual depreciation rate (Alessandria et al., 2024).
- Variety-level technology
  - $\eta = 6$: elasticity of substitution across varieties, implying $\mu = 1.2$.
  - $\theta = 6 > \eta - 1$: Pareto shape parameter for firm productivity (Tombe, 2015; Caliendo and Parro, 2015).
  - $\phi_0 = 1$: normalized productivity lower bound.

Calibrated parameters

- $\nu = 0.79$: curvature of the investment technology; targets a steady-state investment rate of 23%.
- Sector-specific capital shares:

  $$\alpha^{a} = 0.31, \;\; \alpha^{m} = 0.46, \;\; \alpha^{ls} = 0.35, \;\; \alpha^{hs} = 0.43.$$

  Calibrated to match observed labor compensation shares.

Exogenous paths from the data

- labor supply $\{L_{n,t}\}$;
- initial capital stocks $\{K_{n,0}\}$.
- Agricultural labor-efficiency wedge $\{s^{a}_{i,t}\}$: observed gap in value added per worker between non-agriculture and agriculture.
- Country-sector productivity paths $\{A^{j}_{i,t}\}$: recovered from sectoral prices, factor costs, and domestic expenditure shares.

Details TFP

Estimation and Calibration – Non-Homothetic Demand

Estimation strategy

- Demand elasticities are estimated separately for consumption and investment:
  - compare sectoral expenditure shares relative to manufacturing;
  - use variation in relative sectoral prices and real expenditure per worker;
  - relative prices discipline substitution elasticities σ_z;
  - expenditure growth disciplines scale elasticities $\epsilon_z^j - \epsilon_z^m$.

Estimated parameters

- Consumption:
  - $\sigma = 0.80$
  - $(\epsilon^a, \epsilon^m, \epsilon^{ls}, \epsilon^{hs}) = (0.29, 1.00, 1.45, 1.83)$
  - $\{\gamma_n^j\}$ calibrated to match initial consumption shares

Details NH

- Investment:
  - $\sigma_x = 0.76$
  - $(\epsilon_x^a, \epsilon_x^m, \epsilon_x^{ls}, \epsilon_x^{hs}) = (0.24, 0.99, 0.76, 1.48)$
  - $\{\omega_{n,j}^x\}$ calibrated to match initial investment shares

Key implications:

- Sectoral goods are complements: Baumol effects;
- As countries grow, consumption expenditure shifts away from agriculture towards services.
- Investment demand is strongly manufacturing-intensive;

Estimation - Export Finance Wedge I

- Effective trade wedge:
$$\widetilde{\tau}^j_{ni,t} = \tau^j_{ni,t}\zeta^j_{i,t}.$$
- Recover total trade costs from trade shares and prices in the data:
$$\widetilde{\tau}^j_{ni,t} = \left(\frac{\pi^j_{ni,t}}{\pi^j_{ii,t}}\right)^{\frac{1}{1-\eta}} \frac{P^j_{n,t}}{P^j_{i,t}}, \qquad n \neq i.$$
- Next, we identify the component of the total effective trade wedge that is systematically associated with financial development:
$$\zeta^j_{i,t} = \lambda_{i,t}^{-\chi^j}.$$
- $\zeta^j_{i,t}$ captures the finance-induced component of the export wedge.

Estimation - Export Finance Wedge II

- Estimate χ^j, separately in each tradable sector, from:

$$\log \tilde{\tau}^j_{ni,t} = \alpha^j_{ni} + \delta^j_{nt} + \chi^j \log(\frac{1}{\lambda_{i,t}}) + \beta^j \log(GDPpw_{i,t}) + \nu^j_{ni,t}, \qquad j \in \{a, m, hs\},$$

- Baseline estimate:

$$\widehat{\chi}^a = 0.15, \quad \widehat{\chi}^m = 0.21, \quad \widehat{\chi}^{hs} = 0.27.$$

- Implied average finance wedges are 1.14, 1.21, and 1.28, respectively, and the finance component accounts for approximately 7%, 12%, and 12% of the total effective log trade wedge in a, m, and hs.

