Global Imbalances, Trade, and Sovereign Risk

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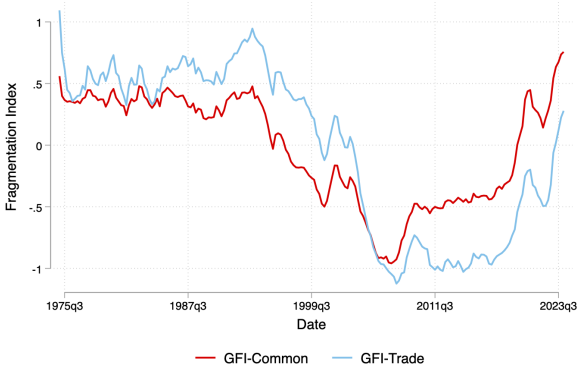
Motivation

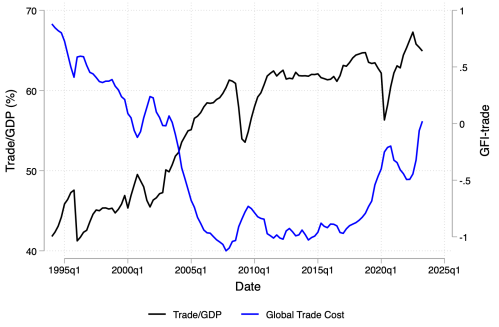
- Resurgence of global protectionist policies:
  - 2018 US–China trade war escalated into global increase in trade barriers
  - Recent US global tariff rollout
- How do global trade shocks affect countries (differentially) under
  - Incomplete international financial markets,
  - Unbalanced trade?
- Common and differential impacts on output, sovereign spreads, trade imbalances

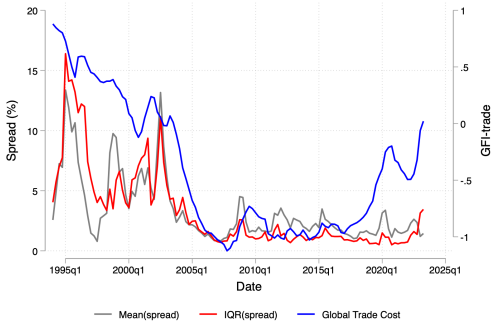
Geopolitical Fragmentation Index



- Trade cost proxied with quarterly *Geopolitical Fragmentation Trade Index* (GFI-trade)
  - Fernandez-Villaverde et al. (2024): dynamic hierarchical factor model
  - 88 countries data $\rightarrow$ 16 global variables, 4 categories

Global Trade Costs and Spreads





- Lower trade costs associated with greater gross trade, lower & less dispersed spreads

Our Model

- **World GE model:** global trade + sovereign default
  - Rep. advanced economy (AE) and a continuum of emerging markets (SOE)
  - Gross trade flows: all import final goods from all, use as intermediates
  - Global and idiosyncratic iceberg trade cost
  - Sovereign default setting for SOEs: incomplete markets, default, haircuts

Our Model

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- **Mechanism**: Global trade cost shock ↑
  - Intermediate goods ↓ ⇒ output ↓ ⇒ sovereign default risk ↑ (**same across countries**)
  - High-debt countries need to save: imports fall more than export
    ⇒ Larger output drop, larger depreciation
    ⇒ Disincentivize debt repayment
    ⇒ Sovereign default risk ↑ more (**heterogeneous across countries**)

A Model of Gross Trade Flows and Default

Model

- World general equilibrium model:
  - Measure ξ continuum of small open economies (SOE), discount factor β
  - One stand-in advanced economy (AE), discount factor $\beta_{AE} > \beta$
- Countries
  - Produce using labor and a composite intermediate good
  - Import intermediates from all countries, export final goods
  - Iceberg trade costs
- Imperfect international financial markets
  - Centralized borrowing and default decision
  - Sovereign default $\Rightarrow$ haircut + productivity loss (no market exclusion)
- Shocks: Idiosyncratic productivity z_{it}, trade cost (global τ_t and idiosyncratic ϵ_{it})

Individual Country: Production

- Each country i produces a tradable differentiated good with labor, domestic intermediate H, and imported intermediate M

$$Q_{it} = z_{it} L_{it}^{\alpha} G_{it}^{\theta},$$

where

$$G_{it} = \left((1-\omega_s) H_{it}^{\frac{\gamma-1}{\gamma}} + \omega_s M_{it}^{\frac{\gamma-1}{\gamma}} \right)^{\frac{\gamma}{\gamma-1}}$$

- Firms take prices as given and solve

$$\max_{L_{it}, H_{it}, M_{it}} \left\{ p_{it} Q_{it} - w_{it} L_{it} - p_{it} H_{it} - p_t^M \tau_t \epsilon_{it} M_{it} \right\},$$

