

Dynamic Effects of Industrial Policies Amidst Geoeconomic Tensions

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The views expressed here do not necessarily reflect the position of Bank of Lithuania or Eurosystem

Motivating Facts

US-China Trade War



US bars 'advanced tech' firms from building China factories for 10 years

🕒 7 September



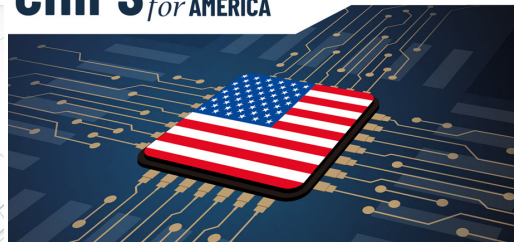
| US Commerce Secretary speaks at White House briefing

Motivating Facts

Subsidies



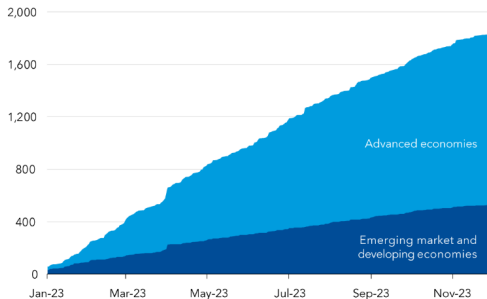
CHIPS *for* AMERICA





Mario Draghi: An Industrial Strategy For Europe

Number of industrial policy measures implemented in 2023



Source: Evenett and others (2024); IMF staff calculations.

Note: Cumulative number of industrial policy measures starting from January 1, 2023. It is possible that the gap between AEs and EMDEs in resort to subsidy interventions will narrow over time as reports from the latter tend to be published with a lag.

IMF

- **Question:** What are the **dynamic** and **distributional** effects of these industrial policies? How does the short-sightedness of policymakers influence their choice of instrument?
- **What We Do:** Build a North-South international trade & macro framework
 - Trade-in-task (Grossman and Rossi-Hansberg, 2008) → Offshoring (Zlate, 2016)
 - Import tariff, offshoring friction, production subsidy, entry subsidy (Juhasz et al., 2023)
- **What We Find:**
 - ⇒ Being short-sightedness influence policymakers' choice of instrument
 - Myopic: production subsidy; Forward-looking: import tariffs
 - Trade-off: more consumption now vs. more varieties in the future
 - ⇒ All instruments reduce wage inequality
 - Strongest: production subsidy, offshoring friction
 - Caveat: inequality vs. aggregate welfare tradeoff (offshoring friction)

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- Production requires two tasks (h, l):

$$y_t(z) = \left[\underbrace{y_{h,t}(z)}_{\text{high-skilled}} \right]^{\alpha} \left[\underbrace{y_{l,t}(z)}_{\text{low-skilled}} \right]^{1-\alpha}$$

- If both tasks are produced **domestically**:

$$y_{h,t}(z) = z Z_t h_t(z), \quad y_{l,t}(z) = \underbrace{z}_{\text{Firm-level TFP}} \underbrace{Z_t}_{\text{North TFP}} \underbrace{l_t(z)}_{\text{North low-skill labor}}$$

- If a firm decides to **offshore low-skilled tasks to the South**:

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- Firm dynamics
 - Entry and exit decision (Ghironi and Melitz, 2005)
 - Sunk entry cost to draw productivity from Pareto distribution
 - After entry, firm starts to produce next period
 - Death shock
 - Endogenous trade and offshoring (Zlate, 2016)
 - Fixed cost of export
 - Fixed cost of offshoring
- Upon entry, a firm can serve domestically (D), export (X), or offshore (V)

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- Representative household maximize expected lifetime utility

$$\mathbb{E}_t \sum_{s=t}^{\infty} \beta^{s-t} \frac{C_s^{1-\gamma}}{1-\gamma}$$

with CRRA parameter γ .