Calibration - Investment Financial Friction

- Investment wedge uses the same financial-development index:

$$\psi_{n,t} = \bar{\psi}\left(\frac{1}{\lambda_{n,t}} - 1\right).$$

- Estimate the empirical slope between investment rates and financial development:

$$\rho_{n,t}^{data} = a_t + b_1\left(\frac{1}{\lambda_{n,t}} - 1\right) + b_2 \log GDPpw_{n,t}^{data} + u_{n,t}.$$

- Estimated slope:

$$\widehat{b}_1 = -0.0084.$$

  Weaker financial development is associated with lower investment rates.
- Calibrate $\bar{\psi}$ so that the model reproduces this empirical slope.
- Baseline calibration:

$$\bar{\psi} = 0.055.$$

- Residual Euler wedge, $\omega_{n,t}$ rationalizes baseline country-year investment paths not explained by the model.

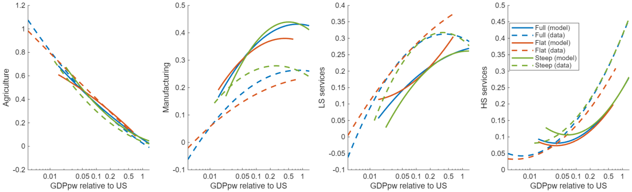
Model Fit

Pooled model–data correlations

Variable	Correlation
Relative prices	
P^a / P^m	0.99
P^{ls} / P^m	0.99
P^{hs} / P^m	1.00
Consumption expenditure shares	
Agriculture	0.92
Manufacturing	0.64
Low-skilled services	0.81
High-skilled services	0.81
Domestic expenditure shares	
Agriculture	0.82
Manufacturing	0.78
High-skilled services	0.78

- The model closely reproduces relative sectoral prices, both in levels and in comovement.
- The estimated demand system captures the broad composition of consumption expenditure along the development path.
- Domestic expenditure shares are also closely matched, providing an internal consistency check for the trade block.

Model Fit – Sectoral Employment



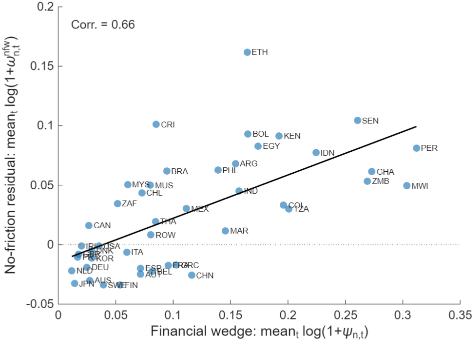
Sectoral employment shares: model and data

- Sectoral employment shares are not targeted and therefore provide a more demanding validation exercise.
- For manufacturing, the model reproduces the comovement with the data:
  - median within-country correlation: 0.78;
  - within-year correlation: 0.70.
- The model overstates the level of manufacturing employment, but the discrepancy is broadly stable across the development distribution.
- At group medians, steep–flat manufacturing-employment gap is 9.8 p.p in the data and 8.7 p.p in the model: the model preserves approx. 90% of the gap.

Model Fit – Investment-Finance Wedge

- We assess whether the financial wedge captures a meaningful component of the distortion needed to rationalize observed investment dynamics.
- We compare two Euler residuals:
  - $\omega_{n,t}^{\text{base}}$: residual required after allowing $\psi_{n,t}$ to operate;
  - $\omega_{n,t}^{\text{nfw}}$: residual required when the structural financial wedge is removed.
- The comparison shows whether the distortion that would otherwise be absorbed by the Euler residual aligns with the structural financial wedge.
- This is not mechanical: $\psi_{n,t}$ is disciplined by financial-development data, while $\omega_{n,t}^{\text{nfw}}$ is recovered independently from the Euler equation.

Model Fit – Investment-Finance Wedge



- The financial wedge is positively related to the residual distortion required in a model without the investment-finance channel:
  - average within-year cross-country correlation: 0.32;
  - correlation of country averages: 0.66, implying $R^2 = 0.43$.
- Variance decomposition shows that $\omega^{\text{nfw}}_{n,t}$ varies mostly within country, while $\psi_{n,t}$ varies mostly across countries.
- $\psi_{n,t}$ captures persistent financial-development distortions, while $\omega^{\text{base}}_{n,t}$ absorbs remaining short-run investment fluctuations.

How Much Can Financial Development Expand Manufacturing ?

- We use the counterfactuals to assess how much financial development expand manufacturing in flat-manufacturing economies and through which margins.
- Main experiment: flat-manufacturing economies close one-half of the gap to the year-specific financial frontier.
  - This brings the average flat-manufacturing economies approximately to the average financial-development level of steep economies.
- Both financial margins are recomputed accordingly:
  - investment wedge $\psi_{n,t}$;
  - export-finance wedge $\zeta_{i,t}^{j}$.
- Productivity, nonfinancial trade costs, preferences, labor, initial capital, and residual wedges are kept at baseline.
- Outcomes are reported for flat-manufacturing economies over 3 periods: 1970–1985 (Early), 1986–2001 (Middle), and 2002–2018 (Late).