Individual Country: Households

- A representative household's optimization problem

$$\max_{\{C_{it},L_{it}\}} \mathbb{E}\sum_{t=0}^{\infty}\beta^t \frac{\left(C_{it}-\chi\frac{L_{it}^{1+1/\nu}}{1+1/\nu}\right)^{1-\sigma}}{1-\sigma}$$

$$\text{s.t.} \quad p_{it}C_{it} = w_{it}L_{it} + T_{it} + \pi_{it},$$

  - T_{it}: lump sum tax or transfer from government
  - π_{it}: profits of the representative firm

- Optimal GHH labor supply: $\chi L_{it}^{1/\nu} = \frac{w_{it}}{p_{it}}$

Individual Country (SOE): Sovereign

- Country i issued claims to b_{it+1} units of long-term defaultable bonds
  - Sequence of payments starting from $t+1$: κ, $\kappa(1-\delta)$, $\kappa(1-\delta)^2$, ...
  - δ: controls bond duration

- The sovereign decides whether to default and future bond position b_{it+1}
  - Default ($d_{it}=1$) $\Rightarrow$ *immediate* debt reduction, $b_{it} \to \phi b_{it}$, with $\phi < 1$
  - Cost: utility cost (ψ) + productivity loss ($\tilde{z}_{it} = h(z_{it}, d_{it}) \leq z_{it}$)

- Budget constraint

$$T_{it} = -\kappa \phi^{d_{it}} b_{it} + q_t(z_{it}, b_{it+1}) \left[b_{it+1} - (1-\delta)\phi^{d_{it}} b_{it} \right]$$

Advanced Economy

- Identical production structure as SOEs
- No idiosyncratic shocks
- No default, bond economy
- Later, AE import tariffs and/or export taxes

Global Intermediate Producer

- Competitive global intermediaries assemble goods from all countries:

$$Y_t = \left(X_{\text{AE},t}^{\frac{\eta-1}{\eta}} + \xi \int_0^1 X_{it}^{\frac{\eta-1}{\eta}} di \right)^{\frac{\eta}{\eta-1}}$$

- Optimization

$$\max_{X_{\text{AE},t},\{X_{it}\}} p_t^M Y_t - \xi \tau_t \int_0^1 p_{it} \epsilon_{it} X_{it} di - \underbrace{p_{\text{AE},t}}_{\to 1} \tau_t X_{\text{AE},t}$$

$\Rightarrow$ demand function and price index for global intermediate

$$X_{\text{AE},t} = \left(\frac{\tau_t}{p_t^M} \right)^{-\frac{1}{\eta}} Y_t, \qquad X_{it} = \left(\frac{\tau_t \epsilon_{it} p_{it}}{p_t^M} \right)^{-\frac{1}{\eta}} Y_t, \qquad p_t^M = \tau_t \left(1 + \xi \int_0^1 (\epsilon_{it} p_{it})^{1-\eta} di \right)^{\frac{1}{1-\eta}}$$

Static Private Trade Equilibrium

Given the trade cost τ_t and distribution $\Omega_t(z_{it}, \epsilon_{it}, T_{it})$, the static-private equilibrium allocations $\{C_{it}, L_{it}, Q_{it}, X_{it}, M_{it}\}$, prices $\{w_{it}, p_{it}, p_t^M\}$ satisfy the following

- Firms' optimization, for each i and AE
- Households optimizes, for each i
- Global intermediate producers optimize
- Goods market clearing and balance of payment, for each i

$$Q_{it} = C_{it} + H_{it} + \tau_t \epsilon_{it} X_{it}, \qquad T_{it} + \underbrace{p_{it}\tau_t \epsilon_{it} X_{it}}_{\text{Exports}} = \underbrace{p_t^M \tau_t \epsilon_{it} M_{it}}_{\text{Imports}}$$

- Global intermediate goods clearing, $Y_t = \tau_t \left(M_{\text{AE},t} + \xi \int_0^1 \epsilon_{it} M_{it} di \right)$

Dynamic World Equilibrium: AE

- AE: trades assets internationally, full commitment
- Euler equation

$$u_{\mathrm{AE},t} q_t^{\mathrm{rf}} = \beta_{\mathrm{AE}} u_{\mathrm{AE},t+1} \left(\kappa + (1-\delta) q_{t+1}^{\mathrm{rf}} \right)$$

- Define short-term risk-free rate

$$R_t = \frac{1}{\beta_{\mathrm{AE}}} \frac{u_{\mathrm{AE},t}}{u_{\mathrm{AE},t+1}}$$

