

# Global Imbalances, Trade, and Sovereign Risk

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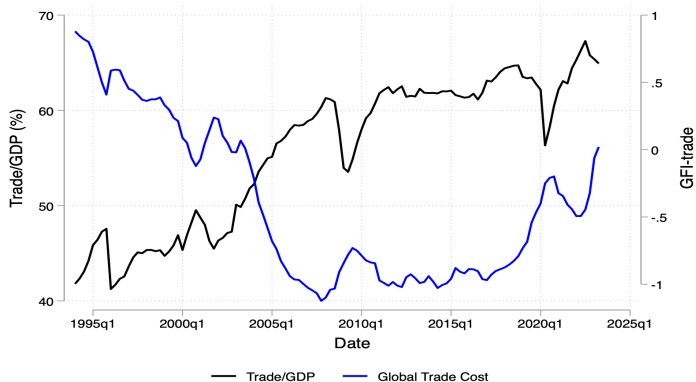
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Midwest Macro Meetings (FRB Cleveland)

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

# Global Trade and Trade Costs

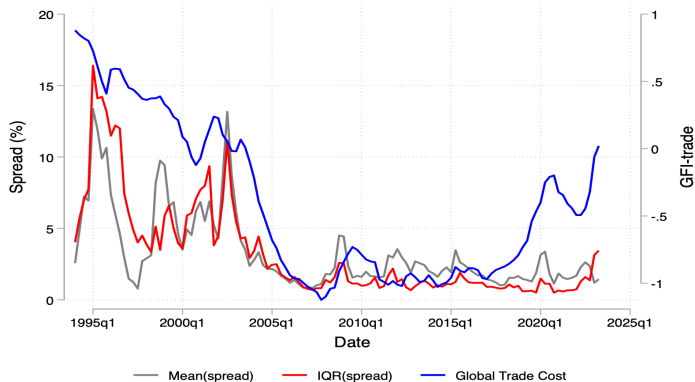


Falling global trade cost accompanied by larger trade flows

Global trade cost measured by GFI-Trade index from Fernández-Villaverde, Mineyama and Song (2025)

35 countries including small OECD + emerging countries

# Global Trade Costs and Spreads



Falling global trade cost accompanied by lower & less dispersed sovereign spreads

*How do global trade shocks affect countries on average and differentially?*

- **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

- **World GE model:** global trade + sovereign default
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  - Global and idiosyncratic iceberg trade cost
  - Sovereign default setting for SOEs: incomplete markets, default, haircuts
- **Mechanism:** Global trade cost shock  $\uparrow$ 
  - Intermediate goods  $\downarrow \Rightarrow$  output  $\downarrow \Rightarrow$  sovereign default risk  $\uparrow$  (**same across countries**)
  - High-debt countries need to save: imports fall more than export
    - $\Rightarrow$  Larger output drop, larger depreciation
    - $\Rightarrow$  Disincentivize debt repayment
    - $\Rightarrow$  Sovereign default risk  $\uparrow$  more (**heterogeneous across countries**)

# **A Model of Gross Trade Flows and Default**

- World general equilibrium model:
  - Measure  $\xi$  continuum of small open economies (SOE), discount factor  $\beta$
  - 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)
- Idiosyncratic productivity shock  $z_{it}$ , trade cost shocks (global  $\tau_t$  and idiosyncratic  $\epsilon_{it}$ )



# 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

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

# 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
- $\pi_{it}$ : profits of the representative firm
- Optimal GHH labor supply:  $\chi L_{it}^{1/\nu} = \frac{w_{it}}{p_{it}}$

# Individual Country (SOE): Sovereign

- Country  $i$  issues claims to  $b_{it+1}$  units of long-term defaultable bonds at  $t$ 
  - Sequence of payments starting from  $t + 1$ :  $\kappa, \kappa(1 - \delta), \kappa(1 - \delta)^2, \dots$
  - $\delta$ : controls bond duration
- The sovereign decides whether to default and future bond position  $b_{it+1}$ 
  - Default ( $d_{it} = 1$ )  $\Rightarrow$  *immediate* debt reduction,  $b_{it} \rightarrow \phi b_{it}$ , with  $\phi < 1$
  - Cost: utility cost ( $\psi$ ) + productivity loss ( $\tilde{z}_{it} = h(z_{it}, d_{it}) \leq z_{it}$ )
- Budget constraint

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

- 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:

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

- Optimization

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

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

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

# Static Private Trade Equilibrium

Given the trade cost  $\tau_t$  and distribution  $\Omega_t(\tilde{z}_{it}, \epsilon_{it}, T_{it})$ , 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  $i$

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

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

# Dynamic World Equilibrium: AE

- Int'l lenders with full commitment
- AE Euler equation

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

- Define short-term risk-free rate

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

# 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

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

## ■ New borrowing

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

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

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

$$\Omega_{t+1} = H_\Omega(\Omega_t, \tau_t)$$



# 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:

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

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

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

# Differential Effects of Global Trade Shocks

- Mechanism, numerical example
- Static private-trade eq'm under exogenous distribution of trade balances ( $T_{it}$ )
- $T_{it} < 0$ : high-debt countries who need to save

# Static Private Equilibrium

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

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

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

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

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

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

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

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

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

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

# Mechanism: Effects of Trade Cost Shocks

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

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

# 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  $\% \Delta Q$ 
  - 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 differential 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  $\Rightarrow$  more reduction in  $Q$
- Disincentivize gov't from repaying debt  $\rightarrow$  high spread

# Full Model with Dynamic General Equilibrium

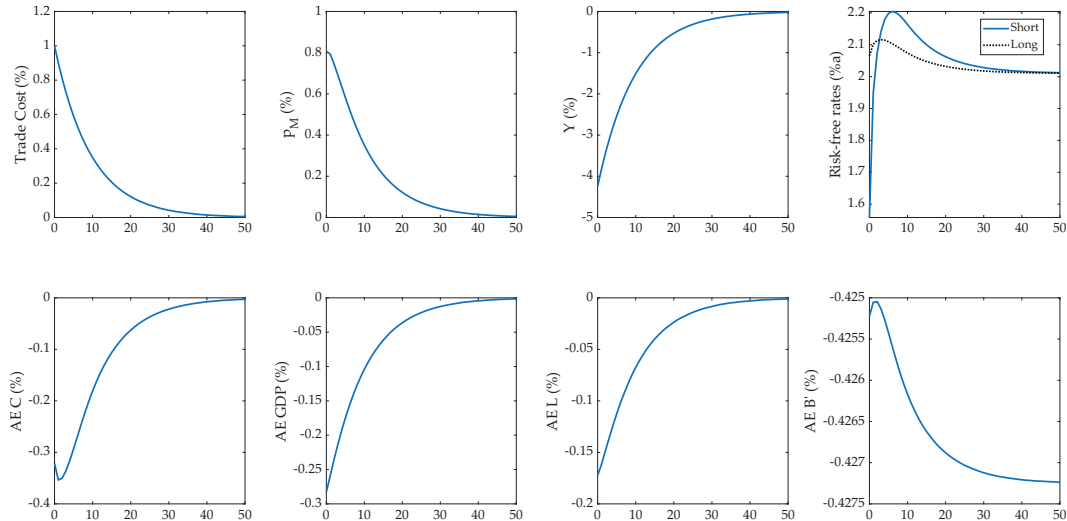
- Gov't internalizes the impact of  $\tau$
- Endogenous borrowing and default decision
- Global bonds markets clear

- Parameterize using trade and sovereign spreads moments ▶ Parameterization ▶ 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  $\tau$ :  $1 \rightarrow 1.01$  in period 0
- Differential effect after global trade cost shock
  - Which country’s spreads increase by more?