Quantitative Results - Financial Development

	Period	Flat mfg. emp. share pp	Flat Y/L %	Flat C/L %	Flat investment rate pp	Flat exports/ output pp
	Early	2.71	17.23	7.60	5.86	2.85
Financial convergence	Middle	2.01	16.44	12.49	2.30	2.21
	Late	1.82	13.25	10.41	1.36	2.29

Notes: Differences from baseline for flat-manufacturing economies. Periods: Early 1970–1985, Middle 1986–2001, Late 2002–2018. Percent variables are percentage changes; shares and rates are percentage-point changes.

- Flat-manufacturing economies move halfway to the financial frontier.
- Financial development raises manufacturing employment throughout the transition:
  - the increase is largest early on, at approximately 2.7 pp;
  - the effect remains sizable in the late period.
  - Agricultural and low-skilled-services employment shares move in the opposite direction.
- Aggregate gains are substantial:
  - output per worker increases by approximately 13–17%;
  - consumption per worker increases by approximately 8–12%.
- Investment and exports also rise:
  - the investment response is strongly front-loaded;
  - exports relative to output increase persistently across periods.

Quantitative Results - Margin Decomposition

- Decompose the main experiment by changing one financial margin at a time:
  - investment-demand margin only: update $\psi_{n,t}$;
  - export-finance margin only: update $\zeta^{j}_{i,t}$.

	Period	Flat mfg. emp. share pp	Flat Y/L %	Flat C/L %	Flat investment rate pp	Flat exports/ output pp
Investment-demand margin only	Early	2.36	15.07	5.79	5.69	-0.15
	Middle	1.28	13.50	9.77	2.18	-0.22
	Late	1.05	9.71	7.11	1.15	-0.23
Export-finance margin only	Early	0.31	1.73	1.65	0.03	3.01
	Middle	0.65	2.52	2.42	0.05	2.45
	Late	0.70	3.22	3.10	0.17	2.52

Notes: Differences from baseline for flat-manufacturing economies. Periods: Early 1970–1985, Middle 1986–2001, Late 2002–2018. Percent variables are percentage changes; shares and rates are percentage-point changes.

- The two margins play different roles:
  - The investment margin explains most of the manufacturing response.
  - The export-finance margin drives the export response and becomes relatively more important for manufacturing later in the transition.

Quantitative Results - Finance and Nonfinancial Trade Costs

	Period	Flat mfg. emp. pp	Flat Y/L %	Flat C/L %	Flat exports/Y pp
Lower trade costs	Early	2.00	8.04	7.63	10.98
	Middle	6.22	19.33	18.07	12.92
	Late	6.15	26.12	24.59	18.61
Financial convergence	Early	2.71	17.23	7.60	2.85
	Middle	2.01	16.44	12.49	2.21
	Late	1.82	13.25	10.41	2.29
Financial convergence + lower trade costs	Early	6.47	33.74	21.66	18.30
	Middle	9.80	46.32	39.58	18.28
	Late	8.49	48.22	42.61	23.01
Interaction effect	Early	1.76	8.47	6.43	4.47
	Middle	1.57	10.55	9.02	3.15
	Late	0.52	8.85	7.61	2.11

Notes: Differences from baseline for flat-manufacturing economies. Periods: Early 1970–1985, Middle 1986–2001, Late 2002–2018. Percent variables are percentage changes; shares and rates are percentage-point changes. The interaction effect is the combined effect minus the sum of the finance-only and trade-cost-only effects.

- Lower trade costs alone increase manufacturing and raise exports.
- Important interaction between financial development and lower trade costs.
- Complementary exercise: under autarky, financial convergence results are attenuated.

Quantitative Results - Manufacturing Peak Gap

- The empirical peak gap is the difference between the average maximum manufacturing-employment shares of steep- and flat-manufacturing economies: 11.26 pp.

Exercise	Net peak gain pp	Share of flat–steep gap %
Financial convergence	3.19	28.3
Investment-demand margin only	1.94	17.2
Export-finance margin only	0.93	8.2
Financial convergence + lower trade costs	8.28	73.5

Notes: The empirical flat–steep manufacturing peak gap is 11.26 percentage points. The table reports how much of that gap is closed by each counterfactual. The net peak gain is the average peak gain for flat-manufacturing economies minus the corresponding average gain for steep-manufacturing economies.