Dynamic World Equilibrium: SOE

Given aggregate state variable $S_t = (\tau_t,\ \Omega_t(z_{it}, \epsilon_{it}, b_{it}))$, government i solves

- Default decision

$$V_{it}(z_{it}, \epsilon_{it}, b_{it}|S_t) = \max_{d_{it}\in\{0,1\}} \{d_{it}\left[W_{it}(\tilde{z}_{it}, \epsilon_{it}, \phi b_{it}|S_t) - \psi\right] + (1-d_{it})W_{it}(z_{it}, \epsilon_{it}, b_{it}|S_t)\}$$

- New debt issuance

$$W_{it}(z_{it}, \epsilon_{it}, b_{it}|S_t) = \max_{b_{it+1}} \{u(C_{it}, L_{it}) + \beta \mathbb{E}_t V(z_{it+1}, \epsilon_{it+1}, b_{it+1}|S_{t+1})\}$$

$$\text{s.t. } T_{it} = -\kappa b_{it} + q_t(z_{it}, b_{it+1})\left[b_{it+1} - (1-\delta)b_{it}\right],$$

$$C_{it} = \mathcal{C}_{it}(z_{it}, \epsilon_{it}, T_{it}, S_t), \quad L_{it} = \mathcal{L}_{it}(z_{it}, \epsilon_{it}, T_{it}, S_t),$$

$$\Omega_{t+1} = H_\Omega(S_t)$$

Bond Pricing and Market Clearing

- Intl' lenders: risk neutral and competitive, fully committed
  - $b_{it+1} \leq 0$: Country i holds long-term bonds issued by international lenders
  - $b_{it+1} > 0$: Lenders hold long-term risky bonds issued by country i
- Equilibrium bond prices:

$$q_{it} = \begin{cases} q_t^{\text{rf}}, & \text{if } b_{it+1} \leq 0 \\ \frac{1}{R_t} \mathbb{E}_t \left[\phi^{d_{it+1}} \left(\kappa + (1-\delta) q_{it+1} \right) \right], & \text{otherwise} \end{cases}$$

with $q_t^{\text{rf}} = \frac{1}{R_t} \left(\kappa + (1-\delta) q_{t+1}^{\text{rf}} \right)$

- Bonds market clearing: $q_t^{\text{rf}} b_{\text{AE},t} + \xi \int q_t(z_{it}, \epsilon_{it}, b_{it+1}) b_{it+1} d\Omega_t = 0.$

Static Private Equilibrium

Given $\{\tau, Y, p^M\}$, (z, T) for each SOE, $\{C, L, H, M, X, Q, p\}$ solve

$$X = \left(\frac{\tau p}{p^M}\right)^{-\eta} Y \qquad \text{(export demand)}$$

$$\alpha Q/L = \chi L^{1/\nu} \qquad \text{(labor market)}$$

$$\tau p^M/p = \theta(1-\omega) Q G^{\frac{1}{\gamma}-1} M^{-\frac{1}{\gamma}} \qquad (M \text{ demand})$$

$$1 = \theta\omega Q G^{\frac{1}{\gamma}-1} H^{-\frac{1}{\gamma}} \qquad (H \text{ demand})$$

$$Q = z L^{\alpha} G(H, M)^{\theta} \qquad \text{(gross output)}$$

$$C = Q - H - \tau X \qquad \text{(domestic resources)}$$

$$T + \tau p X = \tau p^M M \qquad \text{(balance of payment)}$$

Similarly for AE conditions, but without BoP and $p_{AE} = 1$

Global intermediate goods clearing $Y = \tau \left(M_{\text{AE}} + \xi \int M(z, T) d\Omega(z, T)\right)$

Mechanism: Effects of Trade Cost Shocks

Following a global trade cost shock $\tau \uparrow$,

1. Output Q, export, import $\downarrow$ for all countries (z, T)

Mechanism: Effects of Trade Cost Shocks

Following a global trade cost shock $\tau \uparrow$,

1. Output Q, export, import $\downarrow$ for all countries (z, T)
2. Under balanced trade, all countries (SOE & AE) have same $\%\triangle Q$
   - Independent of country size

Mechanism: Effects of Trade Cost Shocks

Following a global trade cost shock $\tau \uparrow$,

1 Output Q, export, import $\downarrow$ for all countries (z, T)

3 Under dispersed trade balances,
Larger incentives to save due to high debt ($T < 0$)
$\Rightarrow Q \downarrow$ more, $p \downarrow$ (depreciate) more

$$\underbrace{-T/p}_{\text{saver}>0} = \tau X - \tau p^M M/p \approx \tau X - (1-\theta)Q$$

