The Fragmentation Paradox: De-risking Trade and Global Safety

Thierry Mayer [1] Isabelle Méjean [2] Mathias Thoenig [3]

[1]Sciences Po, CEPII and CEPR

[2]Sciences Po and CEPR

[3]University of Lausanne, IMD and CEPR

Berlin, October 17, 2024

Motivation

- Fast-growing literature on the geopolitical fragmentation of global trade
  - ▷ Example: How to "de-risk" / "de-couple" trade away from geopolitical rivals
  - ▷ High on the policy agenda of EU, USA, etc.
  - ▷ Looks at trade policy in an unsecure world... taking conflict risk as given
- This literature overlooks how fragmentation feedbacks on conflict risk
  - ▷ Yet, historical collapse of global trade in the interwar period
  - ▷ This paper models the two-way causation between trade policy and geopolitics
  - ▷ De-risking can paradoxically make the world less safe...
  - ▷ ... which undoes some of its welfare gains.

This paper: Quantitative geoeconomics

- Combine a diplomatic game of escalation to conflict with a structural gravity model of trade
  - ▷ Rational leaders, despite immense costs of war, may fail at deescalating geopolitical tensions
  - ▷ This captures the so-called "paradox of war"

- Analysis reveals that diplomatic & trade margins can be connected in a transparent way
  - ▷ Key concept = Opportunity Cost of War (`OCW`) = foregone real consumption
  - ▷ Structural gravity allows for an easy computation of `OCW`
  - ▷ Enables to smoothly bring the model to the data

- **Portable approach:** Can be adjusted further to accommodate more complex/realistic setup

Roadmap and take-aways

1. Welfare formula in the shadow of war

- Involves a set of endogenous geoeconomic factors, that all depend on the trade regime:
    1) probability of escalation to war
    2) ex-post true cost of war
    3) peace-preserving diplomatic concessions
- `OCW` is a sufficient statistic for all 3 factors

2. Quantitative trade model is simulated to quantify `OCW`

3. This machinery can be used to assess the geoeconomic impact of various trade policies

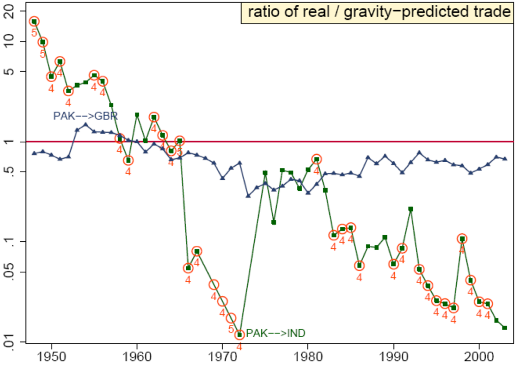
- Today: application to the case of the US-China decoupling
- Estimated welfare impact differs substantially from peacetime predictions
- War probability is typically extremely small. Yet the costs of diplomatic concessions can be large ("the shadow welfare cost of war")

Section 2

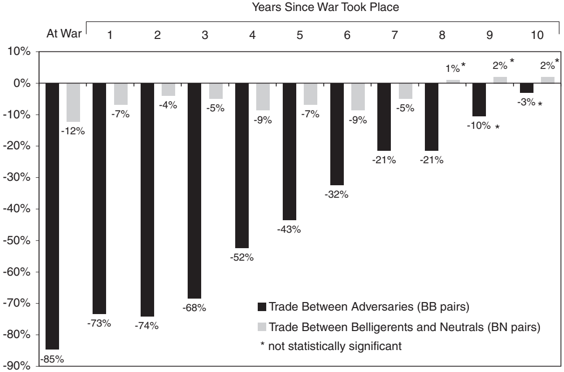
A Quantitative Model of Trade and War

Trade dependence and conflict: logic and pitfall

- Montesquieu (1748) and the logic of "Doux Commerce": Trade dependence raises OCW
    - ▷ Key element: conflicts disrupt trade. Empirically well-grounded:



(a) Martin et al. 2008



(b) Glick and Taylor 2010

- ▷ Unclear that trade losses increase OCW enough to matter: need a quantitative evaluation

Setup I

- Multi-country world, trade and war are both endogenous

- Sequence of events

  1. Exogenous geopolitical dispute arises between 2 countries n and m about sharing a divisible resource (territory, oil field, water body, political reputation or prestige, etc.)
  2. n and m agree on a diplomatic protocol to de-escalate . Other countries ℓ are neutral.
  3. They negotiate under the chosen protocol:
     (i) Agreement on a peace-compatible transfer $n \rightarrow m$: $T_{nm} \gtrless 0$
     (ii) Otherwise negotiation fails and War_{nm} occurs
  4. Markets clear: Production, trade, and consumption for all countries.