- Consumption basket for the Northern household includes:

$$C_t = \left[\underbrace{\int_{z_{\min}}^{z_{V,t}} y_{D,t}(\omega)^{\frac{\theta-1}{\theta}} d\omega}_{\text{Domestic}} + \underbrace{\int_{z_{V,t}}^{\infty} y_{V,t}(\omega)^{\frac{\theta-1}{\theta}} d\omega}_{\text{Offshoring}} + \underbrace{\int_{z_{X,t}^*}^{\infty} y_{X,t}^*(\omega)^{\frac{\theta-1}{\theta}} d\omega}_{\text{Foreign Export}} \right]^{\frac{\theta}{\theta-1}}$$

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- Budget constraint

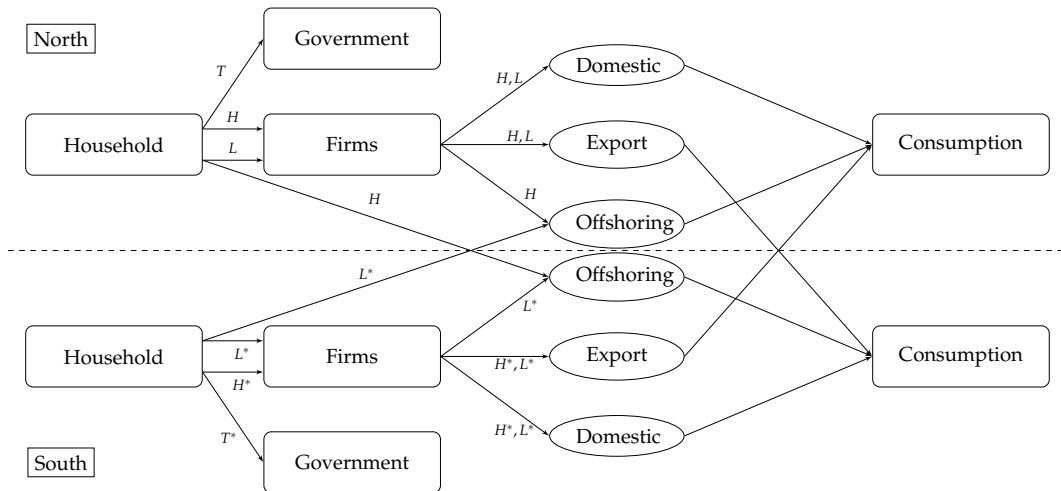
$$\begin{aligned}
 & \underbrace{\widehat{C}_t}_{\text{Consumption}} + \underbrace{\left(\underbrace{N_t + N_{E,t}}_{\text{Incumbent \& entrant mass}} \underbrace{\tilde{v}_t}_{\text{Exp. value}} \underbrace{x_{t+1}}_{\text{\# shares}} \right)}_{\text{Savings in firm mutual fund}} + \underbrace{\widehat{B}_{t+1}}_{\text{Savings domestic bonds}} \\
 &= \underbrace{(\tilde{v}_t + \underbrace{\tilde{d}_t}_{\text{Dividends}}) N_t x_t}_{\text{Payout firm mutual fund}} + \underbrace{(1 + r_t) B_t}_{\text{Payout domestic bonds}} \\
 &+ \underbrace{w_{h,t} H}_{\text{High skilled earnings}} + \underbrace{w_{l,t} L}_{\text{Low skilled earnings}} + \underbrace{T_t}_{\text{Government transfers}}
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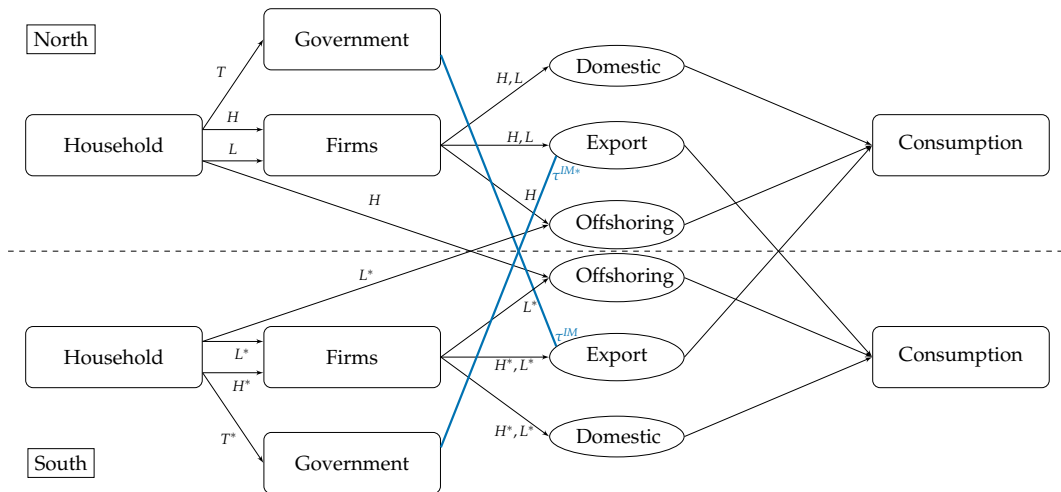
Model Setup