- Imports (thus Q) $\downarrow\downarrow$, X falls by less (thus $p \downarrow\downarrow$)
- Fall in p further increases real trade surplus $\Rightarrow$ greater reduction in Q
- Disincentivize gov't from repaying debt $\rightarrow$ high spread

Full Model with Dynamic General Equilibrium

- Gov't alters borrowing following the τ shock
- Endogenous borrowing and default decision
- Global bonds and goods markets clear

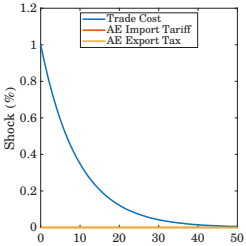
Full Model

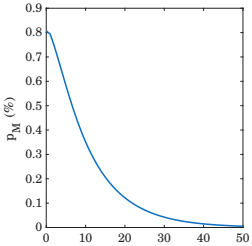
- Parameterize using trade and sovereign spreads moments
  - At the invariant distribution, $R = 1/\beta_{AE}$
  - Data AE: USA + Germany + Japan + China
  - Data SOE: 35 countries, OECD small + emerging markets
- One-time "MIT" transitory shock to global trade cost τ: $1 \to 1.01$ in period 0
- Differential effect after global trade cost shock
  - Which country's spreads increase by more?

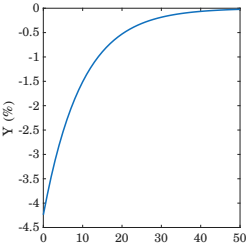
	Value	Internal	Source or Target
Production and Trade			
ζ	56.7	×	AE share of World GDP
z_{AE}	32.8		Normalization of Q_{AE}
z_{SOE}	2.7	×	Relative GDP size of average SOE to AE
ω_{AE}	0.31	×	Import share AE
ω	0.16	×	Import share SOE
α	0.4		Returns to scale, Labor
θ	0.43		Return to scale, Intermediates
η	3.0		Imported intermediates substitution
γ	3.0		Domestic-imported intermediates substitution
ρ_z	0.9		Arellano et al. 2025
ρ_ϵ	0.9	×	Corr spread, imports-to-GDP
σ_z	$8.7e^{-3}$	×	SOE GDP volatility
σ_ϵ	$2.2e^{-2}$	×	Corr imports, exports
Preferences			
σ	2.0		Reference value
β_{AE}	0.995		Short-term risk-free rate
β	0.959	×	Std log consumption to std log GDP ratio
χ	441.5		Normalization of AE labor supply
ν	0.72		Frisch elasticity, Healthcote et al. 2010
Debt and Default			
δ	16^{-1}		Macaulay duration
λ_0	-0.9	×	Spread
λ_1	0.945	×	Spread volatility
ϕ	0.5		Haircut, excl. preemptive, Cruces and Trebesch 2013
ψ	0.31	×	SOE debt-to-GDP
$\bar{q}$	0.6		Underwriting stds., Chatterjee and Eiygongur 2012

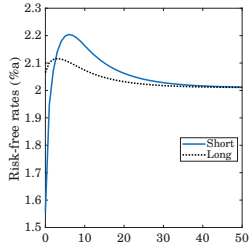
	Data	Model	Targeted
Means			
AE Share of World GDP	49.5	49.5	×
Average SOE to AE GDP	1.8	1.8	×
Spread	1.0	1.9	×
Debt-to-GDP	25.8	25.5	×
Imports-to-GDP AE	16.2	16.2	×
Imports-to-GDP SOE	29.4	30.0	×
Trade Balance-to-GDP	1.0	0.5	
Standard Deviations			
Log GDP	5.2	5.6	×
Spread	1.0	0.7	×
Std Log C / Std Log GDP	1.0	1.0	×
Trade Balance-to-GDP	3.5	2.3	
Exports-to-GDP	6.1	2.7	
Imports-to-GDP	6.0	2.8	
Correlations			
Spread, Log GDP	-11	-49	
Spread, Trade Balance-to-GDP	19	58	
Spread, Exports-to-GDP	-12	9	
Spread, Imports-to-GDP	-35	-39	×
Trade Balance-to-GDP, Log GDP	-18	23	
Exports-to-GDP, Log GDP	7	28	
Imports-to-GDP, Log GDP	19	8	
Exports, Imports	83	65	×