Setup II

Modeling the effect of $\texttt{War}_{nm}$

In peace, countries n and m

- have L_n, L_m workers, and TFP A_n, A_m
- face bilateral trade costs τ_{mn}

Parametric assumptions of the effects of $\texttt{War}_{nm}$:

- ▷ Human losses: Γ % population drop
- ▷ Economic damages: α % TFP drop
- ▷ Trade disruption (AVE):
  - ▶ τ^{bil}% increase in bilateral frictions with the other belligerent
  - ▶ τ^{mul}% increase in multilateral frictions with the RoW
  - ▶ Trade between third countries is not disrupted

Utility Cost of War

Utility differential in absence of a negotiated transfer

$$\widetilde{\texttt{UCW}}_n \equiv (\log C_n(\text{peace}) + v_n) - (\log C_n(\text{war}) + v_n - \tilde{u}_n)$$

$$= \underbrace{\log C_n(\text{peace}) - \log C_n(\text{war})}_{\equiv \texttt{OCW}_n} + \underbrace{\tilde{u}_n}_{\text{private information}}$$

- C_n: equilibrium consumption
- $v_n \geq 0$: peacetime value of the share of the resource controlled by n (= numeraire good)
- $v_n - \tilde{u}_n \geq 0$: wartime value of the share of the resource controlled by n
- $\tilde{u}_n \gtrless 0$ is a random war shock privately observed by n (fog of war)
- Aggregate resource constraint: peace Pareto-dominates war (destruction)

$$(v_n - \tilde{u}_n) + (v_m - \tilde{u}_m) < v_n + v_m \qquad \Rightarrow \qquad \widetilde{\texttt{UCW}}_n + \widetilde{\texttt{UCW}}_m > 0$$

Gravity to measure $\texttt{OCW}_n$

Diplomacy and resolution of geopolitical disputes I

- Benchmark: No war under perfect information!
  - ▷ Peace $\overset{\text{pareto}}{\succ}$ War: $\exists$ non-empty set of peace-compatible transfers
  - ▷ Intuitively: transfer from the ctry with the largest `UCW` to the ctry with the lowest `UCW`

- Diplomacy = bargaining under asymmetric information
  - ▷ Unconstrained diplomacy: **leaders are free to choose in a large class of bargaining protocol** $\rightarrow$ one-shot or multi-stage, public or secrete, mediated by UN, etc.

  (a) Each leader can unilaterally leave the negotiation table: **non-binding protocol**

  (b) (Negatively) **correlated war shocks**: $\mathbb{E}\left[\tilde{u}_n \tilde{u}_m\right] < 0$, uniformly distributed, $\tilde{u} \in [\underline{u}, \underline{u} + \eta]$

  - ▷ War diplomacy $\neq$ standard mechanism design approach (Myerson & Satterthwaite 1983)

Diplomacy and resolution of geopolitical disputes II

- Optimal protocol: 2nd best reached with a simple mechanism (Compte & Jehiel, 2009):
  1. Leaders announce $\texttt{UCW}$s and check joint compatibility with the resource constraint:
  $$0 < \widetilde{\texttt{UCW}}_n^a + \widetilde{\texttt{UCW}}_m^a$$
  2. If compatible, a $n \to m$ transfer is agreed upon and peace is maintained:
  $$\widetilde{T}_{nm} = \frac{\widetilde{\texttt{UCW}}_n^a - \widetilde{\texttt{UCW}}_m^a}{2} \gtrless 0$$
  3. If not compatible, negotiation fails, war breaks out, countries receive $\tilde{U}(\text{war})$