- Financial convergence closes more than one quarter of the peak gap.
- The investment-demand margin explains a larger share of the peak response, while the export-finance margin is also quantitatively relevant.
- Combining financial convergence with lower trade costs closes almost three quarters of the peak gap.

Conclusion

- Financial development helps explain why some economies miss a strong manufacturing phase.
- Finance operates through two margins:
  - The investment-demand margin raises demand for manufacturing-intensive capital goods;
  - the export-finance margin improves competitiveness in finance-dependent tradables.
- Moving flat-manufacturing economies halfway to the financial frontier:
  - closes 28.3% of the flat–steep manufacturing peak gap;
  - raises output per worker by 13–17%.
- The investment-demand margin is the main source of peak-gap closure; the export-finance margin mainly raises exports.
- Finance and lower trade costs are complementary:
  - lower trade costs expand manufacturing on their own, but their effects are stronger when financial development also improves;
  - together, they close 73.5% of the flat–steep peak gap.

Thank you for your attention!

Appendix - High-skilled services paths

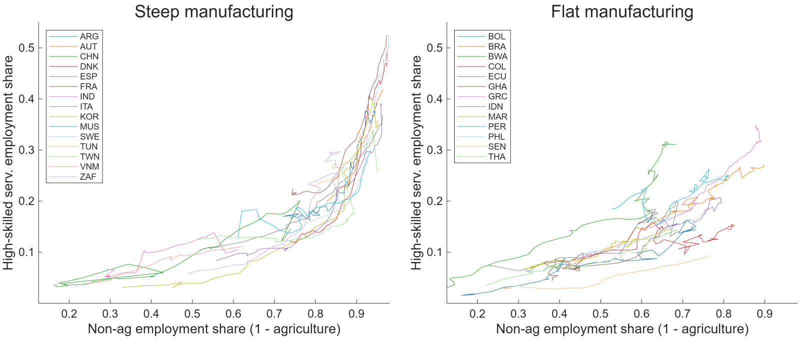


Figure: High-skilled services employment vs Non-agriculture employment share

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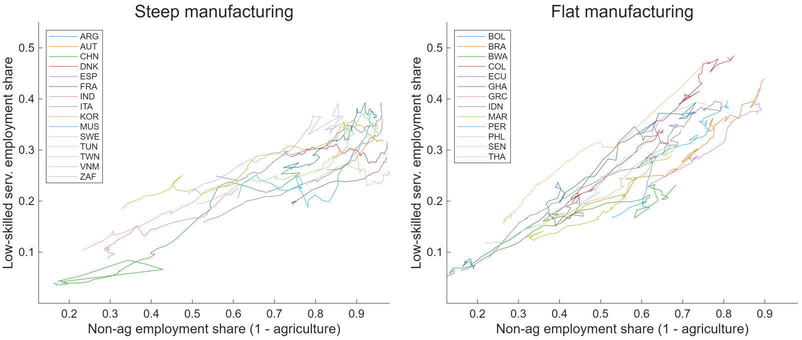
Appendix - Low-skilled services paths



Low-skilled services employment vs Non-agriculture employment share

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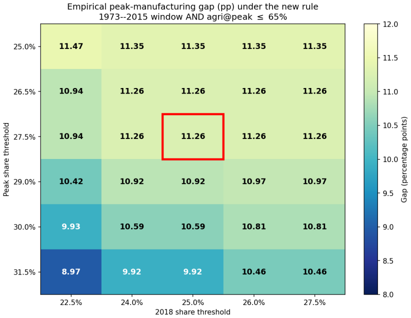
Appendix – Robustness of the Flat–Steep Classification



Empirical peak gap across alternative classification thresholds.

Baseline classification

- An economy is classified as steep if:

$$\max_t m_{i,t} \geq 27.5\% \quad \text{or} \quad m_{i,2018} \geq 25\%.$$

- Baseline empirical peak gap:

$$11.26 \text{ percentage points.}$$

Robustness checks

- Across alternative threshold pairs, the gap remains between **9.0 and 11.5 p.p.**
- A peak-only classification leaves the gap unchanged.
- No leave-one-out country exclusion changes the gap by more than **1 p.p.**
- Permutation test: $p < 10^{-4}$.
- Bootstrap 95% confidence interval:

$$[8.71,\ 14.03].$$

Notes: The empirical peak-gap comparison restricts attention to economies whose observed manufacturing-employment peak occurs within 1973–2015 and whose agricultural-employment share at the peak is no higher than 65%. The gap also remains positive in each region for which a within-region comparison is informative.

