War and Trade

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New geoeconomic realities

Current state of world affairs doesn't look so good

- Outright war and increasing geopolitical tensions
- Increasing economic fragmentation

30 years ago we didn't think we'd end up here

- How did it come to that?

Lasting peace?

End of cold war

- End of history
- Promise that globalization would lead to lasting peace

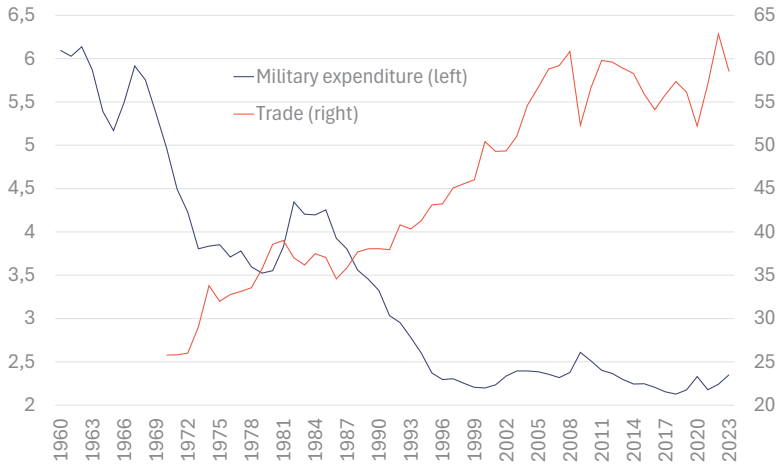
Liberal paradigm

- First articulated by Montesquieu (1748): "Peace is the natural effect of trade."
- War is bad for trade $\leftrightarrow$ Trade is bad for war

New world equilibrium should feature lots of trade and little conflict

World didn't look so bad until recently

Percent of world output (Source: World Bank)



What I'll talk about next . . .

Part I. War is indeed bad for trade

- Costs of war massive war site, but also for neighbors
- These costs materialize via trade

Part II. How trade impacts the probability of war

- Martin et al model (2008) and Thoenig's fundamental security dilemma (2024)

Part III. The Montesquieu model (work in progress)

- Interdependence of trade and interstate conflict
- Unstable equlibria and trade traps

Part I: War → Trade

"The Price of War"

joint with Jonathan Federle, Andre Meier, Willi Mutschler & Moritz Schularick

What is the macroeconomic impact of war?

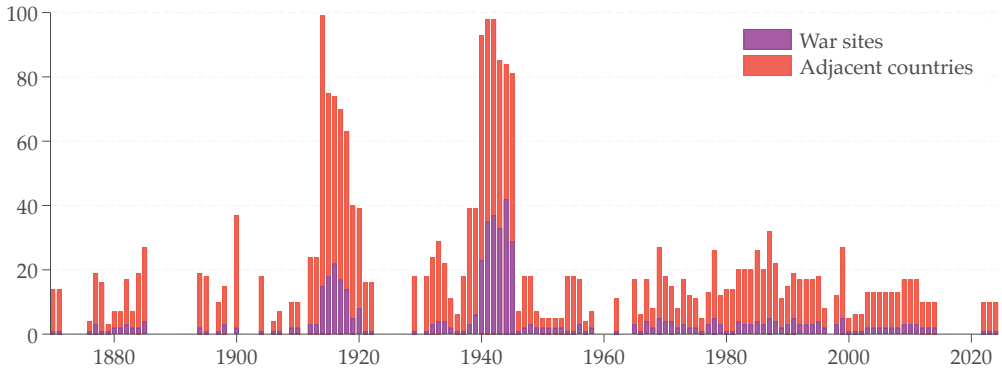
- Military buildups expansionary (Ramey Shapiro 1998, Ilzetzki 2024)
- Death and destruction of the war-site contractionary: many economic disasters associated with wars on country's own soil (Barro 2006)

What about other countries? Do they pay a price for the war as well?

- Potentially strong economic spillovers from war site to other countries, depending on geographic distance
- Nearby countries pay substantial price of war, even if not party to war

Countries exposed to interstate wars 1870–2023

Unconditional prob. war site: 2.4% v 11.5% for war next door



Annual observations: 1870–2023

Outcome variables: output and inflation for up to 60 countries

- Macroeconomic History Base (Jorda Schularick Taylor), extended in Funke Schularick Trebesch (2023)

Bilateral distance from war site measured in kilometers

- Distance of two most populated cities across countries (Mayer Zignago 2011)

Analysis centered around war sites

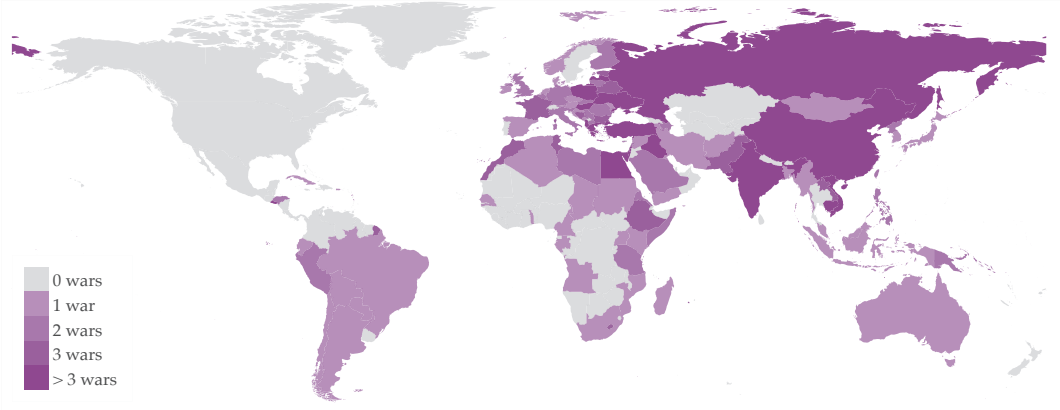
- *Correlates of War project* (Sarkees Wayman, 2010): all interstate wars ($>1\,000$ battle deaths) between 1816 and 2007 & updated (UCDP + Invasion of Ukraine): 75 wars
- Geolocate war sites: digitize disaggregated battle-level data based on Clodfelter (2017) and various other sources