- Optimal announcement:
$$\widetilde{\texttt{UCW}}_n^a = \frac{2}{3}\widetilde{\texttt{UCW}}_n + \frac{1}{12}\max\widetilde{\texttt{UCW}}_n - \frac{1}{4}\max\widetilde{\texttt{UCW}}_m.$$

Leaders strategically misreport a lower $\texttt{UCW}$ to extract more concession $\to$ risk of negotiation failure

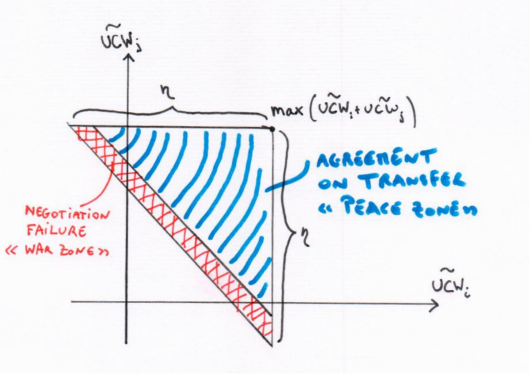
Diplomacy and resolution of geopolitical disputes III

When do negotiations fail?

(i) joint realization of `UCWs` is low (less to loose)

(ii) informational noise η is large enough

$\rightarrow$ Diplomacy is relatively efficient at deescalating the most intense forms of war.



Geoeconomic factors

$$\mathbb{E}\left[\widetilde{\texttt{UCW}}_n\right] = \texttt{OCW}_n + \mathbb{E}\left[\tilde{u}_n\right] \qquad \text{with} \qquad \texttt{OCW}_n = \log \frac{C_n(\text{peace})}{C_n(\text{war})}$$

Probability of Appeasement:

$$s_{nm} = \frac{1}{\eta^2} \times \left(\texttt{OCW}_n + \texttt{OCW}_m\right)^2$$

Peace Keeping Costs

$$\mathbb{E}\left[\widetilde{T}_{nm}|\text{peace}\right] \equiv \texttt{PKC}_n = \frac{\texttt{OCW}_n - \texttt{OCW}_m}{2}$$

True Cost of War

$$\mathbb{E}\left[\widetilde{\texttt{UCW}}_n|\text{war}\right] \equiv \texttt{TCW}_n = \texttt{OCW}_n + \mathbb{E}\left[\tilde{u}\right] - \frac{1}{4}\frac{\left[\texttt{OCW}_n + \texttt{OCW}_m\right]^2}{\eta + \texttt{OCW}_n + \texttt{OCW}_m}$$

Geoeconomic factors II

"Welfare in the shadow of war" peacetime utility net of geoeconomic loss

$$\mathbb{E}\tilde{U}_n \equiv s_{nm}\left(U_n(\text{peace}) - \mathbb{E}\left[\widetilde{T}_{nm}|\text{peace}\right]\right) + (1 - s_{nm}) \times \left(U_n(\text{peace}) - \mathbb{E}\left[\widetilde{\texttt{UCW}}_n|\text{war}\right]\right)$$

$$= U_n(\text{peace}) - \mathcal{L}_n, \quad \text{where} \quad \mathcal{L}_n \equiv s_{nm} \times \texttt{PKC}_n + (1 - s_{nm}) \times \texttt{TCW}_n$$

$$= \log C_n(\text{peace}) + v_n - [s_{nm} \times \texttt{PKC}_n + (1 - s_{nm}) \times \texttt{TCW}_n]$$

Sufficient statistics: Geoeconomic factors $\{s_{nm}, \texttt{PKC}_n, \texttt{TCW}_n\}$ can all be derived from $\texttt{OCW}_n$ (all increasing in $\texttt{OCW}_n$)