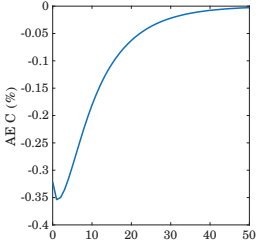
Global Trade Cost Shock: AE

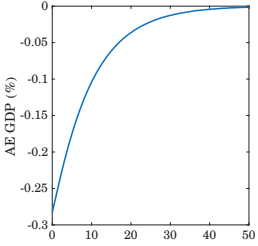


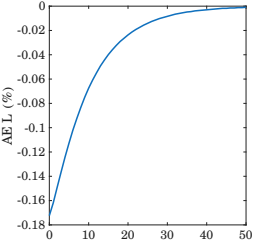


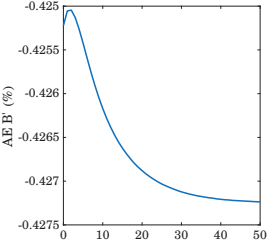




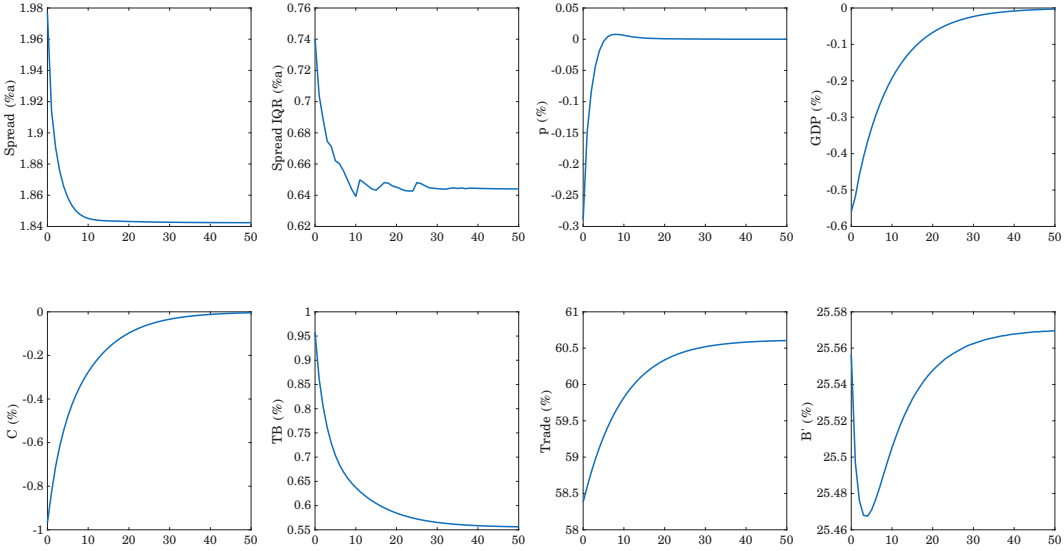




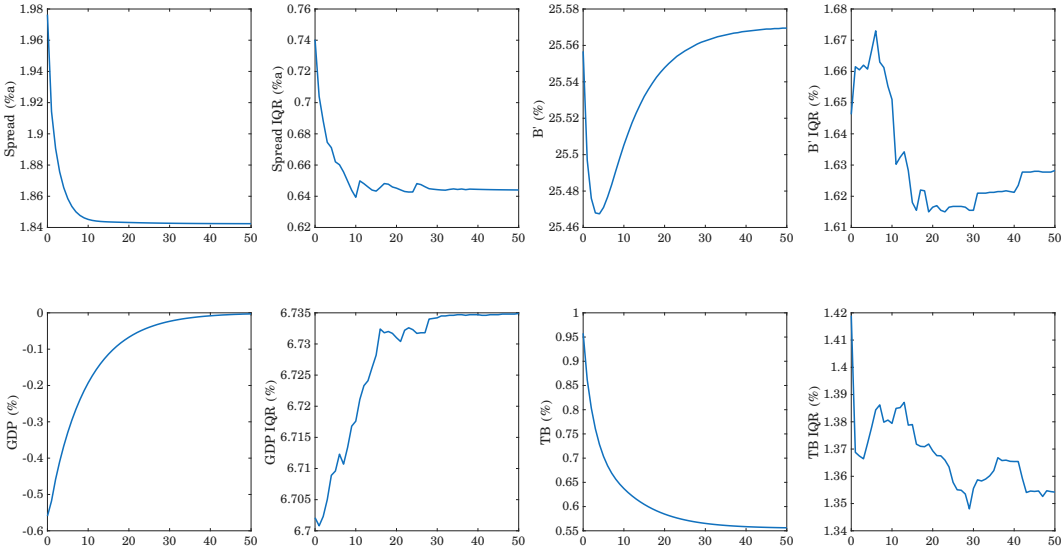




Global Trade Cost Shock: SOE



Global Trade Cost Shock: IQRs

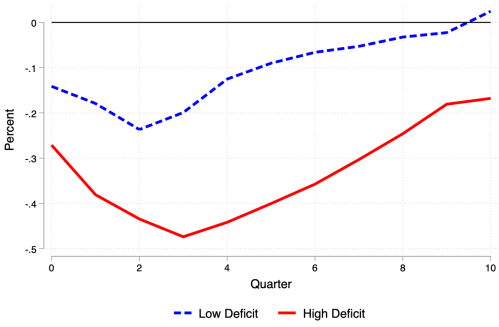


Testing the Differential Effect of τ

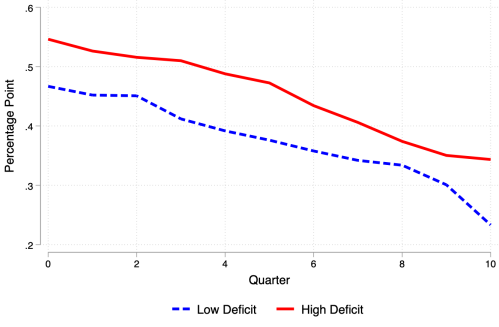
- Unbalanced sample: 35 countries 1975Q1–2023Q2
- Using net foreign asset position (NFA) to measure b_{it} in the model
  - Debt $b_{it} > 0$ corresponds to *negative* NFA
- Panel Local Projection, Jorda (2005)
  - Heterogeneous effects, Cloyne-Jorda-Taylor (2023)

$$y_{i,t+h} = \beta_0^h \cdot \text{GFI}_t + \beta_1^h \cdot \text{GFI}_t \times \text{NFA}_{i,t} + \alpha_i^h + X_{i,t} \cdot \gamma^h + \varepsilon_{i,t+h}, \quad h \in \{0, 1, \ldots, T\}$$