War sites

- Geolocate 1625 battles: collect number of deaths, missing, wounded (causalities)
- Aggregate back to country level **using today's borders**
- Cross-check via GPT-4 yields another 5 war sites
- Exclude battles taking place far from core territory (e.g., Aleutian Islands in WW2)

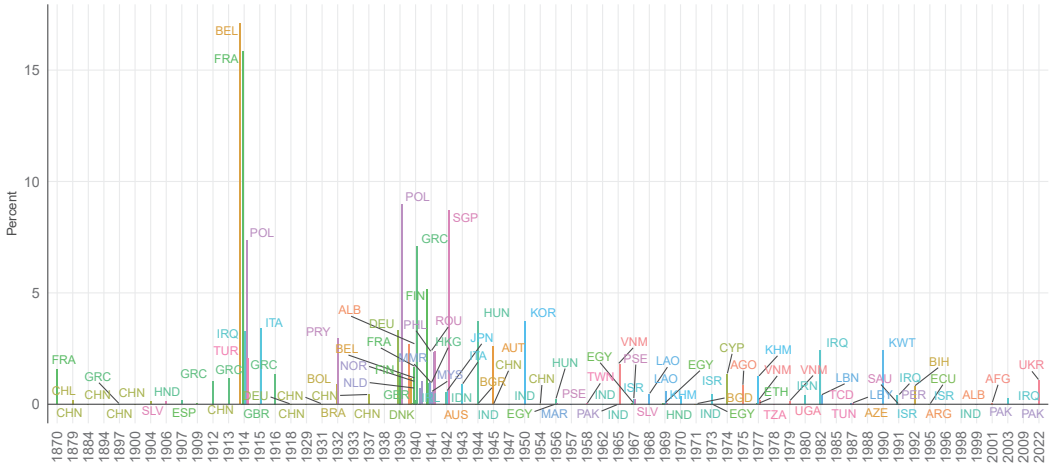
Casualties		Length		Wars	Macro time-series for...		
Min	Mean	Mean	Median	Total	Sites	Belligerents	Third
2	220,134	2.5	2	224	86	122	2,525

All war sites 1870–2023 (geographical distribution)

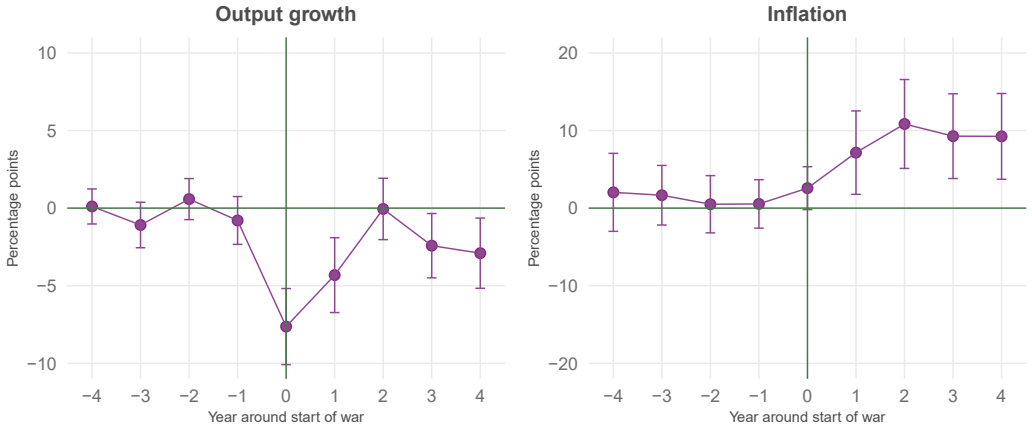


Severity of war in terms of casualties

Restricted sample (population data)



Growth and inflation around start of war



Are wars exogenous to the business cycle?

Common assumption in fiscal policy literature

- Military spending (news) good instrument (e.g., Ramey Shapiro 1998, Barro Redlick, 2011; Ramey Zubairy, 2018; Miyamoto et al 2019)

Some evidence that US Presidents more likely go to wars

- In times of economic stress (Ostrom Job 1986)
- During recession & if president up for reelection (Hess Orphanides 1995)

Verify using a narrative approach a la Romer Romer (2010)

- Classify *casus belli* for all wars in our sample
- Initial classification according to the warfare encyclopedia by Clodfelter (2017)
- Cross-checks based on more than 80 different (historical) sources

Why countries go to war: 8 non-exclusive categories

	Notion	# Wars
Nationalism	Creation of own sovereign state, wars for independence, imperialism	46
Power Transition or Security Dillemma	Rising power challenges a dominant one, arms races, security dilemma	33
Religion or Ideology	Deep-rooted disagreements over religious beliefs or ideologies (e.g., communism)	23
Border Clashes	Unclear borders or intensifying border clashes	15
Economic, Long-Run	Control over trade routes, markets, or valuable resources; economic rivalry and protectionism	10
Domestic Politics	Leaders may use foreign war to distract from domestic issues or to rally their population around a common cause	8
Revenge/Retribution	Wars can be initiated in response to perceived wrongs or to regain lost honor, even if there's no tangible gain to be had	3
Economic, Short-Run	Economy in severe recession (e.g., unemployment is high)	2

Empirical framework

Variables capture start of the war: country i is ...