No Industrial Policies



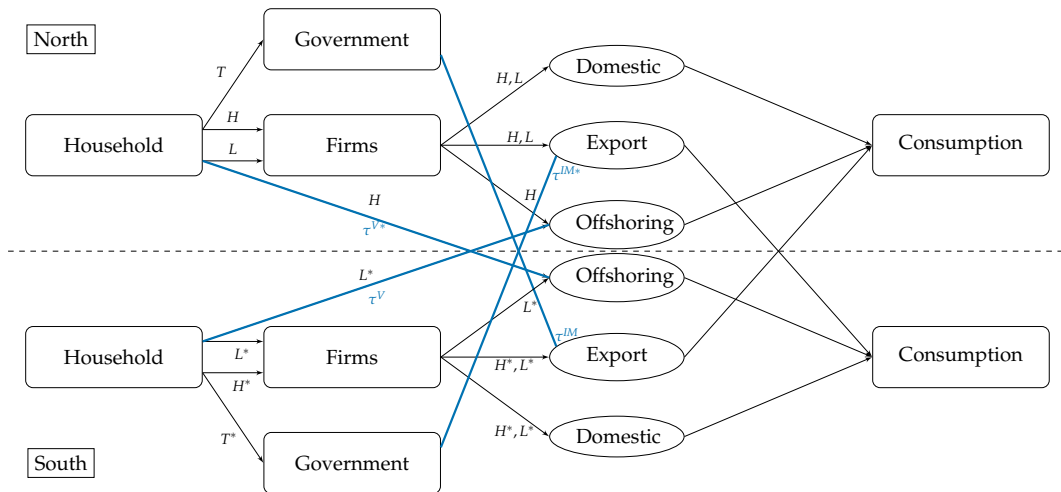
Model Setup

+ Tariffs (τ^{IM})



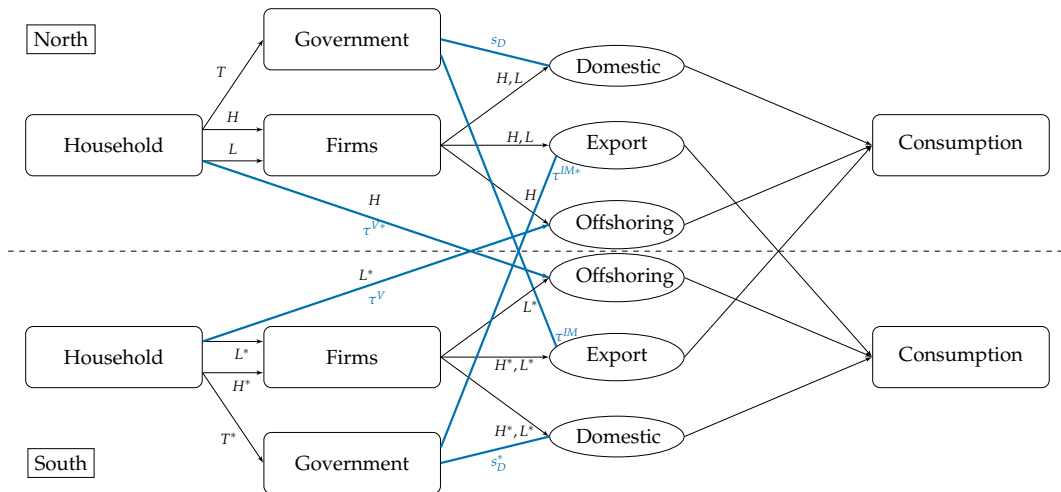
Model Setup

+ Tariffs (τ^{IM}) + Offshoring Frictions (τ^V)