Panel LP w/ Heterogeneous Effects



GDP



Spread

Work in progress: ToT and REER depreciations, alt measures of trade costs, …

Towards an Analysis of AE Tariffs (and Export Taxes)

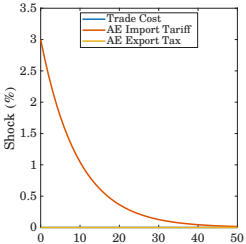
- Advanced economy imposes tariffs ε^m_{AE}
- Equilibrium conditions

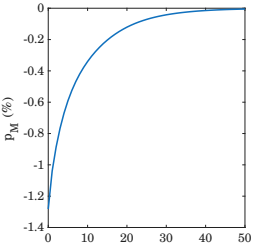
$$\tau p^M (1 + \varepsilon^m_{AE})/p = \theta(1-\omega) Q G^{\frac{1}{\gamma}-1} M^{-\frac{1}{\gamma}} \qquad (M \text{ demand})$$

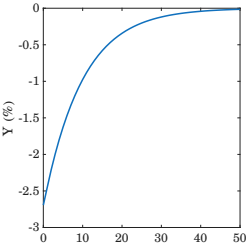
Other conditions same as before, including

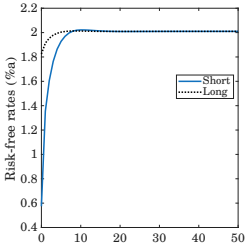
$$C_{AE} = Q_{AE} - H_{AE} - \tau X_{AE} \qquad \text{(domestic resources)}$$

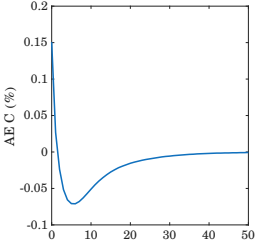
AE Tariff: AE

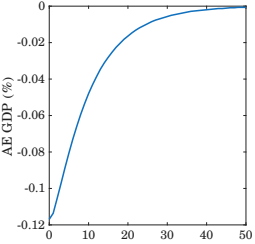

Trade Cost
AE Import Tariff
AE Export Tax
Shock (%)

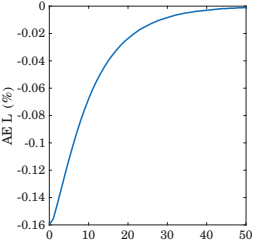

P_M (%)

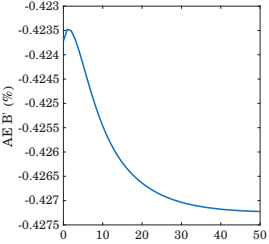

Y (%)


Short
Long
Risk-free rates (%a)