- $Site_{i,t} = 1$ if war starts on soil of country i in year t
- $Third_{i,t} = \sum_{j \in T_{i,t}} \varepsilon_{j,t}$ if war starts in country j (and i is not participating) where $\varepsilon_{j,t} \equiv GDP_{j,t-1}/GDP_{world,t-1}$ is economic size of war site

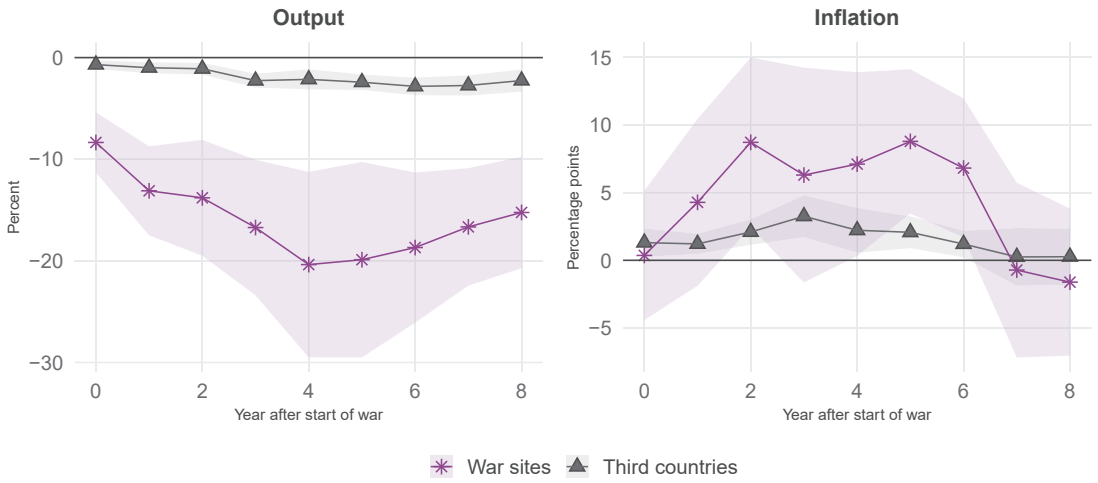
Estimate dynamic effect of war in sites and third countries

$$x_{i,t+h} - x_{i,t-1} = \alpha_{i,h} + \gamma_h Site_{i,t} + \psi_h Third_{i,t} + \zeta_h Controls_{i,t} + u_{i,t+h}$$

- $x_{i,t+h}$: output or inflation (baseline)
- Controls: 4 lags of dependent variable and regressors

Strong adverse effect on war site, small spillovers **on average**

War site accounts for 5% of world GDP



Zooming in: condition spillovers on **distance** from sites

Smooth transition model

$$x_{i,t+h} - x_{i,t-1} = \cdots + \psi_{n,h}\left[1 - F(i,t)\right] Third_{i,t} + \psi_{d,h} F(i,t)\, Third_{i,t} + \ldots$$

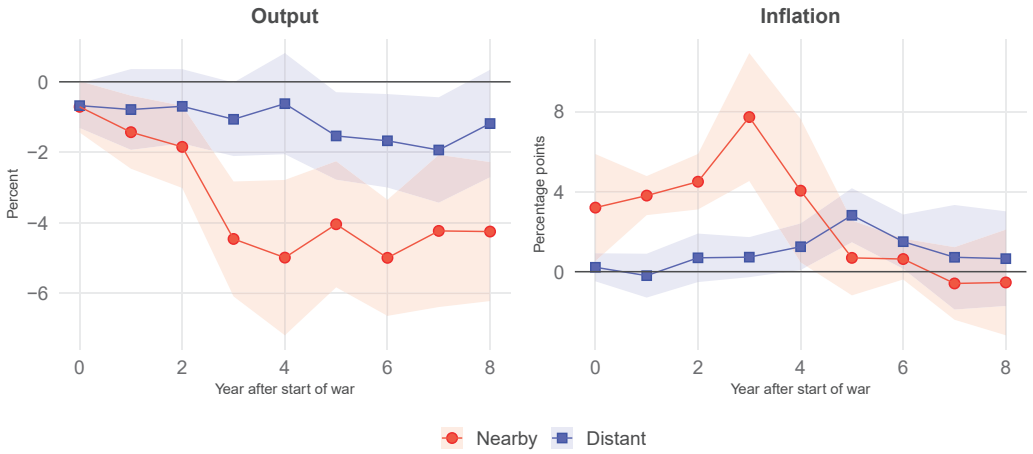
- Limiting cases: $\psi_{n,h}$ (nearby) v $\psi_{d,h}$ (distant)
- Spillovers depend on shock-weighted normalized distance

$$F(i,t) = \sum_{j \in T_{i,t}} \frac{\varepsilon_{j,t}}{\sum_{k \in T_{i,t}} \varepsilon_{k,t}} \left[\frac{\ln(1 + d_{i,j})}{\ln(1 + d^{\max})} \right],$$

where $d_{i,j}$ denotes geographic distance between countries i and j, and d^{max} maximum distance between any two countries

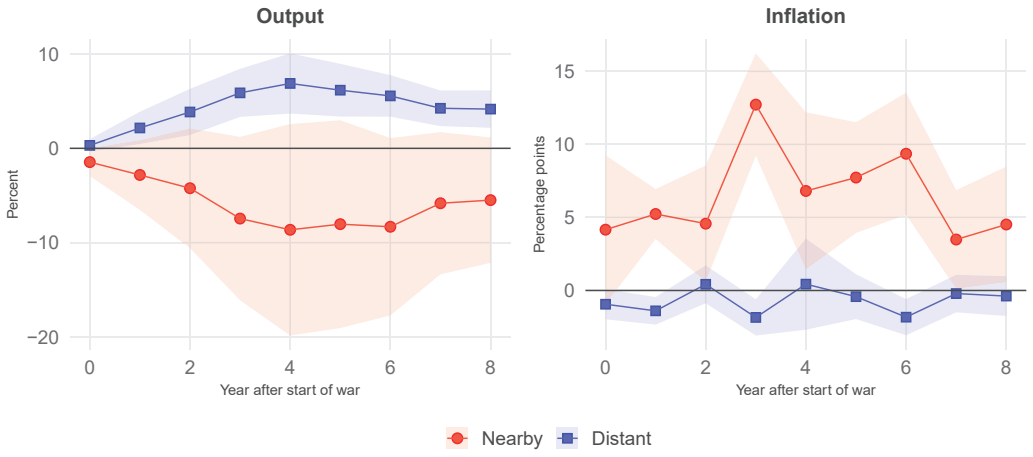
Strong adverse spillovers on **third countries** if close to war site