Section 3

Empirical illustration: The geoeconomics of the US-China pair

The trade model

- Simplified version of di Giovanni et al. (2024) with i) Nested CES for final and int. demand, ii) IO linkages using TiVA , iii) exog. labor supply, iv) EHA ($\Delta \log x \equiv \log\left(\frac{x(\text{war})}{x(\text{peace})}\right)$).
- We want to measure $\texttt{OCW}_n = -\Delta \log C_n \equiv \Delta \log P_n^{CPI} - \Delta \log \sum_{i \in C} \tau_{in} p_i c_{in}$.
- In our model (neglecting GE effects on w), this gives

$$\texttt{OCW}_n = \Gamma - \alpha(\tilde{\pi}_{nn} + \tilde{\pi}_{mn}) + \tau^{\text{bil}}(\pi_{mn} + \breve{\pi}_{mn}) + \tau^{\text{mul}}\left[\sum_{\ell \neq n,m} (\pi_{\ell n} + \breve{\pi}_{\ell n})\right]$$

$\pi_{\ell n} \equiv \sum_{i \in C_\ell} b_{in}$: cons. share of ℓ goods / $\tilde{\pi}_{\ell n} \equiv \sum_{i \in C_\ell} \lambda_{in}$: overall incidence on cons. (direct + IO relationships) / $\breve{\pi}_{\ell n} \equiv \sum_{i \in C} \lambda_{in} \sum_{l \in C_\ell} \Omega_{li}$: exposure of n to trade shocks affecting ℓ goods

- Without IO linkages, back to MMT08: $\texttt{OCW}_n^{\text{noIO}} = \Gamma - \alpha(\pi_{nn} + \pi_{mn}) + \tau^{bil}\pi_{mn} + \tau^{mul}\left[\sum_{\ell \neq m,n} \pi_{\ell n}\right]$.

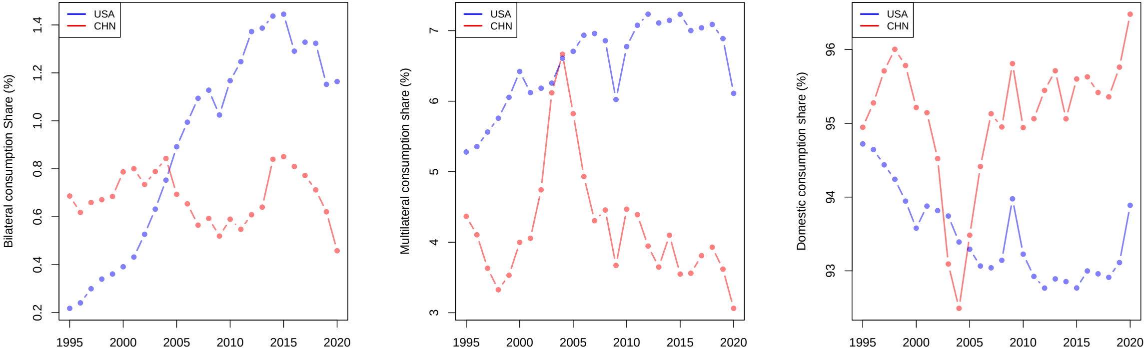
Calibration

- Applied on TiVA data for 1995-2020
- Calibrated parameters

Parameter	Value	Source	Interpretation
ω	.35	Baqaee & Fahri (2020)	CES between sectors (inter. consumption)
θ	.5	Baqaee & Fahri (2020)	CES between sectors (final consumption)
λ	.1	Baqaee & Fahri (2020)	CES between VA and inputs
η	.101	Match probability of conflicts in Martin et al. (2008)	Variance of `UCW`
α	.03	Match figure in Federle et al. (2024)	% TFP lost
Γ	0		% workforce/consumers lost
σ_j		Caliendo & Parro (2015)	Armington elasticities
$\pi^l_{m,j,0}$		TiVA data	Labor shares
$\pi^X_{m,ij,0}$		TiVA data	Intermediate shares
$\pi^X_{nm,ij,0}$		TiVA data	Intermediate trade shares
$\pi^c_{n,j,0}$		TiVA data	Final consumption shares
$\pi^c_{mn,j,0}$		TiVA data	Final trade shares
$y_{nm,j,0}$		TiVA data	Trade flows
$P_{n,0}C_{n,0}$		TiVA data	Final consumption

- η targets a probability of conflicts of 4.6% between country pairs with distance < 1000km