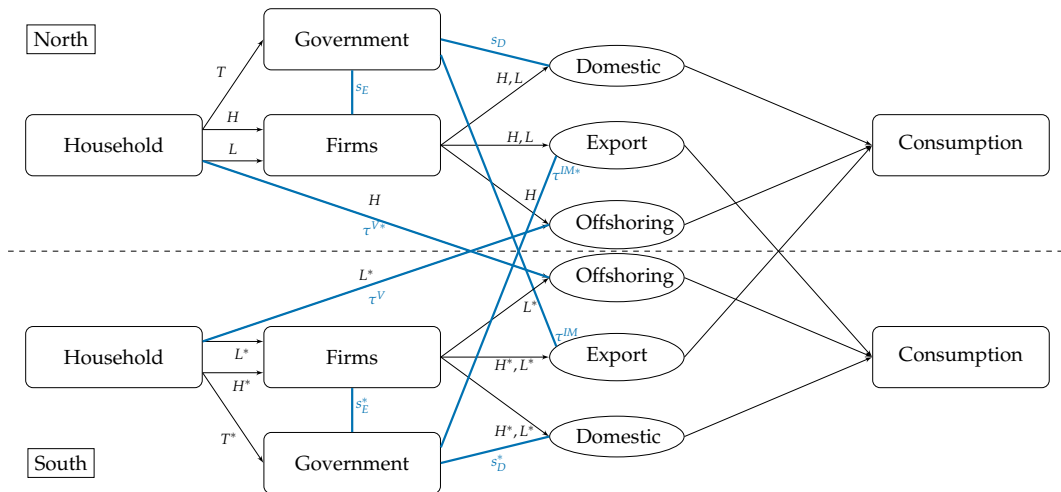
Model Setup

+ Tariffs (τ^{IM}) + Offshoring Frictions (τ^V) + Domestic Production Subsidy (s_D)



Model Setup

+ Tariffs (τ^{IM}) + Offshoring Frictions (τ^V) + Domestic Production Subsidy (s_D) + Entry Subsidy (s_E)

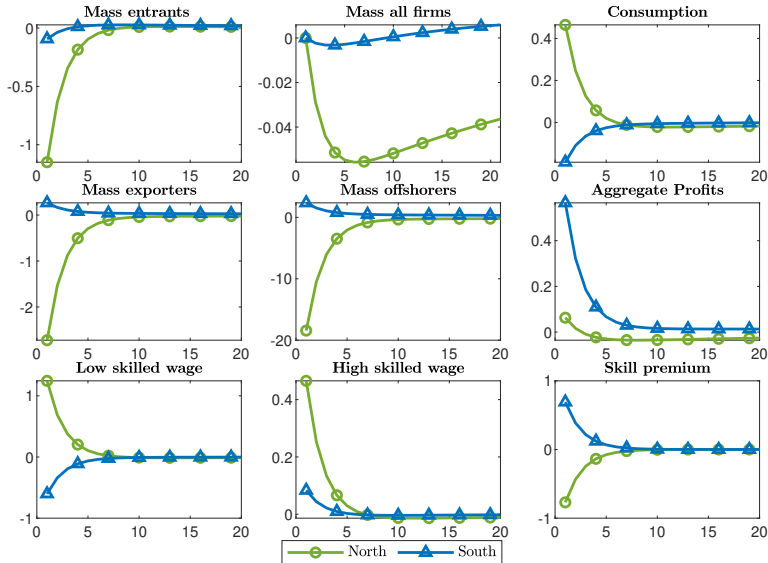


- Dynamics
 - Impulse responses to 1% individual industrial policy shocks
 - Focusing on production subsidy and tariff
- Welfare in consumption equivalents
 - Bilateral policy wars
 - Different time horizons: 1 year, 4 years, full transition path

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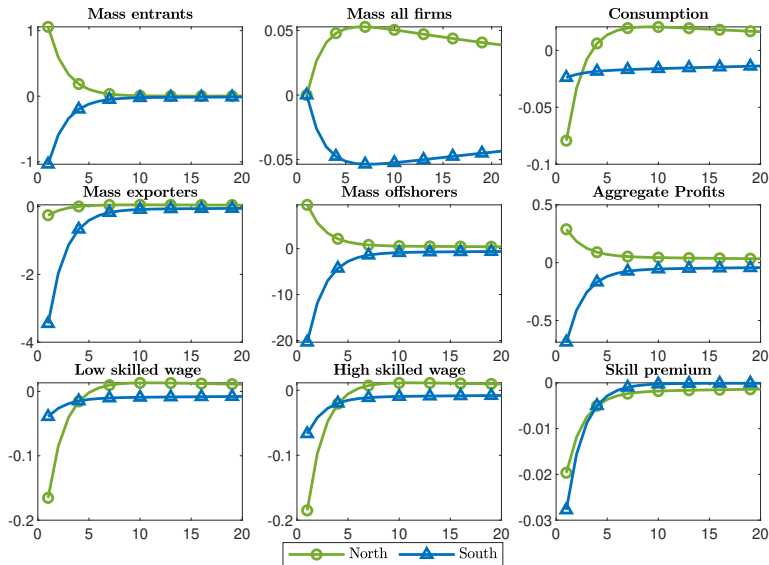
Dynamics