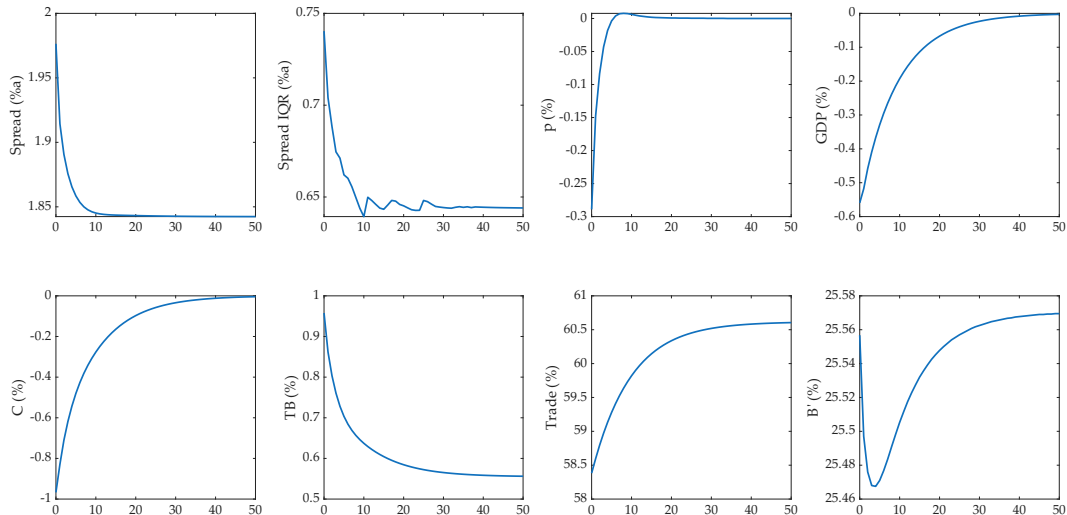
# Full Model: Global Trade Cost Shock

Advanced economy:



# Full Model: Global Trade Cost Shock

Small open economies:



# **Evidence on Differential Effect of Trade Shocks**

# Testing the Differential Effect of $\tau$

- 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)
- Do the same regression with model-simulated data

Global trade costs  $\uparrow \Rightarrow$  high-debt countries: greater output  $\downarrow$ , greater spread  $\uparrow$ , greater depreciation

# Towards an Analysis of AE Tariffs

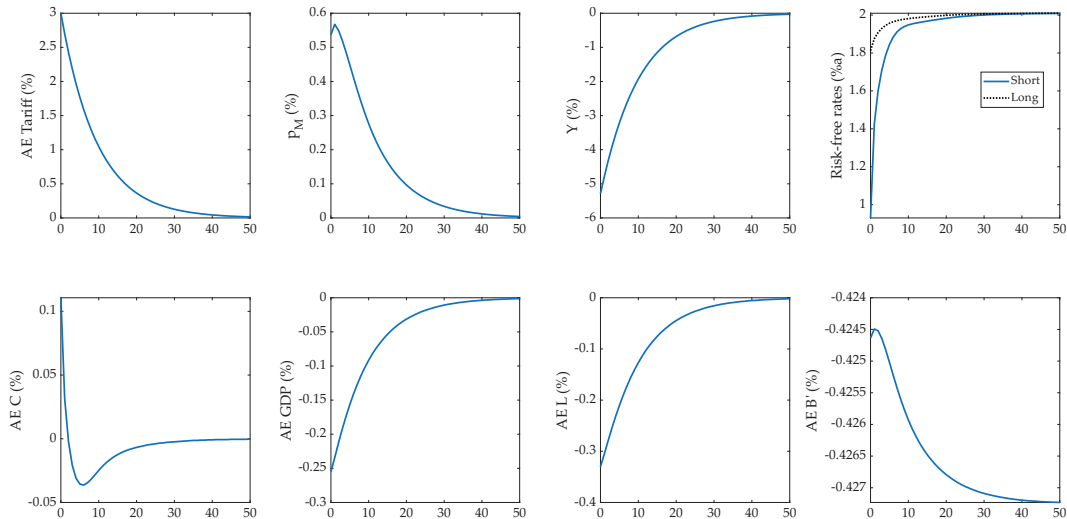
- Advanced economy imposes tariffs  $\varepsilon_{AE}^m$
- Equilibrium conditions

$$\tau p^M(1 + \varepsilon_{AE}^m)/p = \theta(1 - \omega)QG^{\frac{1}{\gamma}-1}M^{-\frac{1}{\gamma}} \quad (M \text{ demand})$$