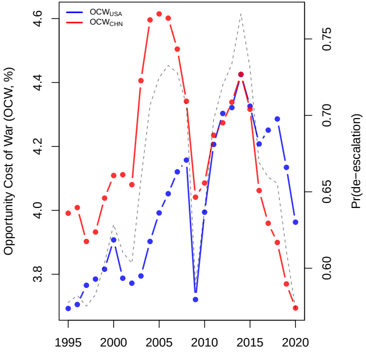
Increasing **asymmetric** dependence (TiVA raw data)



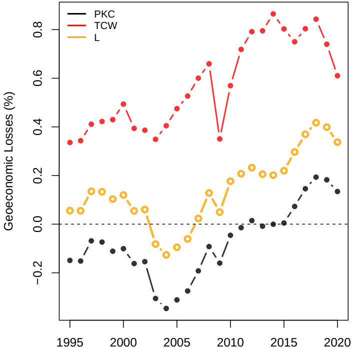
(a) Bilateral (b) Multilateral (c) Domestic

Decomposing Geoeconomic Losses (I/O, $\alpha = -3\%$, $\eta = 0.101$)

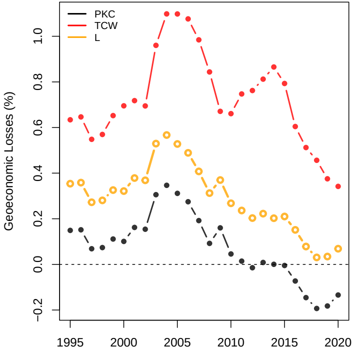
Geoeconomic Losses: $\mathcal{L}_n \equiv s_{nm} \times \texttt{PKC}_n + (1 - s_{nm}) \times \texttt{TCW}_n$, with $s_{nm} = \frac{1}{\eta^2} \times (\texttt{OCW}_n + \texttt{OCW}_j)^2$



(a) $\texttt{OCW}$ and s



(b) $\mathcal{L}_{\text{USA}}$



(c) $\mathcal{L}_{\text{CHN}}$

Simulation of a post-2018 derisking

- CF scenario: ΔTrade Cost$_{\text{CHN}\to\text{USA}}$ in 2018
- Δ means with / without derisking here
- Welfare change decomposes into standard peacetime welfare gains + geoeconomic gains

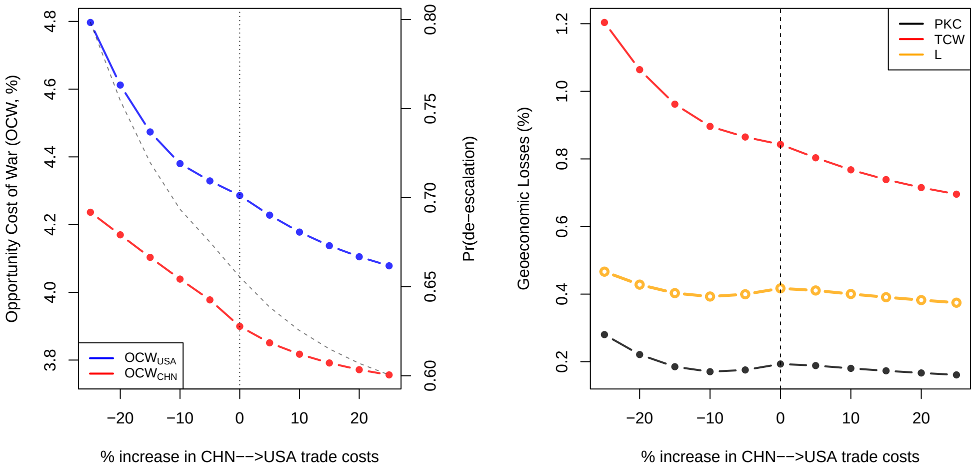
$$\Delta\mathbb{E}\tilde{U}_n = \Delta \log C_n(\text{peace}) - \Delta\left[s_{nm} \times \texttt{PKC}_n + (1 - s_{nm}) \times \texttt{TCW}_n\right]$$

- Security dilemma related to trade dependence vis-a-vis geopolitical rivals
  - ▷ Decoupling = policy-induced decrease in bilateral over multilateral sourcing
  - → $\Delta\texttt{OCW}_n < 0$
  - → Welfare gain: $\Delta\texttt{PKC}_n < 0$ and $\Delta\texttt{TCW}_n < 0$
  - → Welfare loss: $\Delta s_{nm} < 0$
  - → Net effect? Calls for a quantification!