War site accounts for 5% of world GDP



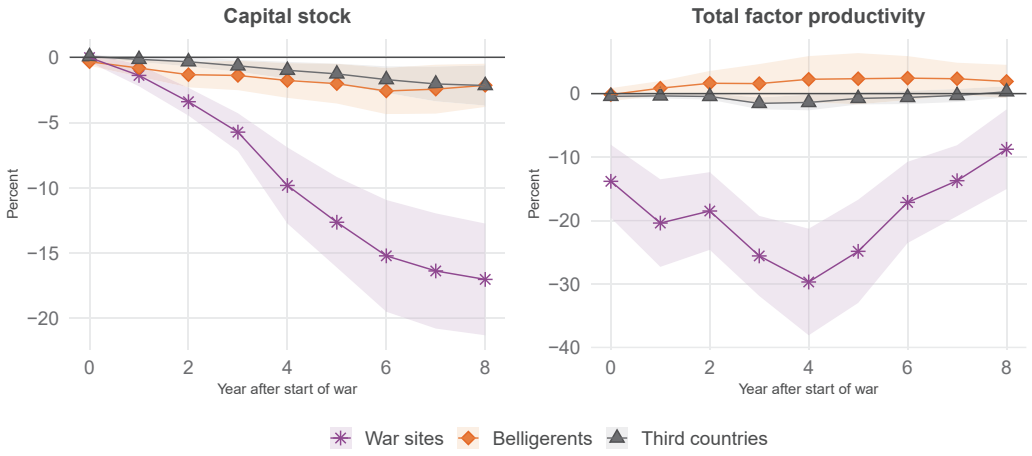
Spillovers to **belligerents**

War site accounts for 5% of world GDP



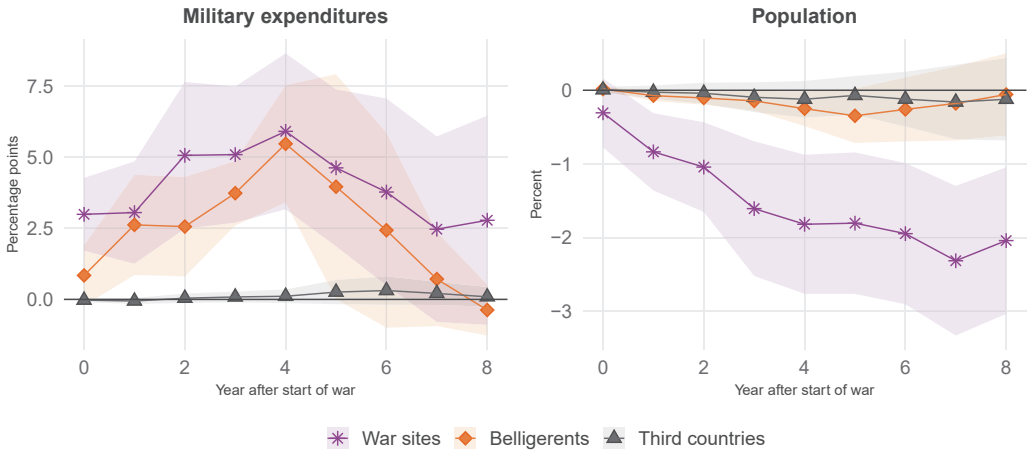
Evidence on underlying causes

Source: Long-Term Productivity Database (Bergeaud et al 2016); restricted sample

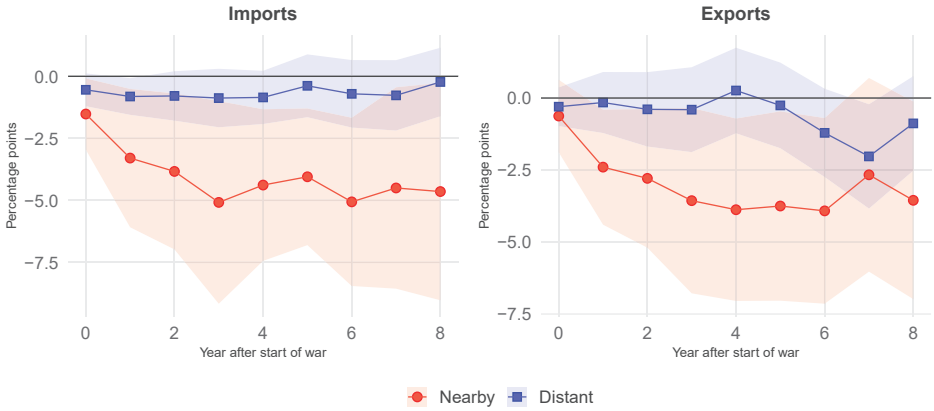


Evidence on underlying causes cont'd

Source: Correlates of War / Maddison project; restricted sample



Trade suffers, too



Structural interpretation

Multi-country model (Gopinath et al 2020, Eichenbaum et al 2021)

- Site, Nearby, Distant, each 5% of world output; and Rest of the World
- Site and Nearby fully integrated; little trade with Distant
- Intermediate inputs in production
- Incomplete financial markets; labor and capital immobile across countries
- Monopolistic competition & stickiness in labor and goods market
- Monetary policy determined by money growth rules

War as AR(2) shock with 4 dimensions

(i) Destroys capital stock in **Site (only)**, as in rare disasters (Gourio 2012)
(ii) Reduces TFP in **Site (only)**, as in rare disasters (Gourio 2012)
(iii) Raises military spending in **Site (only)**
(iv) Monetary policy accommodates **globally**, but to different degrees

