Navigating Shocks:
The Ripple Effects of Shipping Route Closures

UKTPO Conference, London — 26 November 2026

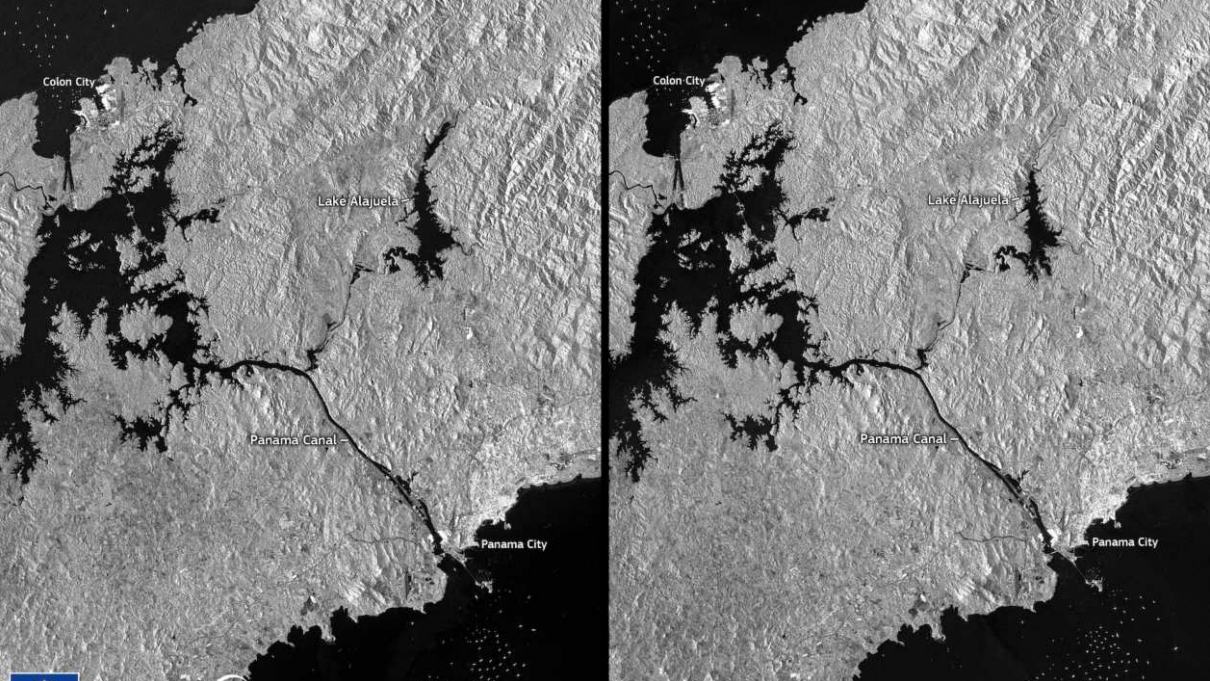
Carsten Brockhaus,[1,2] **Julian Hinz**[1,3], Charles Serfaty[4]

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[3] Bielefeld University [4] Banque de France

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Colon City
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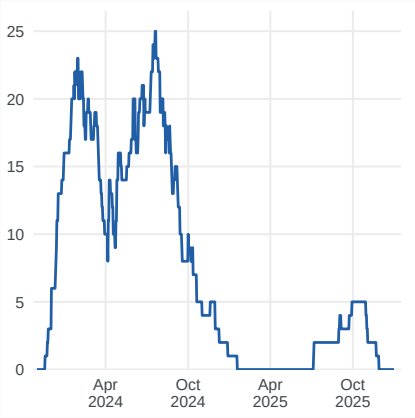


Bab al-Mandab



Bab al-Mandab





Houthi attacks on commercial vessels, 60-day rolling count. Source: Wikipedia.

This paper

Question: who pays when a chokepoint closes or gets costlier?