1% Production Subsidy Shock from North



Dynamics

1% Tariff Shock from North



One year horizon ($T = 4$)

		South		
North		—	τ^{IM*}	s_D^*
	—	(0.00, 0.00)	(-0.02, -0.06)	(-0.06, 0.23)
	τ^{IM}	(-0.03, -0.02)	(-0.05, -0.08)	(-0.09, 0.21)
	s_D	(0.23, -0.10)	(0.20, -0.16)	(0.17, 0.13)

Four year horizon ($T = 16$)

		South		
North		—	τ^{IM*}	s_D^*
	—	(0.00, 0.00)	(-0.02, 0.01)	(-0.02, 0.05)
	τ^{IM}	(0.01, -0.02)	(-0.01, -0.01)	(-0.01, -0.03)
	s_D	(0.05, -0.03)	(0.03, -0.03)	(0.03, 0.01)

Infinite horizon ($T \rightarrow \infty$)

		South		
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- **What Did We Do?**

- DSGE model with firm heterogeneity, trade-in-task, endogenous export and offshoring

- **What Did We Learn?**

- Love of variety + sluggish adjust of firms
 - ⇒ Industrial policy debate needs to take into account **producer dynamics**
- Temporary improvement in income inequality
 - ⇒ **Short-term gains** may appear beneficial, they may not offset **long-term losses**

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 - Temporary improvement in income inequality
 - ⇒ **Short-term gains** may appear beneficial, they may not offset **long-term losses**
- Thank You!

- **What Did We Do?**

- DSGE model with firm heterogeneity, trade-in-task, endogenous export and offshoring

- **What Did We Learn?**

- Love of variety + sluggish adjust of firms

- ⇒ Industrial policy debate needs to take into account **producer dynamics**

- Temporary improvement in income inequality

- ⇒ **Short-term gains** may appear beneficial, they may not offset **long-term losses**

- **Thank You!**

Appendix

- Equilibrium is defined such that
 - All agents are optimising,
 - All markets are clearing,
 - Free entry condition holds, [Show](#)
 - Government budget constraint holds, [Show](#)
 - Balance of payments condition holds. [Show](#)

- Revenues equal subsidies plus transfers to households

$$\begin{aligned}
 & \overbrace{\tau^{IM} N_{X,t}^* \tilde{\rho}_{X,t}^* [(1 + \tau^{IM}) \tilde{\rho}_{X,t}^*]^{-\theta} C_t}^{\text{Tariffs on final good imports}} \\
 &= \overbrace{s_E N_{E,t} \frac{f_E}{Z_t} \left(\frac{w_{l,t}}{1 - \alpha} \right)^{1-\alpha} \left(\frac{w_{h,t}}{\alpha} \right)^\alpha}^{\text{Subsidies on entry}} \\
 &+ \overbrace{s_D N_{D,t} \tilde{\rho}_{D,t}^{-\theta} C_t \frac{1}{Z_t \tilde{z}_D} \left(\frac{w_{l,t}}{1 - \alpha} \right)^{1-\alpha} \left(\frac{w_{h,t}}{\alpha} \right)^\alpha}^{\text{Subsidies on production}} + \overbrace{T_t}^{\text{Transfers}} .
 \end{aligned}$$