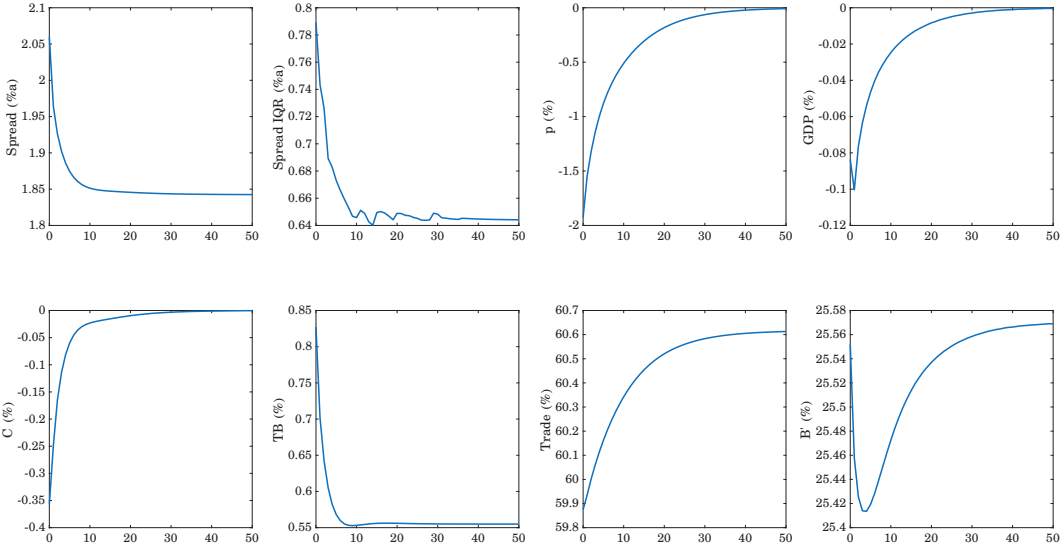

AE C (%)


AE GDP (%)

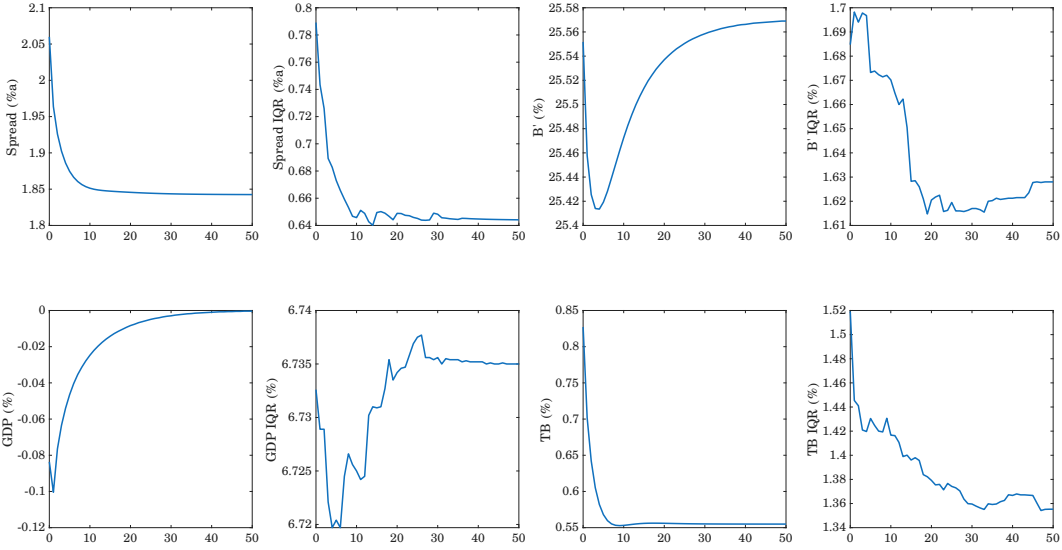

AE L (%)


AE B (%)

AE Tariff: SOE



AE Tariff: SOE IQRs



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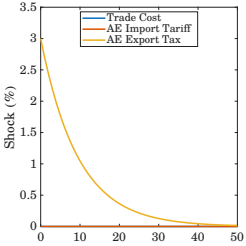