Model outline

Household objective in country j

$$E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \frac{1}{1-\sigma^C} \left(C_{j,t}(h) - \phi^C c_{j,t-1} \right)^{1-\sigma^C} - \frac{\chi^L}{1+\sigma^L} (L^s_{j,t}(h))^{1+\sigma^L} \right\}$$

Owns internationally immobile capital stock, $k_{j,t}$, which evolves according to:

$$k_{j,t} = \left((1-\delta^K) k_{j,t-1} + \Phi^K \left(\frac{i_{j,t}}{k_{j,t-1}} \right) k_{j,t-1} \right) e^{-\Delta^K_j \omega_t}$$

War shock follows AR(2) process:

$$\omega_t = \rho^\omega_1 \omega_{t-1} + \rho^\omega_2 \omega_{t-2} + \eta_t$$

Budget constraint of county j in real per-capita terms:

$$c_{j,t} + i_{j,t} + \mathcal{E}^r_{Rj,t} b_{Rj,t} + \frac{\phi^B}{2} \left(\mathcal{E}^r_{Rj,t} b_{Rj,t} \right)^2 + \tau_{j,t}$$
$$= \frac{1}{n_j} \int_{\mathcal{N}_j} \frac{W_{j,t}(h) L^s_{j,t}(h)}{P_{j,t}} dh + r^K_{j,t} k_{j,t-1} + \mathcal{E}^r_{Rj,t} \frac{R_{R,t-1}}{\Pi_{R,t}} b_{Rj,t-1} + \sum_i div_{ji,t}$$

Final good is CES aggregate of wholesale goods from country i

$$y_{j,t} = \left(\gamma_{jj}^{\frac{1}{\sigma}} y_{jj,t}^{\frac{\sigma-1}{\sigma}} + \sum_{i \neq j} \gamma_{ij}^{\frac{1}{\sigma}} \left[\varphi_{ij,t} y_{ij,t} \right]^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$$

with $\gamma_{jj} = 1 - \sum_{i \neq j} \gamma_{ij}$. σ is trade-price elasticity and $\varphi_{ij,t}$ import-adjustment costs.
Import shares reflect size and home bias

$$\gamma_{ij} = \Omega_{ij}\ n_i, \text{ where in calibration } \Omega_{HN} = \Omega_{NH} = 1$$

Producers operate under monopolistic competition with Calvo price setting constraint assuming producer currency pricing (PCP)

Production function:

$$A_{j,t}(X^d_{j,t}(m))^{\alpha^X}\left(K^d_{j,t}(m)^{\alpha^K}L^d_{j,t}(m)^{1-\alpha^K}\right)^{1-\alpha^X} = \sum_i Y^d_{ji,t}(m).$$

where $x_{j,t} = \frac{1}{n_j}\int_{\mathcal{N}_j} X^d_{j,t}(m)dm$ are intermediate inputs in production (sourced from final goods)

Productivity subject to war shock:

$$\log(A_{j,t}/A_j) = \rho^A \log(A_{j,t}/A_j) - \Delta^A_j \omega_t$$

Market clearing for final goods

$$y_{j,t} = c_{j,t} + i_{j,t} + x_{j,t} + \frac{P_{jj,t}}{P_{j,t}}g_{j,t} + \frac{\phi_b}{2}\left(\mathcal{E}^r_{Rj,t}b_{Rj,t}\right)^2$$

where $g_{j,t}$ is per-capita government spending (funded through lump-sum taxes) and impacted by war shock

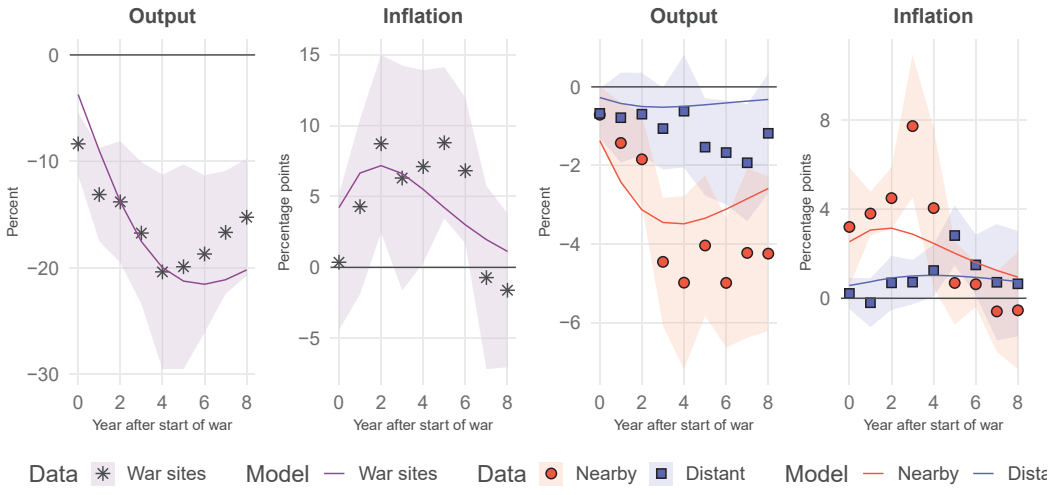
$$\frac{g_{j,t}}{gdp_j} = \left(\frac{g_j}{gdp_j}\right) + \Delta^G_j\ \omega_t$$