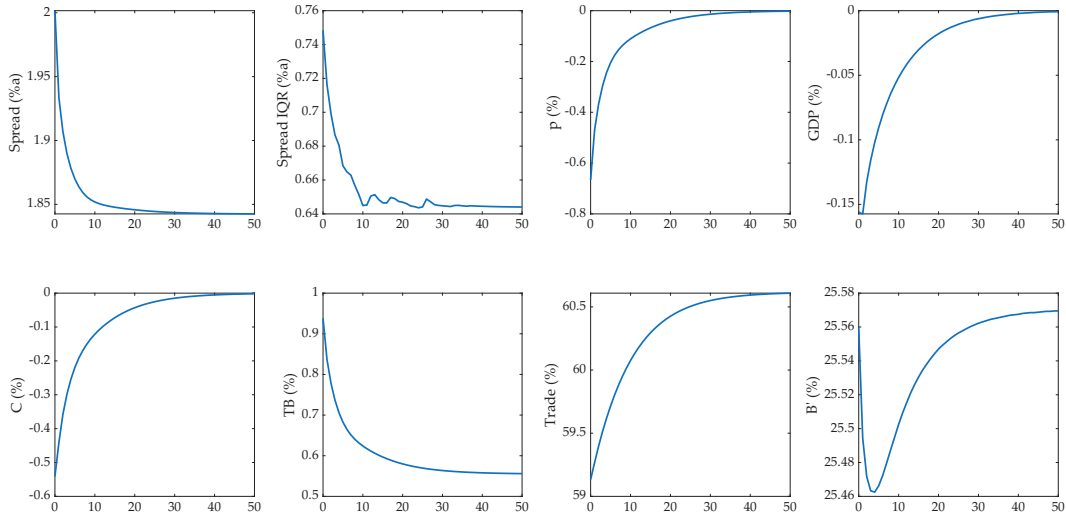
Other conditions same as before, including

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

# Increase AE tariffs to 1.03



# Response of small open economies



- 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



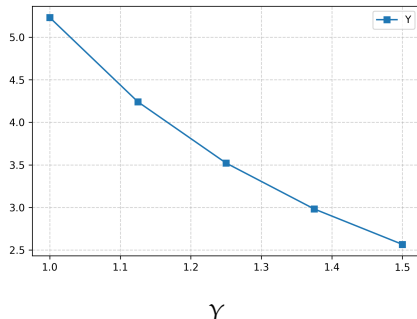
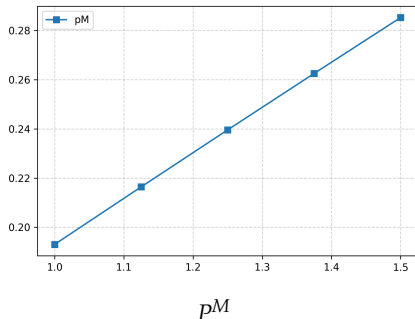
# Appendix

# Simple Numerical Illustration

- Given  $\{\tau, Y, p^M\}$ ,  $(z, T)$  for each country, solve static private equilibrium
- Fix standard parameter values:  
 $\alpha = 0.4, \theta = 0.43, \chi = 1.0, \nu = 0.72, \eta = 3, \gamma = 1, \omega = 0.6$
- Equilibria with  $\tau \in [1, 1.5]$ 
  - AE the same size as average SOE, uniform mass SOE
  - Total transfer equals zero,  $T_{AE} + \sum T_i = 0$
  - $T_i < 0$ : *larger incentives to save*

# Global Trade Shock: Average Effect

Given  $\{\tau, Y, p^M\}$ ,  $(z, T)$  for each country, solve static private equilibrium

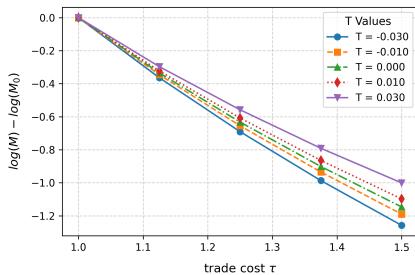


- Higher trade cost  $\Rightarrow$  global intermediate price  $p^M \uparrow$ , global demand  $Y \downarrow$

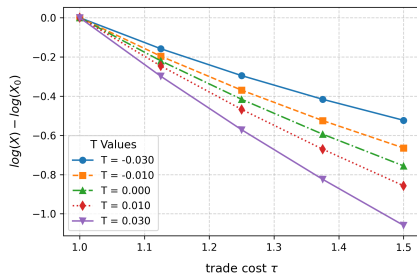
# Global Trade Shock

Given  $\{\tau, Y, p^M\}$ ,  $(z, T)$  for each country, solve static private equilibrium

- Differential effect: After  $\tau \uparrow$ , high-debt countries who need to save ( $T < 0$ )  $\Rightarrow$
- (Blue line) Import falls by more, export falls by less