1. Evidence on trade and shipping after the Houthi attacks

→ AIS vessel tracks, Turkish customs data

→ Red Sea-dependent trade falls, reroutes via the Cape, recovers within months

2. Quantitative trade model with endogenous freight costs and transit fees

→ Substitution across routes, modes and origins

3. Counterfactuals

→ Red Sea, Suez freight +35%: mainly costs Egypt its canal revenue

→ Hormuz toll: falls on the Gulf economies behind the strait



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Closest related papers

	Model	Question
Fuchs, Leibovici & Wong (2026)	Spatial GE, recursive routing, fleet ownership	Strategic dependence on foreign shipping; U.S.–China; port fees
Bai, Fernández-Villaverde, Li, Marto & Zanetti (2026)	U.S. GE, one congestible container fleet	Effective vs potential capacity; Red Sea −0.35% of U.S. output
This paper	160 countries, routes and modes, endogenous freight costs	**Who prices a chokepoint** and who pays when it closes

- Only here: revenue-maximising canal tolls, multi-country incidence, Hormuz, firm-level evidence



The Red Sea Crisis

Data

- **Shipping**: AIS trajectories and port calls, 6,032 container vessels

  → August 2021–August 2024

- **Firms**: Panjiva Turkish customs

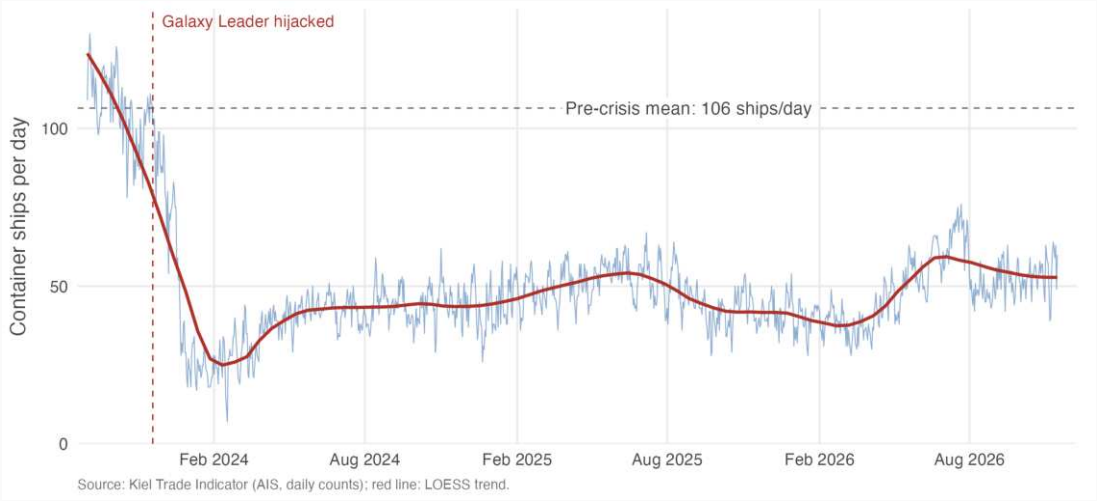
  → firm × partner × week exports

- **Ports**: IMF PortWatch port shares, UNCTAD liner connectivity

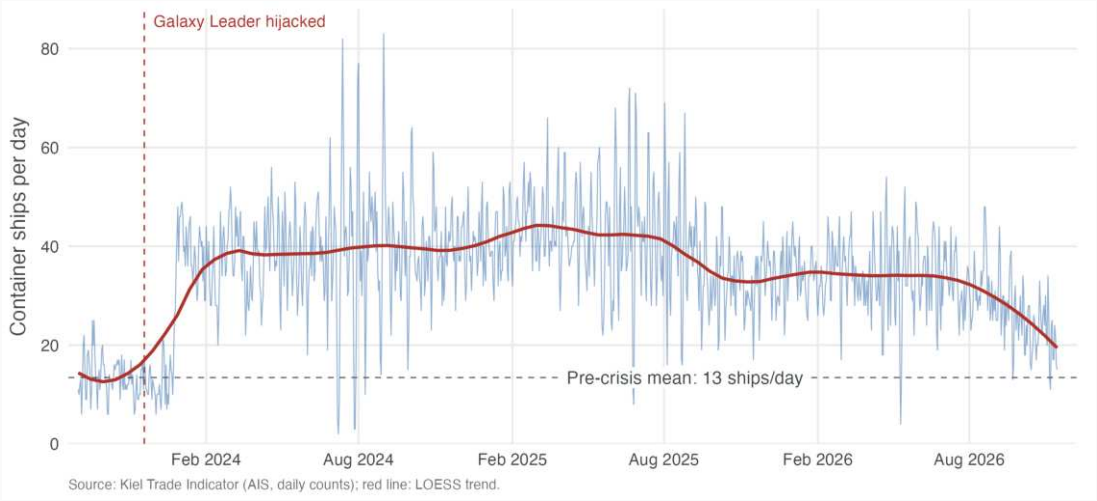
  → port-to-port sea distances with each chokepoint closed