Appendix. Model - Sectoral Consumption and Investment Demand

- Let $P^c_{n,t}$ and $P^x_{n,t}$ denote the average price of final consumption and investment:

$$P^c_{n,t} C_{n,t} = \sum_{j \in \mathcal{J}} P^j_{n,t} c^j_{n,t}.$$

$$P^x_{n,t} X_{n,t} = \sum_{j \in \mathcal{J}} P^j_{n,t} x^j_{n,t}.$$

- Cost minimization implies:

$$c^j_{n,t} = C_{n,t} (\gamma^j_n)^\sigma \left(\frac{P^j_{n,t}}{P^c_{n,t}} \right)^{-\sigma} \left(\frac{C_{n,t}}{L_{n,t}} \right)^{(1-\sigma)(\epsilon^j - 1)} .$$

- Investment demand for sector j is:

$$x^j_{n,t} = X_{n,t} (\omega^x_{n,j})^{\sigma_x} \left(\frac{P^j_{n,t}}{P^x_{n,t}} \right)^{-\sigma_x} \left(\frac{X_{n,t}}{L_{n,t}} \right)^{(1-\sigma_x)(\epsilon^j_x - 1)} .$$

- Sectoral demand responds to both relative prices and income/scale effects.

Appendix. Model - Households: Aggregation across sectors

Optimization of this problem leads to per-capita expenditure shares defined by

$$\frac{P^k_{n,t}\, c^k_{n,t}}{P_{n,t}\, C_{n,t}} = \left(\gamma^k_n\right)^{\sigma} \left(\frac{P^k_{n,t}}{P_{n,t}}\right)^{1-\sigma} \left(\frac{C_{n,t}}{L_{n,t}}\right)^{(1-\sigma)\left(\epsilon^k-1\right)},$$

and aggregate price index:

$$P_{n,t} = \left(\sum_{k\in\{a,m,ls,hs\}} \left(\gamma^k_n\right)^{\sigma} \left(P^k_{n,t}\right)^{1-\sigma} \left(\frac{C_{n,t}}{L_{n,t}}\right)^{(1-\sigma)\left(\epsilon^k-1\right)}\right)^{\frac{1}{1-\sigma}}.$$

Appendix - Model - Sectoral Revenues and Factor Demands

- Sectoral absorption in destination n is:

$$y^j_{n,t} = c^j_{n,t} + x^j_{n,t}, \qquad E^j_{n,t} = P^j_{n,t} y^j_{n,t}.$$

- Producer revenues in origin i are:

$$R^j_{i,t} = \sum_n \pi^j_{ni,t} E^j_{n,t}, \qquad j \in \mathcal{T}.$$

- For low-skill services:

$$R^{ls}_{i,t} = E^{ls}_{i,t}.$$

- With Cobb-Douglas production and constant markups:

$$L^j_{i,t} = \frac{1-\alpha}{\mu w_{i,t}} R^j_{i,t}, \qquad K^j_{i,t} = \frac{\alpha}{\mu r_{i,t}} R^j_{i,t}.$$

Appendix – Model: Sectoral Revenues and Factor Demands

- Sectoral absorption and expenditure in destination n are:

$$y^j_{n,t} = c^j_{n,t} + x^j_{n,t}, \qquad E^j_{n,t} = P^j_{n,t} y^j_{n,t}, \qquad j \in \mathcal{J}.$$

- Bilateral expenditure shares allocate tradable-sector demand across origins:

$$R^j_{i,t} = \sum_n \pi^j_{ni,t} E^j_{n,t}, \qquad j \in \mathcal{T}.$$

For non-tradable low-skilled services:

$$R^{ls}_{i,t} = E^{ls}_{i,t}.$$

- With sector-specific Cobb–Douglas shares α_j and constant markup μ, payments to effective labor and capital are fixed shares of revenue:

$$L^j_{i,t} = \frac{1-\alpha_j}{\mu w_{i,t}} R^j_{i,t}, \qquad K^j_{i,t} = \frac{\alpha_j}{\mu r_{i,t}} R^j_{i,t}.$$