Equilibrium definition

- Trade balance defined as

$$\begin{aligned}
 TB_t \equiv & \underbrace{N_{X,t} \tilde{\rho}_{X,t} \left((1 + \tau^{IM*}) \tilde{\rho}_{X,t} \right)^{-\theta} C_t^* Q_t}_{\text{Regular exports}} + \underbrace{\tau^{V*} N_{V,t}^* w_{h,t} \tilde{h}_{V,t}^*}_{\text{Offshoring exports}} \\
 & - \underbrace{\tau^V N_{V,t} w_{l,t}^* \tilde{l}_{V,t} Q_t}_{\text{Offshoring imports}} - \underbrace{N_{X,t}^* \tilde{\rho}_{X,t}^* \left((1 + \tau^{IM}) \tilde{\rho}_{X,t}^* \right)^{-\theta} C_t}_{\text{Regular imports}}.
 \end{aligned}$$

- Aggregate net fixed offshoring costs

$$FC_t = N_{V,t} f_V \frac{Q_t}{Z_t^*} \left(\frac{w_{l,t}^*}{1-\alpha} \right)^{1-\alpha} \left(\frac{w_{h,t}^*}{\alpha} \right)^{\alpha} \\ - N_{V,t}^* f_V^* \frac{1}{Z_t} \left(\frac{w_{l,t}}{1-\alpha} \right)^{1-\alpha} \left(\frac{w_{h,t}}{\alpha} \right)^{\alpha}.$$

- Balance of payments

$$FC_t = TB_t$$

Equilibrium definition

$$\max_{\rho_{D,t}(z)} d_{D,t}(z) = \rho_{D,t}(z)y_{D,t}(z) - \underbrace{\frac{1-s_D}{Z_t z} \left(\frac{w_{l,t}}{1-\alpha} \right)^{1-\alpha} \left(\frac{w_{h,t}}{\alpha} \right)^\alpha}_{\equiv mc_{D,t}(z)} y_{D,t}(z)$$

$$\max_{\rho_{V,t}(z)} d_{V,t}(z) = \rho_{V,t}(z)y_{V,t}(z) - \underbrace{\frac{1}{z} \left(\frac{\tau^V Q_t w_{l,t}^*}{Z_t^* (1-\alpha)} \right)^{1-\alpha} \left(\frac{w_{h,t}}{Z_t \alpha} \right)^\alpha}_{\equiv mc_{V,t}(z)} y_{V,t}(z)$$

$$- \underbrace{f_V \frac{Q_t}{Z_t^*} \left(\frac{w_{l,t}^*}{1-\alpha} \right)^{1-\alpha} \left(\frac{w_{h,t}^*}{\alpha} \right)^\alpha}_{\text{Fixed cost of offshoring}}$$

$$\max_{\rho_{X,t}(z)} d_{X,t}(z) = Q_t \rho_{X,t}(z)y_{X,t}(z) - \underbrace{\frac{\tau Q_t^{-1}}{z Z_t} \left(\frac{w_{l,t}}{1-\alpha} \right)^{1-\alpha} \left(\frac{w_{h,t}}{\alpha} \right)^\alpha}_{\equiv mc_{X,t}(z)} y_{X,t}(z)$$

$$- \underbrace{\frac{f_X}{Z_t} \left(\frac{w_{l,t}}{1-\alpha} \right)^{1-\alpha} \left(\frac{w_{h,t}}{\alpha} \right)^\alpha}_{\text{Fixed cost of export}}$$

- Expected entry value equals post-subsidy sunk cost

$$\underbrace{\tilde{v}_t}_{\text{Exp. entry value}} = \underbrace{(1 - s_E)}_{\text{Subsidy to entry}} \underbrace{f_E}_{\text{Sunk cost}} \underbrace{\frac{1}{Z_t} \left(\frac{w_{l,t}}{1 - \alpha} \right)^{1-\alpha} \left(\frac{w_{h,t}}{\alpha} \right)^\alpha}_{\text{Effective cost of labour}}$$