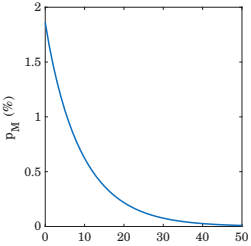

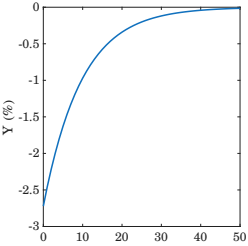

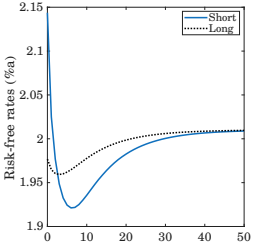

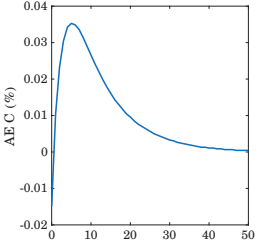

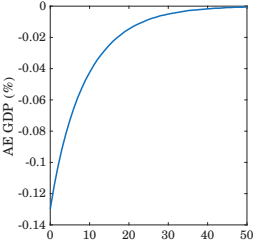

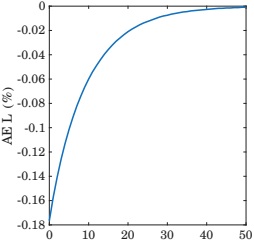

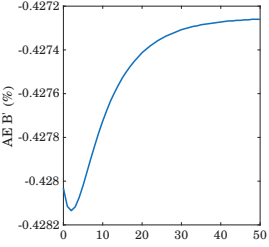

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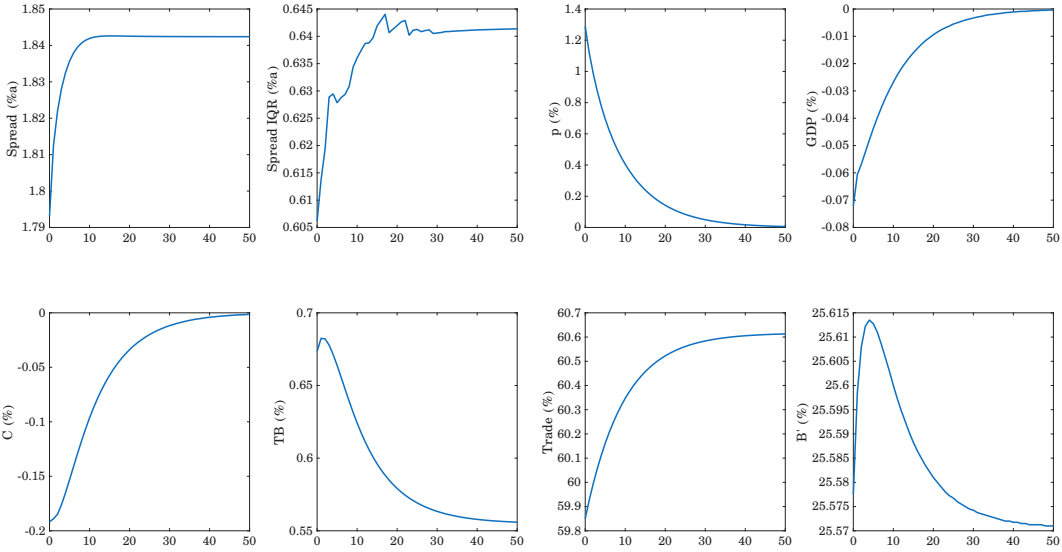

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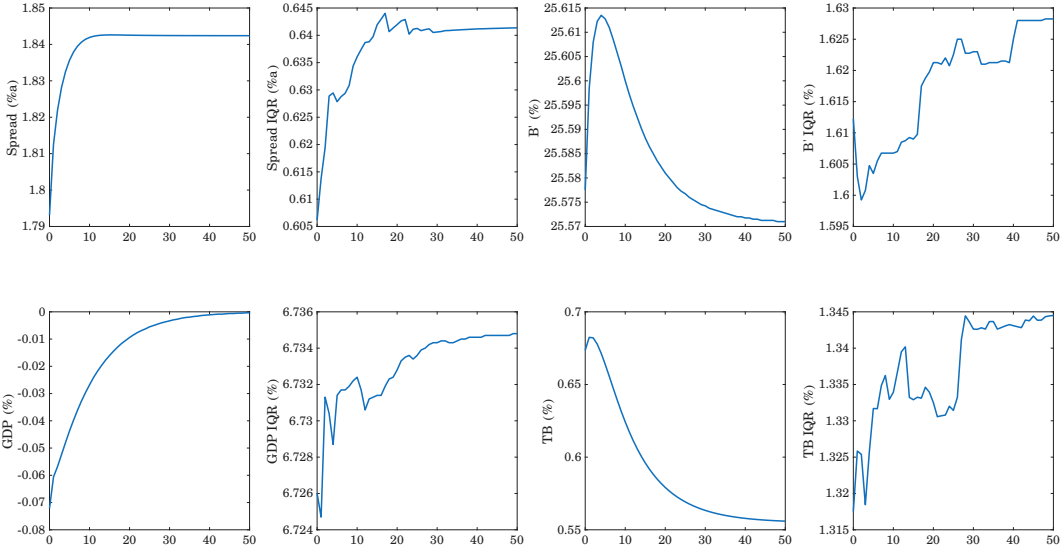

Summary

- We build a world GE model with gross trade and sovereign default
- We find differential effects of global trade cost shocks
  - High-debt countries (savers): greater fall in output & larger increase in spreads
  - Explains movements in average and cross-country dispersion of spreads
- A framework to study impact of tariffs from advanced economies under imperfect international financial markets