Monetary policy

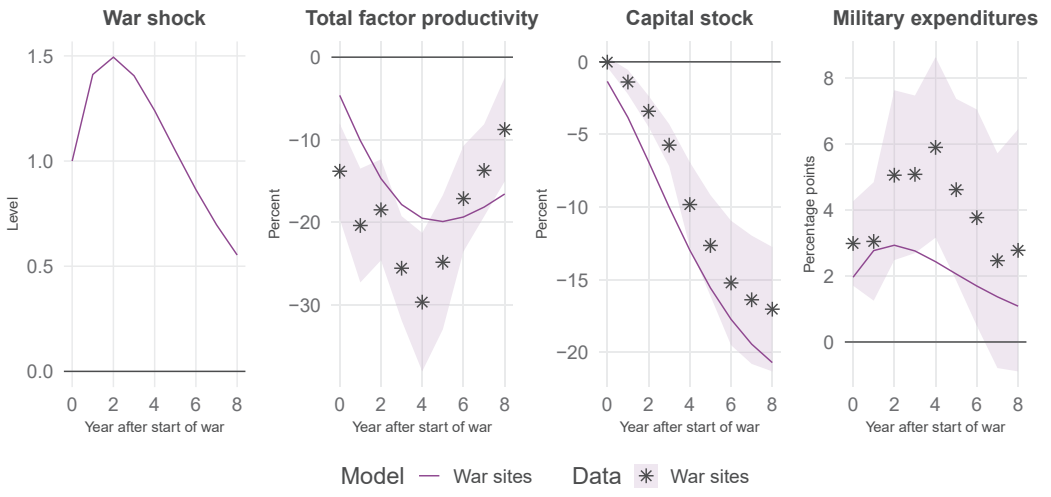
$$\left(\frac{M_{j,t}}{M_{j,t-1}}\right) = (1-\rho^M_j)\Pi_j + \rho^M_j\left(\frac{M_{j,t-1}}{M_{j,t-2}}\right) + \Delta^M_j\ \omega_t$$

Real GDP defined as value added: $gdp_{j,t} = y_{j,t} - x_{j,t}$

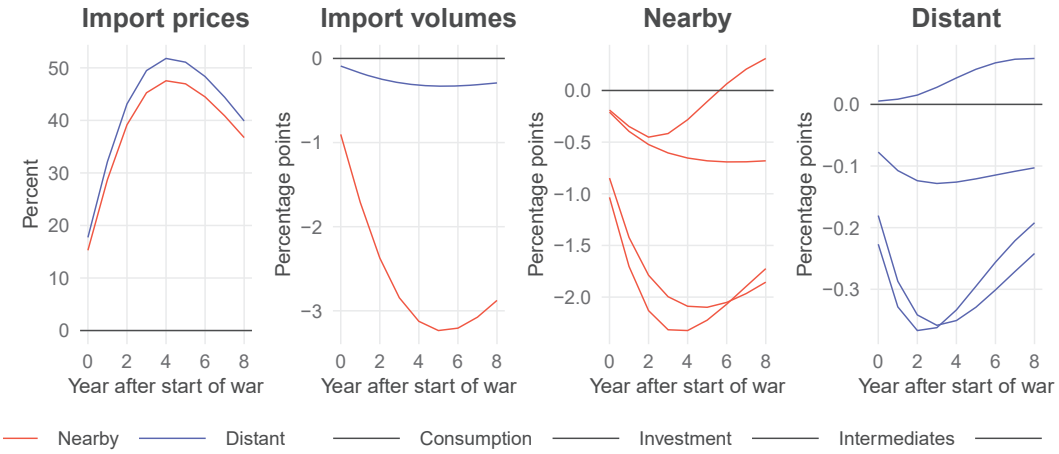
Macroeconomic impact of war in Site, Nearby, and Distant



Implications of calibrated model—External validation



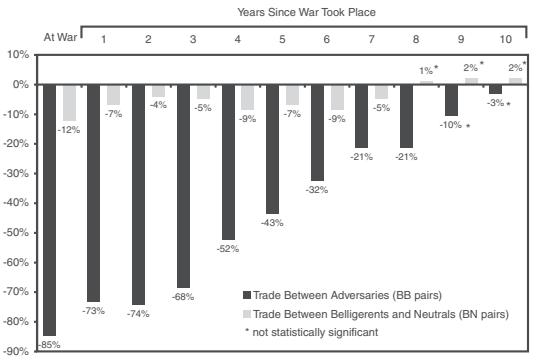
Mechanism: adverse supply side spillovers materialize via trade



Direct evidence on the effect of war on trade based on gravity

Figure: Glick and Taylor (2010)

FIGURE 1.—IMPACT OF WAR ON TRADE FOR A GIVEN COUNTRY PAIR: CONTEMPORANEOUS IMPACT AND LAGS 1 THROUGH 10



Source: Table 3, column 1.

Part II: War ← Trade

Martin et al (2008) model of war ("Make trade not war")

Exposition follows generalization of Thoenig (2024): "Trade in the shadow of war"

Trading partners i and j face exogenous conflict

- Escalation into war determined endogenously
- Trade determines the opportunity costs of war (OCW)
- Together with (unobserved) utility costs of war u_i and u_j

Game of diplomatic negotiation

- Leaders strategically misreport their OCW: War avoided if $OCW_i + OCW_j > 0$
- Country with higher OCW pays transfer (PKC: peace keeping costs)
- Diplomacy helps avoiding most destructive wars (WIM: war intensity mitigation)

Gravity model of trade: geography of import sourcing

- Bilateral trade raises OCW: trade frictions between belligerents increase
- Multilateral trade lowers OCW: substitute away from expensive belligerent goods

Evidence: bilateral (multilateral) trade makes escalation less (more) likely

Martin et al (2008)

TABLE 3

Impact of trade on military conflict—I (benchmark results)

	Dependent variable: MID					
	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
ln bil. openness $t-4$	−0·090 ***	−0·127 **	−0·851 ***	−0·236 *	0·271	−0·003
	(0·032)	(0·050)	(0·163)	(0·132)	(0·178)	(0·009)
ln mult. openness $t-4$	0·039	0·275 **	1·922 ***	1·520 ***	1·315 **	0·159 ***
	(0·106)	(0·124)	(0·556)	(0·451)	(0·585)	(0·030)

. . . lots of additional controls

Important qualification to liberal paradigm

- More multilateral trade can raise probability of escalation of conflict into war

Quantitative analysis of Thoenig (2024)

Country pairs with history of violence; calibration based on 2018 data; s_{ij} is prob. of deescalation

TABLE 2 Estimates of geoeconomic factors in 2018.