"Derisking": Unilateral $\nearrow \tau_{\text{CHN}\to\text{USA}}$ (I/O, $\alpha = -3\%$, $\eta = 0.101$)

(a) `OCW` and s

(b) $\mathcal{L}_{\text{USA}}$

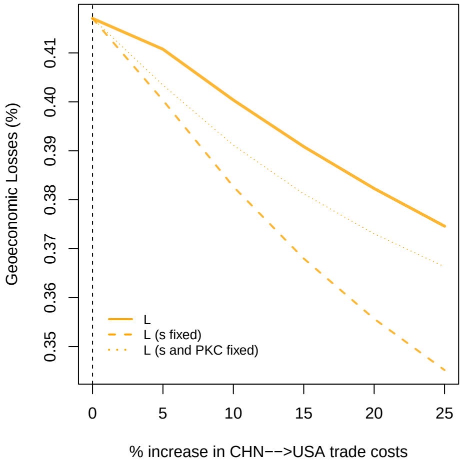


Interpretation

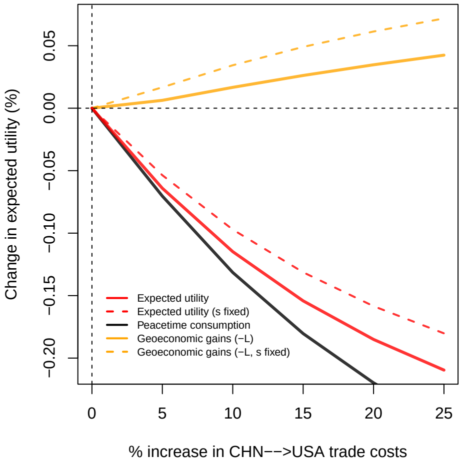
- Increase in tariffs reduce bilateral dependence and therefore $\texttt{OCW}$
- Reduction of dependence on China reduces $\texttt{TCW}$ for the USA, the desired effect.
- Also reduces $\texttt{PKC}$, which improves welfare if peace is guaranteed $(s = 1)$
- However, peace becomes less likely (when $\nearrow \tau$ reduce $\texttt{OCW}$ enough)
- Hence, total geoeconomic loss $(\mathcal{L}_{\text{USA}})$ goes from the black to the red curve
- Net effect on welfare is ambiguous, here decreasing...
- ...which would not be the case without adjusting s.

Welfare under the shadow of war (I/O, $\alpha = -3\%$, $\eta = 0.101$)

(a) $\Delta \mathcal{L}_{\text{USA}}$ with and w/o Δs



(b) Decomposing $\Delta \mathbb{E}\tilde{U}_{\text{USA}}$



Interpretation, cont.

- Reduction in consumption dominates quantitatively the geoeconomic gains
- The fall in PKC compensates but less so as s falls
- Keeping s unchanged amplifies the geoeconomic gains.
- Reduction of dependence on China reduces `TCW` for the USA only helps total welfare if s gets really small (war very likely, indeed reducing true cost of war makes sense)

Section 4

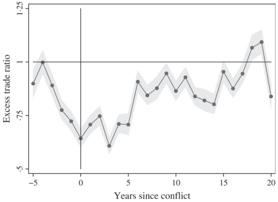
Additional material

Gravity to measure $\texttt{OCW}_n$ (simplest case, no I/O, one factor)

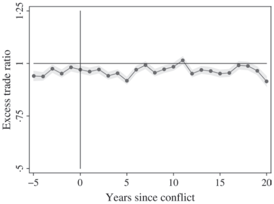
- How to measure the ratio of peace/wartime real consumption (welfare in that setup)?
- Need a model to rationalize changes in consumption + output following shocks
- Ideally tractable enough for estimation (τ^{bil} and τ^{mul}) + counterfactual analysis
- Gravity is the tool needed. Bilateral share of expenditure of n:

$$\pi_{mn} \equiv \frac{(\tau_{mn} w_m / A_m)^{\epsilon}}{\sum_k (\tau_{kn} w_k / A_k)^{\epsilon}}, \quad \Rightarrow \quad \log(\pi_{mn}) = \epsilon \log \tau_{mn} + \text{FE}_m + \text{FE}_n.$$

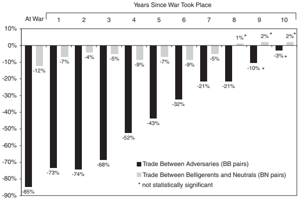
- Allows to estimate effects of wars on trade costs (change in τ).