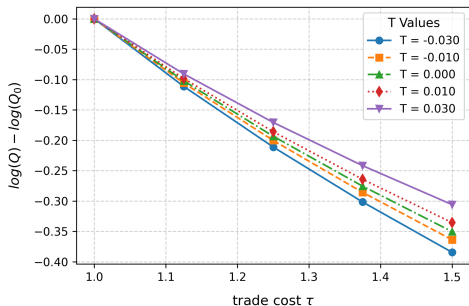


Imported  $M$

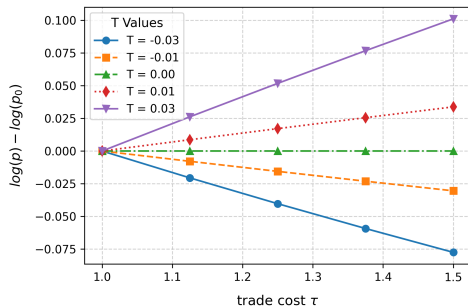


Export  $X$

# Global Trade Shock: Differential Effect



Output

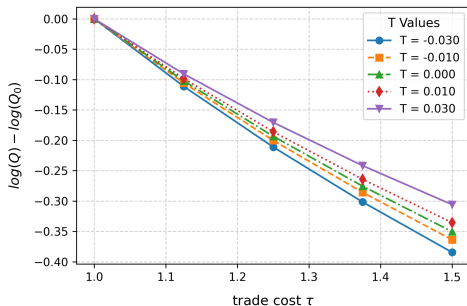


Domestic price  $p$

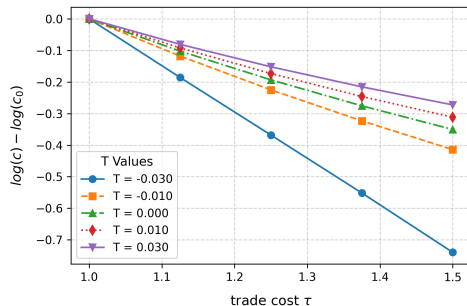
After  $\tau \uparrow$ , high-debt countries who need to save ( $T < 0$ )  $\Rightarrow$

- $Q$  falls by more,  $p$  falls by more (larger depreciation)

# Global Trade Shock: Differential Effect



Output

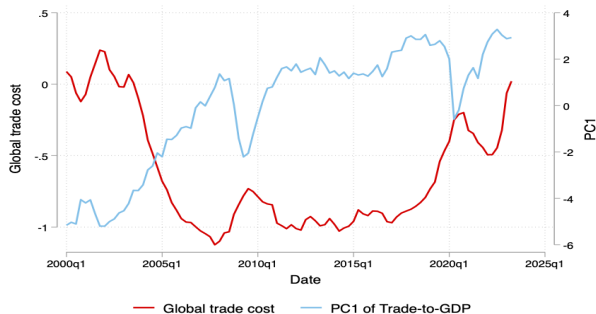


Consumption

After  $\tau \uparrow$ , high-debt countries who need to save ( $T < 0$ )  $\Rightarrow$

- C falls by even more:  $C = \theta Q + T/p$

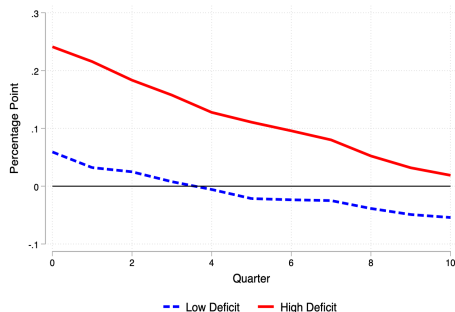
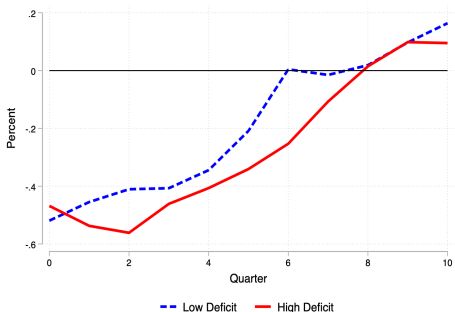
# Global Trade Cost



- First principal component of trade-to-GDP ratios of 12 emerging markets
- Significantly negative correlated with baseline measure of global trade cost