- Since $\widetilde{L}^j_{i,t} = s^j_{i,t} L^j_{i,t}$, headcount employment is:

$$L^j_{i,t} = \frac{1-\alpha_j}{\mu s^j_{i,t} w_{i,t}} R^j_{i,t}, \qquad s^j_{i,t} = \begin{cases} s^a_{i,t} \in (0,1], & j = a, \\ 1, & j \neq a. \end{cases}$$

Appendix. Model - Prices

- A variety produced in origin i and sold in destination n has delivered marginal cost:

$$mc^j_{ni,t}(\phi) = \widetilde{\tau}^j_{ni,t} u^j_{i,t}(\phi).$$

- With monopolistic competition:

$$p^j_{ni,t}(\phi) = \mu \widetilde{\tau}^j_{ni,t} u^j_{i,t}(\phi).$$

- Aggregating across origins and varieties gives the tradable-sector price index:

$$P^j_{n,t} = \mu \tilde{\phi}^{-1} \left[\sum_i \left(\widetilde{\tau}^j_{ni,t} \right)^{1-\eta} \left(\frac{\kappa w^{1-\alpha_j}_{i,t} r^{\alpha_j}_{i,t}}{A^j_{i,t}} \right)^{1-\eta} \right]^{\frac{1}{1-\eta}} .$$

where given no fixed or entry costs, every firm is able to operate. Closed form solution for the representative productivity:

$$\tilde{\phi} := \left[\int_{\phi_0}^{\infty} \phi^{\eta-1} g(\phi)\, d\phi \right]^{1/(\eta-1)} = \left[\frac{\theta}{\theta - (\eta - 1)} \right]^{\frac{1}{\eta-1}} \phi_0,$$

Appendix - Model - Trade Shares

- Sectoral composite in each destination is a CES aggregate of the varieties available.
- The same CES structure determines bilateral expenditure shares.
- For tradable sectors, the share of destination n's expenditure on sector j sourced from origin i:

$$\pi^j_{ni,t} = \frac{\left(\tilde{\tau}^j_{ni,t}\right)^{1-\eta} \left(\kappa_j w_{i,t}^{1-\alpha_j} r_{i,t}^{\alpha_j} / A^j_{i,t}\right)^{1-\eta}}{\sum_h \left(\tilde{\tau}^j_{nh,t}\right)^{1-\eta} \left(\kappa_j w_{h,t}^{1-\alpha_j} r_{h,t}^{\alpha_j} / A^j_{h,t}\right)^{1-\eta}}.$$

- Origins (i) gain market share when they have:
  - higher sectoral productivity;
  - lower exporter-side financial costs ($\zeta^j_{i,t}$);
  - lower iceberg trade costs ($\tau^j_{ni,t}$).
- For low-skill services: $\pi^{ls}_{nn,t} = 1$ and $\pi^{ls}_{ni,t} = 0$ for $i \neq n$.

Appendix – Model: Sequential Equilibrium I

Given parameters, initial capital stocks, and exogenous paths, a sequential equilibrium consists of prices, allocations, and bilateral expenditure shares such that:

- Households choose consumption, investment, and capital accumulation. Their intertemporal allocation satisfies the Euler equation with the structural investment wedge $\psi_{n,t}$ and residual wedge $\omega_{n,t}$.
- Sectoral consumption demand is consistent with the non-homothetic CES consumption aggregator.
- The investment-bundle producer minimizes assembly costs and charges average cost.
- Variety producers minimize costs and set constant markups over delivered marginal costs, including trade and export-finance wedges.
- Sectoral prices and bilateral expenditure shares are consistent with CES aggregation. Low-skilled services are non-tradable:

$$\pi^{ls}_{nn,t} = 1, \qquad \pi^{ls}_{ni,t} = 0 \quad \text{for } i \neq n.$$

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Appendix – Model: Sequential Equilibrium II

Sectoral absorption and revenues

$$y^j_{n,t} = c^j_{n,t} + x^j_{n,t}, \qquad E^j_{n,t} = P^j_{n,t} y^j_{n,t},$$

$$R^j_{i,t} = \sum_n \pi^j_{ni,t} E^j_{n,t}, \qquad R^{ls}_{n,t} = E^{ls}_{n,t}.$$

Factor-market clearing

$$\sum_{j \in \mathcal{J}} L^j_{n,t} = L_{n,t}, \qquad \sum_{j \in \mathcal{J}} K^j_{n,t} = K_{n,t},$$

$$\widetilde{L}_{n,t} = s^a_{n,t} L^a_{n,t} + \sum_{j \neq a} L^j_{n,t}.$$

Labor-market clearing is imposed in headcounts, while firms hire labor in efficiency units. Labor and capital are mobile across sectors domestically, but not internationally.