(a) MMT (2008): τ^{bil}



(b) MMT (2008): τ^{mul}



(c) Glick and Taylor (2010)

Gravity to measure $\texttt{OCW}_n$, cont.

- Gravity also makes counterfactuals very easy. Exact Hat Algebra ($\hat{x} = x'/x$):
- Production: $Y_m = w_m L_m$, with L_m constant, $\hat{w}_m = \hat{Y}_m$.
- Expenditure: $X_n \neq Y_n$, because of trade deficits. Assume that deficit is exogenously given on a per capita basis, $D_n = L_n d_n$. Then $X_n = w_n L_n(1 + d_n)$, so that $\hat{X}_n = \hat{w}_n = \hat{Y}_n$.

$$\hat{\pi}_{mn} = \frac{(\hat{Y}_m \hat{\tau}_{mn} / \hat{A}_m)^\epsilon}{\sum_\ell \pi_{\ell n} (\hat{Y}_\ell \hat{\tau}_{\ell n} / \hat{A}_\ell)^\epsilon}.$$

- Using the market clearing condition that $Y'_m = \sum_n \pi'_{mn} X'_n$:

$$\hat{Y}_m = \frac{1}{Y_m} \sum_n \hat{\pi}_{mn} \pi_{mn} \hat{Y}_n X_n = \frac{1}{Y_m} \sum_n \frac{\pi_{mn} (\hat{Y}_m \hat{\tau}_{mn} / \hat{A}_m)^\epsilon}{\sum_\ell \pi_{\ell n} (\hat{Y}_\ell \hat{\tau}_{\ell n} / \hat{A}_\ell)^\epsilon} \hat{Y}_n X_n.$$

- Fixed point in vector of $\hat{Y}_m$ gives the new equilibrium.

Counterfactual Simulations: Welfare changes in the model

- Arkolakis et al. (2012) formula for change in welfare ($\omega_n = \frac{w_n}{P_n}$).
- Self trade share:

$$\pi_{nn} = (\tau_{nn} w_n / A_n)^{\epsilon} P_n^{-\epsilon} \quad \Rightarrow \quad \frac{w_n}{P_n} = \pi_{nn}^{\frac{1}{\epsilon}} \times \frac{A_n}{\tau_{nn}}$$

- Assume that τ_{nn} are unaffected by CF:

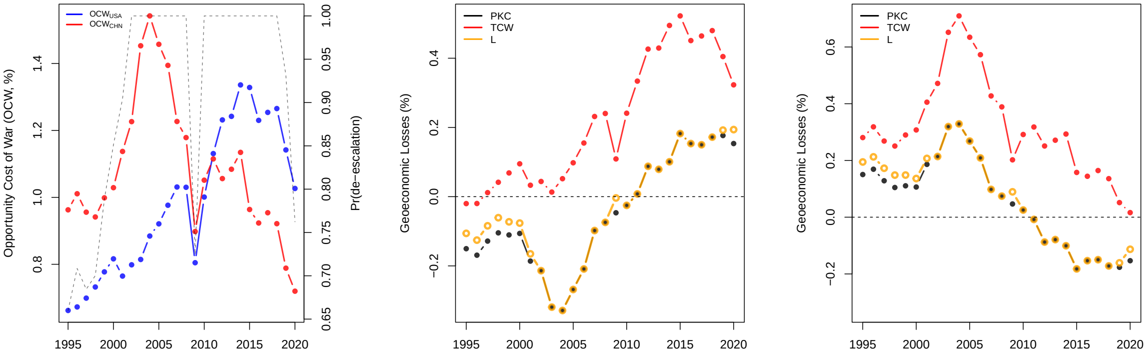
$$\frac{\omega_n'}{\omega_n} = \left(\frac{\pi_{nn}'}{\pi_{nn}}\right)^{\frac{1}{\epsilon}} \times \frac{A_n'}{A_n} \quad \Rightarrow \quad \hat{\omega}_n = (\hat{\pi}_{nn})^{\frac{1}{\epsilon}} \hat{A}_n.$$