		Import Shares		OCW		PKC	WIM	s_{ij}	PVP
		Bilateral	Multilateral	Ctry 1	Ctry 2				
IND	PAK	.8	45.2	6.8	7.1	.1	1.6	73.1	2.4
ISR	EGY	.5	100	4.9	5.9	.5	1.1	44.1	5.5
ZAF	AGO	2.4	80.9	6.2	6.5	.2	1.4	60.8	3.6
ECU	PER	2.7	65.7	6.6	7.1	.2	1.6	70.4	2.6
GRC	TUR	2.3	93.3	6	6.1	0	1.3	54.4	4.3
CHN	USA	8.6	37.8	7.9	10	1.1		100	−1.6
RUS	UKR	7.3	65.5	6.9	8.9	1	1.9	94	.5
FRA	DEU	27.3	105.4	13.9	9	−2.4		100	−6.6
Prox.	Pairs	3.6	105	6.1	5.9	−.1	1.1	53.4	4.3

Note: Each row reports the geoeconomic factors attached to a dispute (susceptible to escalate into an armed conflict) between the two countries of the pair under consideration. Numbers represent percentages. Bilateral and multilateral import sourcing are obtained by summing within the country-pair bilateral import shares in expenditures and total import shares net of bilateral imports (2018 trade data from Head and Mayer (2021). Col. 5 and 6 display the Opportunity Costs of War for countries 1 and 2. Col. 7 reports the Peace Keeping Costs for country 2. Col. 8, 9 and 10 respectively display the War Intensity Mitigation effect of diplomacy, the conditional probability of deescalation and the Pivotal Valence of Peace for the country-pair. The bottom row reports averaged values across the 443 pairs of countries in the sample distant less than 1000 km from each other.

Thoenig's "Fundamental Security Dilemma"

Intensify bilateral trade

- More bilateral trade raises OCW: lowers prob. of war
- Favorable as long as there is no war

Diversify trade

- Lowers OCW: raises prob. of war
- But favorable in case there is war

Thoenig offers quantitative framework to work out tradeoff

- Still very stylized... among other things: does not allow for feedback from risk of war on firm's sourcing decisions

Part III: War $\leftrightarrow$ Trade

"Montesquieu Model"

joint work with Jonas Adolph and Willi Kohler

Focus on trading decisions in domestic economy

- Private sector and government run mix strategies
- Trade and risk of trade disruption ("escalation") jointly determined in equilibrium

Private sector: heterogeneous firms decide on offshoring

- Efficiency v risk of trade disruption
- All else equal, lower risk of trade disruption raises offshoring

Government: decides on whether to escalate geopolitical conflict $\rightarrow$ trade disruption

- Geopolitical benefit (exogenous) v private sector costs
- All else equal, more offshoring leads to lower disruption probability

Montesquieu Model: private sector

Two country Melitz-Chaney (labor only) model with fixed number of firms

- Productivity φ distributed Pareto with shape κ
- CD-CES preferences over numéraire good and differentiated sector(s), with subst. elast. σ
- Countries denoted by D (domestic) and F (foreign)

Differentiated varieties, produced as in Antras Helpman (2004) and Antras (2015)

- Specific, customized inputs, yet complete contracts
- Headquarter services always sourced in D, manufacturing inputs sourced in D or F
- Foreign variable cost advantage $k > 1$, but fixed cost disadvantage $f > 0$

Montesquieu Model: private sector

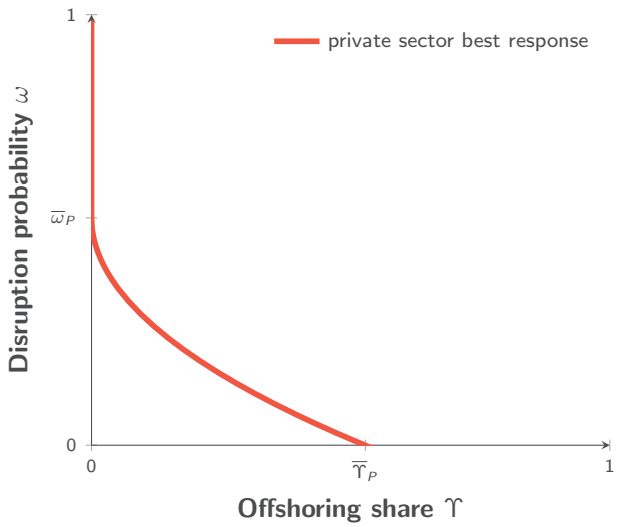
Firms maximize expected profits subject to demand

- Given probability of trade disruption: ω
- Productivity cut-off of offshoring $\widetilde{\varphi}_O(\omega)$
- Cut-off higher if disruption more likely
- Use distribution of productivity $G(\varphi)$ to find private sector best response

$$\Upsilon^{\theta}(\omega) = 1 - G(\widetilde{\varphi}_O(\omega)) = \frac{s}{f}\left[(1-\omega)\,k - 1\right]$$

- Higher disruption probability lowers share of offshoring firms
- Share of offshoring firms increasing in market size s and variable cost advantage k, falling in fixed cost disadvantage f
- $\theta := (\sigma - 1)/\kappa$ is a constant

Montesquieu Model: private sector



Private sector best response

- $\overline{\Upsilon}_P$: offshoring share without disruption risk
- $\overline{\omega}_P$: level of risk above which no offshoring
- For $\omega \in (0, \overline{\omega}_P)$: Offshoring share falling in disruption probability