► Back: motivation

# Trade-to-GDP Proxy Results, $TC_t$ timing

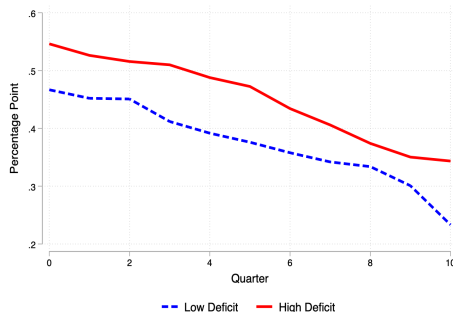
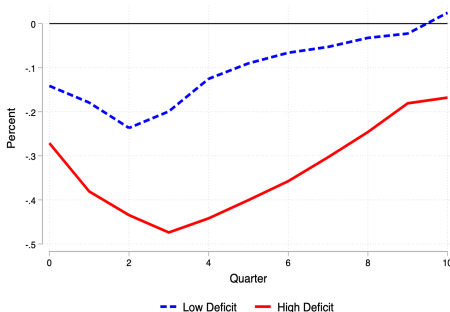


Consistent with theory:

- Significantly greater GDP drop in higher deficit countries (first 4 periods)
- Significantly higher spread increases in higher deficit countries (throughout)



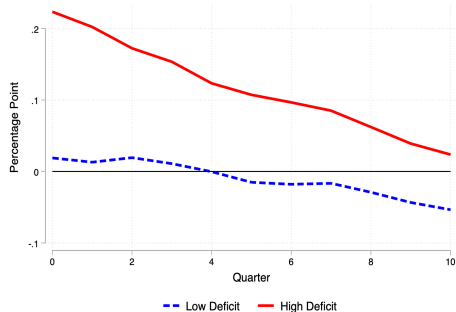
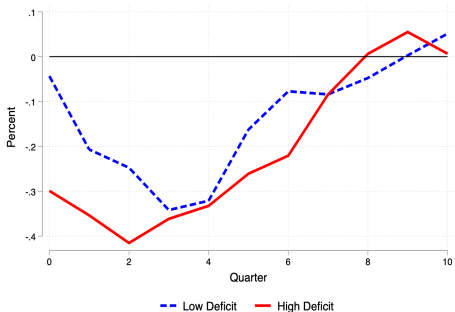
# GFI-Trade Results, $TC_t$ timing



Consistent with theory:

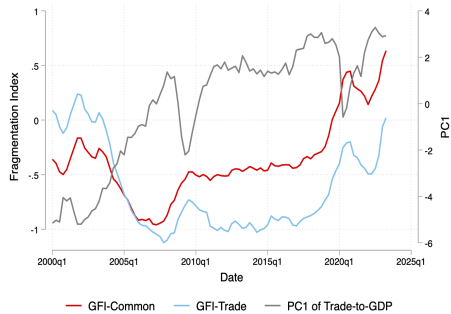
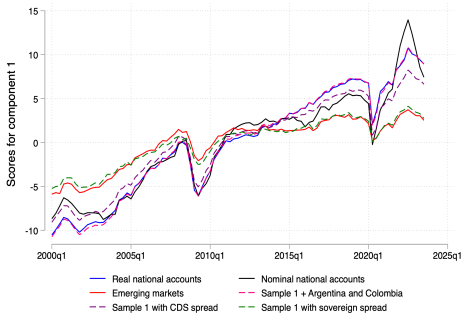
- Significantly greater GDP drop in higher deficit countries (throughout)
- Significantly higher spread increases in higher deficit countries (throughout)

# Trade-to-GDP Proxy Results



Consistent with theory:

- Significantly greater GDP drop in higher deficit countries (first 3 quarters)
- Significantly higher spread increases in higher deficit countries (throughout)



# Parameterization

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<i>Assigned Parameters</i>		<i>Parameters from Moment Matching</i>	
		<i>Using moments from balanced trade</i>	
Risk aversion	$\sigma = 2$	Disutility of working	$\chi = 5.65$
Elas. of substitution:	$\gamma = 3$	Home bias	$\omega = 0.71$
Trade elasticity	$\eta = 3$	Share of SOE	$\xi = 10$
Labor share	$\alpha = 0.40$	Mean AE productivity	$\bar{z}_{AE} = 2.2$
Intermediate share	$\theta = 0.43$		
Frisch elasticity	$\nu = 0.72$		
Debt duration	$\delta = 1/16$	<i>Using moments in simulation</i>	
Debt recovery rate	$\phi = 0.65$	Discount factor SOE	$\beta = 0.975$
Productivity persistence	$\rho_z = 0.9$	Productivity volatility	$\sigma_z = 1.5\%$
Discount factor AE	$\beta = 0.995$	Default costs	$\lambda_0 = -0.95$
Mean SOE productivity	$\bar{z}_{soe} = 1$	Default costs	$\lambda_1 = 0.98$