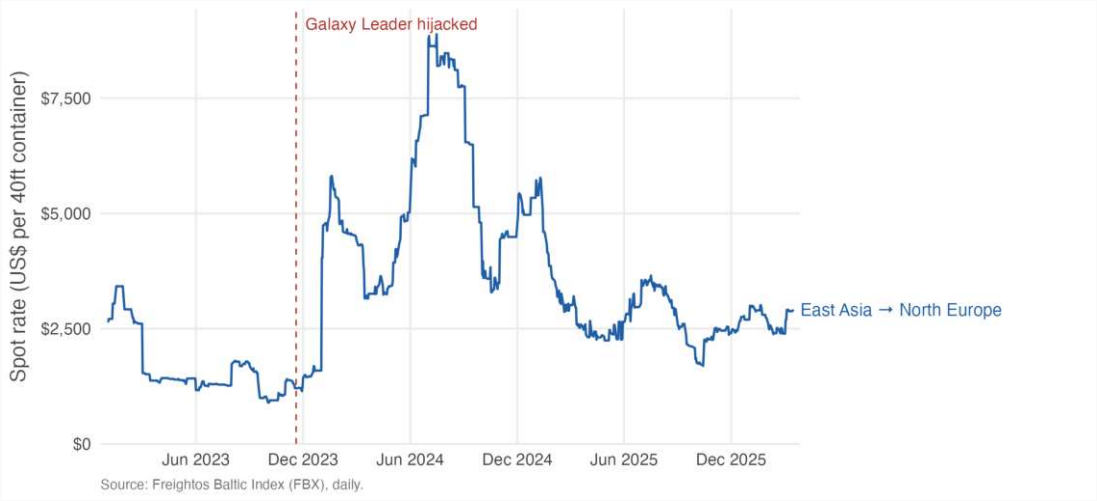
Vessel traffic: Red Sea



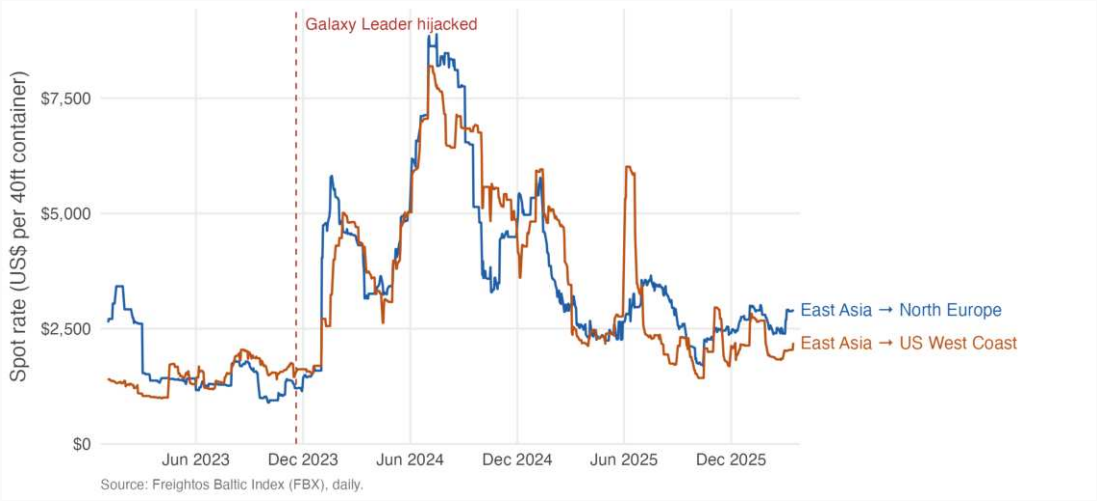
Vessel traffic: Cape of Good Hope