Domestic income, profits, and aggregate absorption

$$Y_{n,t} = \sum_{j \in \mathcal{J}} R^j_{n,t}, \qquad \Pi_{n,t} = Y_{n,t} - w_{n,t} \widetilde{L}_{n,t} - r_{n,t} K_{n,t} = \left(1 - \frac{1}{\mu}\right) Y_{n,t},$$

$$\boxed{P^c_{n,t} C_{n,t} + P^x_{n,t} X_{n,t} = Y_{n,t}.}$$

Note: The investment wedge affects intertemporal incentives but does not absorb resources, because its revenue is rebated lump-sum to households.

Appendix – Estimating Non-Homothetic Final Demand: Equations

- We estimate separate non-homothetic CES systems for:

$$z \in \{c, x\}, \qquad Z_{n,t} = \begin{cases} C_{n,t}, & z = c, \\ X_{n,t}, & z = x. \end{cases}$$

- Sectoral expenditure shares are constructed from OECD and WIOD input–output tables, mapped into the four model sectors. Aggregate consumption and investment expenditures are taken from PWT.
- The expenditure-share equations depend on sectoral prices, the scale of final demand per worker, common elasticities, and country-specific weights.

Taking log ratios relative to manufacturing eliminates the bundle price index. First-differencing then removes the time-invariant relative demand weights:

$$\Delta \log \left(\frac{s_{n,t}^{z,j}}{s_{n,t}^{z,m}} \right) = (1 - \sigma_z) \Delta \log \left(\frac{P_{n,t}^{j}}{P_{n,t}^{m}} \right) + (1 - \sigma_z)(\epsilon_z^j - \epsilon_z^m) \Delta \log \left(\frac{Z_{n,t}}{L_{n,t}} \right) + v_{n,t}^{z,j}, \qquad j \neq m.$$

- For consumption:

$$\sigma_c = \sigma, \qquad \epsilon_c^j = \epsilon^j.$$

  For investment:

$$\sigma_x = \sigma_x, \qquad \epsilon_x^j = \epsilon_x^j.$$

- Identification comes from changes in relative expenditure shares, relative prices, and model-consistent real expenditure per worker.

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Appendix – Estimating Non-Homothetic Final Demand: Fixed Point

- The data contain nominal expenditure per worker, sectoral expenditure shares, sectoral prices, and employment.
- However, the model-consistent real indices

$$\frac{C_{n,t}}{L_{n,t}} \quad \text{and} \quad \frac{X_{n,t}}{L_{n,t}}$$

are not directly observed: their growth rates depend on the elasticities through the non-homothetic aggregators.

Define

$$q^z_{n,t} \equiv \frac{Z_{n,t}}{L_{n,t}}, \qquad e^z_{n,t} \equiv \frac{P^z_{n,t} Z_{n,t}}{L_{n,t}}, \qquad \widehat{Q}_{n,t} \equiv \frac{Q_{n,t}}{Q_{n,t-1}}.$$

Given a parameter guess, the expenditure function implies:

$$\widehat{e}^z_{n,t} = \left[\sum_{j \in \mathcal{J}} s^{z,j}_{n,t-1} \left(\widehat{P}^j_{n,t} \right)^{1-\sigma_z} \left(\widehat{q}^z_{n,t} \right)^{(1-\sigma_z)\epsilon^j_z} \right]^{\frac{1}{1-\sigma_z}}.$$

- Since nominal expenditure growth $\widehat{e}^z_{n,t}$ is observed, this equation recovers the implied real-index growth $\widehat{q}^z_{n,t}$ for every country-year.
- Numerical procedure:
  1. Guess the elasticities.
  2. Recover model-consistent real-index growth.
  3. Update the elasticities using least squares on the relative-share equations.
  4. Iterate until the elasticities and real indices converge jointly.
- The procedure is implemented separately for consumption and investment.

Appendix – Non-Homothetic Final Demand: Estimates and Calibration

- Within each demand system, scale elasticities require a normalization:

$$\epsilon^m = 1 \qquad \text{for consumption,}$$

while investment uses the average-cost normalization

$$\frac{1}{|\mathcal{S}|} \sum_{(n,t)\in\mathcal{S}} \sum_{j\in\mathcal{J}} s_{n,t}^{x,j} \epsilon_x^j = 1.$$

The investment normalization ensures that the sample-average expenditure-share-weighted cost elasticity equals one.