Montesquieu Model: government behavior & equilibrium

Government decides on whether to escalate conflict into trade disruption

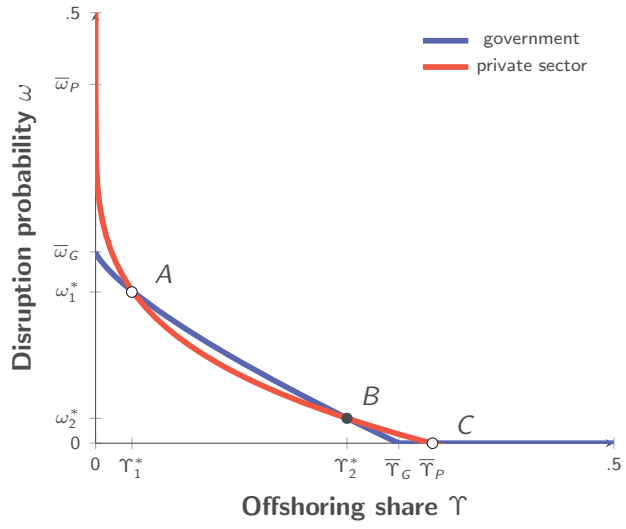
- Geopolitical benefits random $\nu \sim U(\underline{\nu}, \overline{\nu})$
- Economic costs: foregone operating profits of firms $C(\Upsilon) = \frac{Bw_F^{(1-\eta)(1-\sigma)}}{1-\theta}\Upsilon^{1-\theta}$

Disruption probability

$$\omega_G(\Upsilon) = \begin{cases} 1 - \frac{C(\Upsilon) - \underline{\nu}}{\overline{\nu} - \underline{\nu}} & \text{if} \quad C(\Upsilon) \in [\underline{\nu}, \overline{\nu}] \\ 1 & \text{if} \quad C(\Upsilon) < \underline{\nu} \\ 0 & \text{if} \quad C(\Upsilon) > \overline{\nu} \end{cases}$$

Equilibrium in mixed strategies: $\omega^* = \omega_G[\Upsilon_P(\omega^*)]$

Montesquieu Model: multiple equilibria



Multiple equilibria

- A: Low trade & high disrup. prob
- B: intermed. trade & disruption risk
- C: high trade & no disruption risk

Interior equilibrium B *unstable*

Consider deviation from eq. disruption prob. $\omega_0 < \omega^*$

- More firms go in; disruption prob. lower falls further still ...
- Convergence to high trade equilibrium C

Consider deviation from eq. disruption prob. $\omega_0 > \omega^*$

- Less sourcing, disruption prob. higher increases further ...
- Convergence to low trade equilibrium A

Model prediction: convergence to bipolar distribution of trade-&-conflict relations

Confront model prediction with data

Consider data on bilateral import shares

- Sample covers 155 countries and spans years from 1966 to 2018
- Data on tariffs and trade agreement included as well

Analysis based on standard gravity model

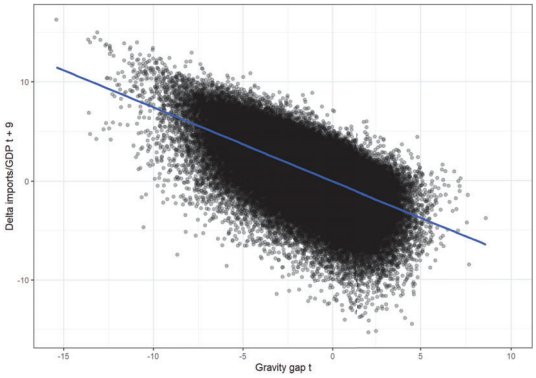
$$imports_{ijt} = \exp\{\alpha_1 EIA_{ijt} + \alpha_2 \log(1 + tariff_{ijt}) + \gamma_{ij} + \gamma_{it} + \gamma_{jt}\} \times \epsilon_{ijt}$$

Montesquieu model

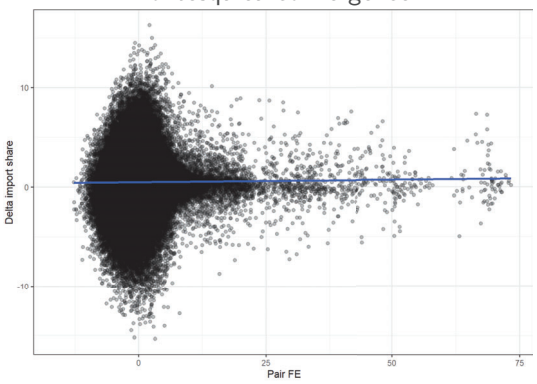
- Country-pair fixed effect γ_{ij} absorbs (among other things) effect of ω on trade
- All else equal, high (low) ω results in more negative (positive) γ_{ij}
- For intermediate values of ω, we expect, all else equal, $|\gamma_{ij}|$ to be small

Vertical axis measures changes in import share over next 10 years

Gravity convergence



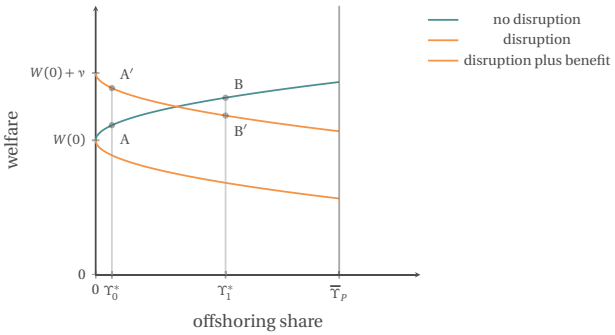
Montesquieu convergence



Consistent with model prediction: intermediate trade levels unstable

- Consistent with convergence to low-trade-high-conflict equilibrium

Not necessarily a bad thing: consider ex post welfare



Trade trap

- B dominates B': no disruption when trade is high
- A dominates B: policy maker would prefer low-trade equilibrium w/ disruption

5. Some tentative conclusions

Does the current state of world affairs refute the liberal paradigm?

- War **is** bad for trade; and costs of war materialize via trade

But the pacifying effect of trade requires some qualification

- **Multilateral** trade lowers OCW and hence raises probability of war
- Low-trade-high-risk equilibria co-exist with high-trade-low-risk equilibria: country pairs converge to either of the two

Insights for policy

- De-risking/diversification strategies ambiguous (fundamental security dilemma)
- Trade trap: too much trade limits policy options