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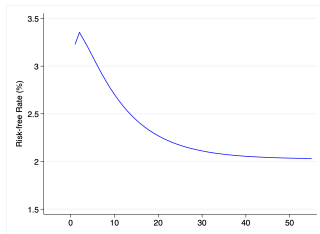
# Targeted Moments

	Data	Model
<i>Moments from Balanced Trade</i>		
GDP <sub>AE</sub> to world GDP	0.29	0.29
Average SOE GDP over GDP <sub>AE</sub>	0.25	0.25
Import share of GDP	0.2	0.2
AE labor	0.3	0.3
<i>Business cycle Moments (%)</i>		
Std. real GDP	2.2	2.3
Mean spread	2.0	2.4
Mean Debt to output	16	8
Std. spread	0.9	0.7
Corr(spread, GDP)	-42	-40

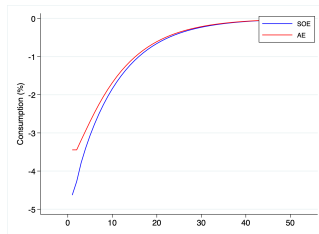
# Full Model: A Transitory Trade Cost Shock

[▶ Back](#)

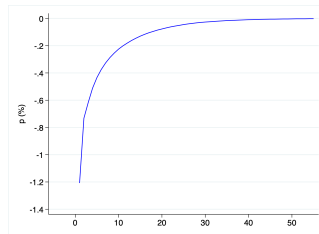
$\tau: 1 \rightarrow 1.05$  in period 0



Risk-free rate



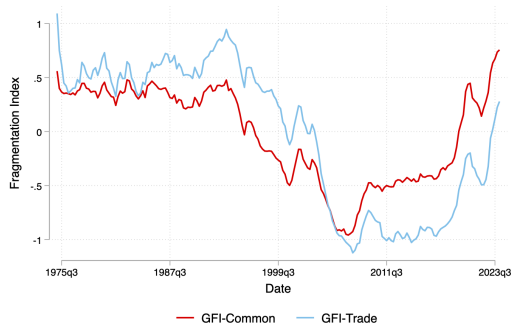
Consumption



Domestic price

- Expensive imported intermediates, depressed global demand, increased risk-free rate
- Output, consumption  $\downarrow$  by more, depreciation

# 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 → 16 global variables, 4 categories
  - Higher GFI-trade  $\Rightarrow$  larger trade barriers [▶ Back: motivation](#) [▶ Back: empirical](#)

# Parameterization

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## *Assigned Parameters*

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Discount factor AE	$\beta = 0.995$
Debt duration	$\delta = 1/16$
Debt recovery rate	$\phi = 0.5$
Productivity persistence	$\rho_z = 0.9$
SOE trade cost persistence	$\rho_\epsilon = 0.9$

## *Parameters from Moment Matching*

### *Using moments from balanced trade*

Disutility of working	$\chi = 441.5$
Import share of AE	$\omega_{AE} = 0.31$
Import share of SOE	$\omega = 0.16$
Mass of SOE	$\xi = 56.7$
AE mean productivity	$\bar{z}_{AE} = 32.8$
SOE mean productivity	$\bar{z}_{SOE} = 2.7$

### *Using moments in simulation*

Discount factor SOE	$\beta = 0.959$
Productivity volatility	$\sigma_z = 0.9\%$
SOE trade cost volatility	$\sigma_\epsilon = 2.2\%$
Default costs	$\lambda_0 = -0.9$
	$\lambda_1 = 0.945$

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# Targeted Moments

	Data	Model
<i>Moments from Balanced Trade (%)</i>		
AE share of world GDP	49.5	49.5
Average SOE GDP over GDP <sub>AE</sub>	1.8	1.8
Import share of GDP, AE	16.2	16.2
Import share of GDP, SOE	29.4	29.4
<i>Business cycle Moments, SOE (%)</i>		
Std. real GDP	5.2	5.6
Mean spread	1.0	1.9
Mean Debt to output	25.8	25.5
Std. spread	1.0	0.7
Std consumption/std GDP	1.0	1.0
Corr(spread, import/GDP)	-35	-39
Corr(export/gdp, import/GDP)	83	65