- Estimated common elasticities:

$$\text{Consumption:} \qquad \sigma = 0.80, \qquad (\epsilon^a, \epsilon^m, \epsilon^{ls}, \epsilon^{hs}) = (0.29, 1.00, 1.45, 1.83),$$

$$\text{Investment:} \qquad \sigma_x = 0.76, \qquad (\epsilon_x^a, \epsilon_x^m, \epsilon_x^{ls}, \epsilon_x^{hs}) = (0.24, 0.99, 0.76, 1.48).$$

- The common elasticities govern how expenditure shares respond to changes in scale and relative prices.
- After estimating the elasticities, we calibrate the time-invariant country weights

$$\{\gamma_n^j\}_{j\in\mathcal{J}} \qquad \text{and} \qquad \{\omega_{n,j}^x\}_{j\in\mathcal{J}}$$

to match each country's initial consumption and investment shares.

- These weights remain fixed in the baseline and counterfactual exercises. They preserve the strong manufacturing intensity of investment demand: manufacturing accounts for 82.5% of initial investment expenditure on average and receives the largest investment weight in every model economy.

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Appendix - Recovering sectoral productivity

Identification. Domestic sales are not affected by international trade costs or by the export-finance wedge. Therefore, conditional on domestic factor costs and sectoral prices, the domestic expenditure share identifies sectoral productivity.

$$\pi^j_{ii,t} \equiv \frac{R^j_{ii,t}}{E^j_{i,t}} = \left[\frac{\mu\kappa_j \left(w^{\mathrm{data}}_{i,t}\right)^{1-\alpha_j} \left(r^{\mathrm{data}}_{i,t}\right)^{\alpha_j}}{A^j_{i,t}\widetilde{\phi}P^j_{i,t}} \right]^{1-\eta},$$

$$A^j_{i,t} = \frac{\mu\kappa_j \left(w^{\mathrm{data}}_{i,t}\right)^{1-\alpha_j} \left(r^{\mathrm{data}}_{i,t}\right)^{\alpha_j}}{P^j_{i,t}\widetilde{\phi}} \left(\frac{1}{\pi^j_{ii,t}}\right)^{\frac{1}{1-\eta}}.$$

For tradable sectors, $\pi^j_{ii,t}$ is obtained from the bilateral trade-share matrices. For low-skilled services, $\pi^{ls}_{ii,t} = 1$.

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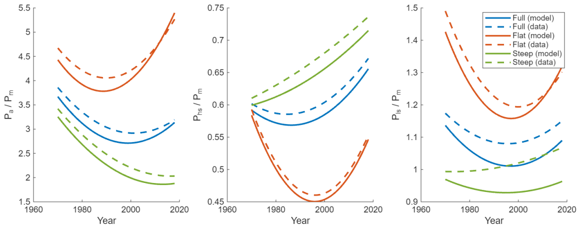
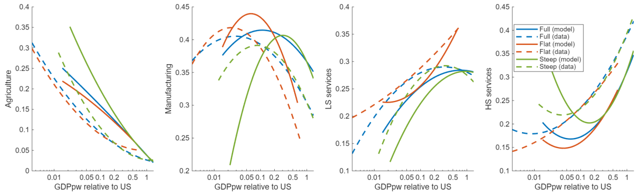
Appendix - Model Fit



Relative sectoral prices: model and data



Sectoral consumption shares: model and data

Appendix – Alternative Financial-Development Measures and Paths

Peak-gap results

Exercise	Net peak gain (p.p.)	Share of the 11.26 p.p. gap
Benchmark: halfway to the financial frontier	3.19	28.3%
Alternative measure: private credit to GDP	4.60	40.8%
Alternative path: Korea	3.79	33.7%
Alternative path: average steep economy	3.26	28.9%

- The benchmark result is not specific to the IMF Financial Institutions Index.
- Using private credit to GDP as the financial-development measure **strengthens** the quantitative result.
- Historical financial paths for Korea and for the average steep-manufacturing economy generate effects of a similar magnitude.

Notes: The net peak gain is the average country-level increase in the manufacturing-employment peak for flat-manufacturing economies minus the corresponding average increase for steep-manufacturing economies. The private-credit-to-GDP exercise uses the alternative calibration and reports gains relative to its corresponding baseline.