- First term is traditional ACR formula. Second term is the change in TFP caused by wars.
- When CF is war, $\texttt{OCW}_n = -\log(\hat{\omega}_n)$
- More elaborate versions of this will take into account I/O linkages, endogenous labor supply etc., but the fundamental intuition remains: Larger trade costs cause a rise in self-trade, all the more costly that goods are weak substitutes. TFP fall is a direct cost.

Back

Decomposing Geoeconomic Losses (I/O, $\alpha = 0$, $\eta = 0.02$)

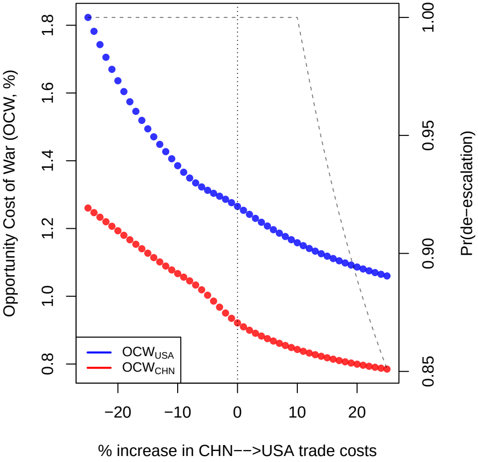
Geoeconomic Losses: $\mathcal{L}_n \equiv s_{nm} \times \texttt{PKC}_n + (1 - s_{nm}) \times \texttt{TCW}_n$, with $s_{nm} = \frac{1}{\eta^2} \times (\texttt{OCW}_n + \texttt{OCW}_j)^2$



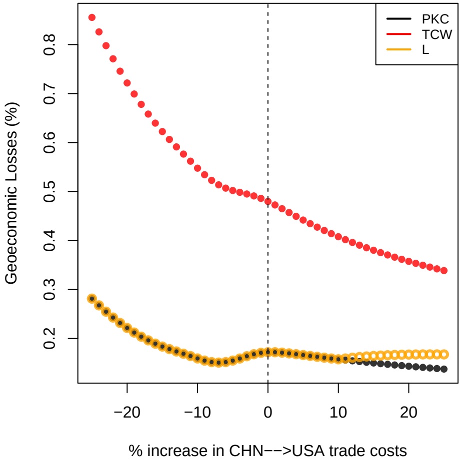
(a) $\texttt{OCW}$ and s (b) $\mathcal{L}_{\text{USA}}$ (c) $\mathcal{L}_{\text{CHN}}$

"Derisking": Unilateral $\nearrow \tau_{\text{CHN}\to\text{USA}}$ (I/O, $\alpha = 0$, $\eta = 0.02$)

(a) OCW and s

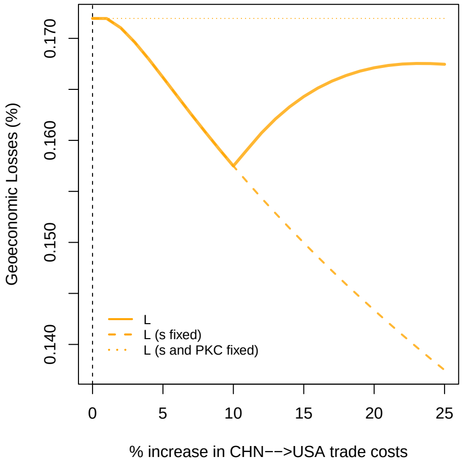


(b) $\mathcal{L}_{\text{USA}}$



Welfare under the shadow of war (I/O, $\alpha = 0$, $\eta = 0.02$)

(a) $\Delta\mathcal{L}_{\text{USA}}$ with and w/o Δs



(b) Decomposing $\Delta\mathbb{E}\tilde{U}_{\text{USA}}$