Equilibrium definition

Parameter	Meaning	Value	Source/target
β	discount factor	0.9900	average interest rate
γ	(inverse) intertemporal elasticity	2.0000	(Ghironi and Melitz, 2005)
θ	elasticity of substitution between varieties	3.8000	(Ghironi and Melitz, 2005)
k	shape parameter of productivity distribution	3.4000	(Ghironi and Melitz, 2005)
τ	melting-iceberg trade cost	1.3000	(Ghironi and Melitz, 2005)
z_{min}	lower bound of productivity	1.0000	normalization
δ	exogenous firm exit shock	0.0250	firm exit rate
α	skill intensity in production	0.4000	wage share of high-skilled
Z	steady state aggregate productivity	1.0000	normalization
ζ	persistence of policy process	0.5600	(Barattieri, Cacciatore, and Ghironi, 2021)
H	endowment of high-skilled labor in North	0.2220	US production workers to managers ratio
L	endowment of low-skilled labor in North	0.7780	US production workers to managers ratio
H^*	endowment of high-skilled labor in South	0.0955	China production workers to managers ratio
L^*	endowment of low-skilled labor in South	0.9045	China production workers to managers ratio
f_V	fixed cost of offshoring in North	0.1910	fraction of offshoring firms
f_X	fixed cost of exporting in North	0.2500	fraction of exporting firms
f_V^*	fixed cost of offshoring in South	0.0400	fraction of offshoring firms
f_X^*	fixed cost of exporting in South	0.2500	fraction of exporting firms
f_E	sunk entry cost	14.522	normalization of high-skilled wage N
τ^{IM}	import tariff	0.0000	no steady state intervention
τ^V	iceberg friction on offshoring	1.0000	no steady state intervention
s_E	entry subsidy	0.0000	no steady state intervention
s_D	domestic production subsidy	0.0000	no steady state intervention

		One year horizon ($T = 4$)				
		South				
		τ^{IM*}	τ^{V*}	s_D^*	s_E^*	
North	—	(0.0000, 0.0000)	(-0.0237, -0.0565)	(-0.0145, 0.0176)	(-0.0576, 0.2276)	(-0.0005, -0.2195)
	τ^{IM}	(-0.0290, -0.0207)	(-0.0527, -0.0773)	(-0.0435, -0.0031)	(-0.0866, 0.2068)	(-0.0295, -0.2402)
	τ^V	(0.0046, -0.0478)	(-0.0191, -0.1044)	(-0.0099, -0.0302)	(-0.0530, 0.1798)	(0.0041, -0.2674)
	s_D	(0.2250, -0.1015)	(0.2013, -0.1580)	(0.2105, -0.0838)	(0.1675, 0.1263)	(0.2244, -0.3211)
	s_E	(-0.2201, 0.0017)	(-0.2438, -0.0548)	(-0.2346, 0.0194)	(-0.2778, 0.2293)	(-0.2206, -0.2177)
		Four year horizon ($T = 16$)				
		South				
		τ^{IM*}	τ^{V*}	s_D^*	s_E^*	
North	—	(0.0000, 0.0000)	(-0.0168, 0.0077)	(-0.0009, -0.0064)	(-0.0172, 0.0464)	(-0.0006, -0.0344)
	τ^{IM}	(0.0062, -0.0173)	(-0.0106, -0.0096)	(0.0053, -0.0237)	(-0.0110, 0.0291)	(0.0056, -0.0517)
	τ^V	(-0.0102, -0.0097)	(-0.0270, -0.0020)	(-0.0111, -0.0160)	(-0.0274, 0.0368)	(-0.0108, -0.0442)
	s_D	(0.0489, -0.0330)	(0.0322, -0.0254)	(0.0480, -0.0394)	(0.0318, 0.0135)	(0.0483, -0.0676)
	s_E	(-0.0366, 0.0019)	(-0.0534, 0.0095)	(-0.0376, -0.0045)	(-0.0539, 0.0482)	(-0.0372, -0.0326)
		Infinite horizon ($T \rightarrow \infty$)				
		South				
		τ^{IM*}	τ^{V*}	s_D^*	s_E^*	
North	—	(0.0000, 0.0000)	(-0.0067, 0.0086)	(0.0015, -0.0044)	(-0.0012, 0.0015)	(-0.0024, 0.0030)
	τ^{IM}	(0.0054, -0.0070)	(-0.0013, 0.0016)	(0.0070, -0.0113)	(0.0043, -0.0055)	(0.0031, -0.0040)
	τ^V	(-0.0047, 0.0008)	(-0.0115, 0.0094)	(-0.0032, -0.0035)	(-0.0059, 0.0023)	(-0.0071, 0.0038)
	s_D	(0.0033, -0.0042)	(-0.0035, 0.0044)	(0.0048, -0.0086)	(0.0021, -0.0027)	(0.0009, -0.0012)
	s_E	(0.0015, -0.0020)	(-0.0052, 0.0066)	(0.0030, -0.0064)	(0.0003, -0.0005)	(-0.0008, 0.0010)