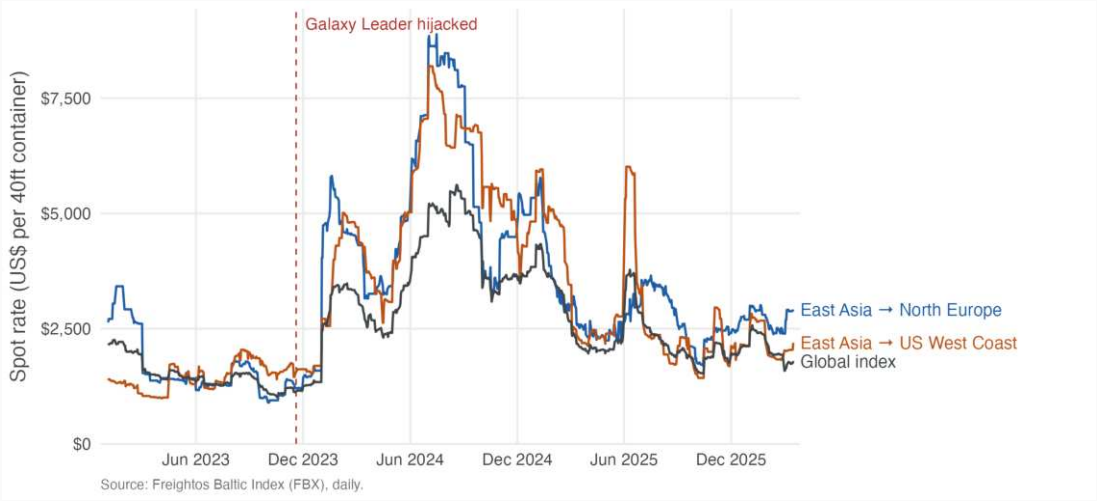
Freight rates



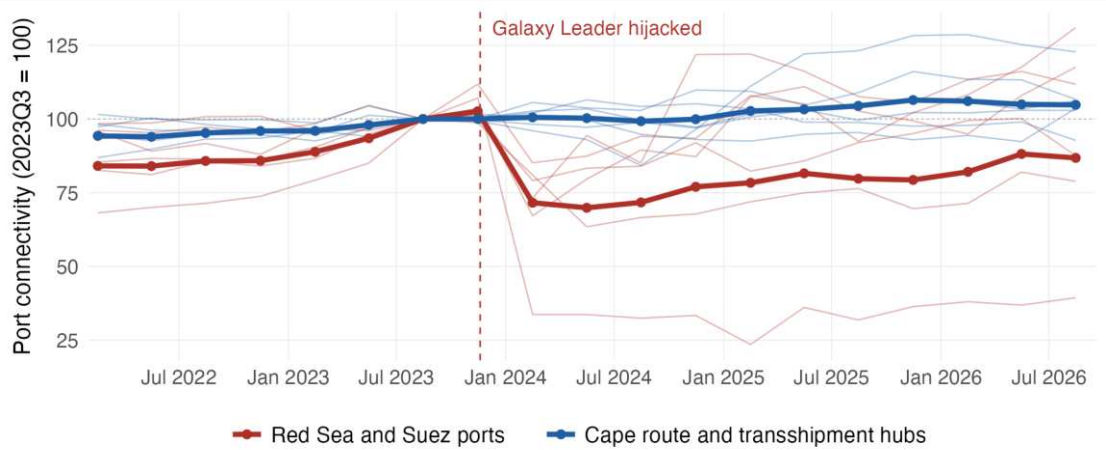
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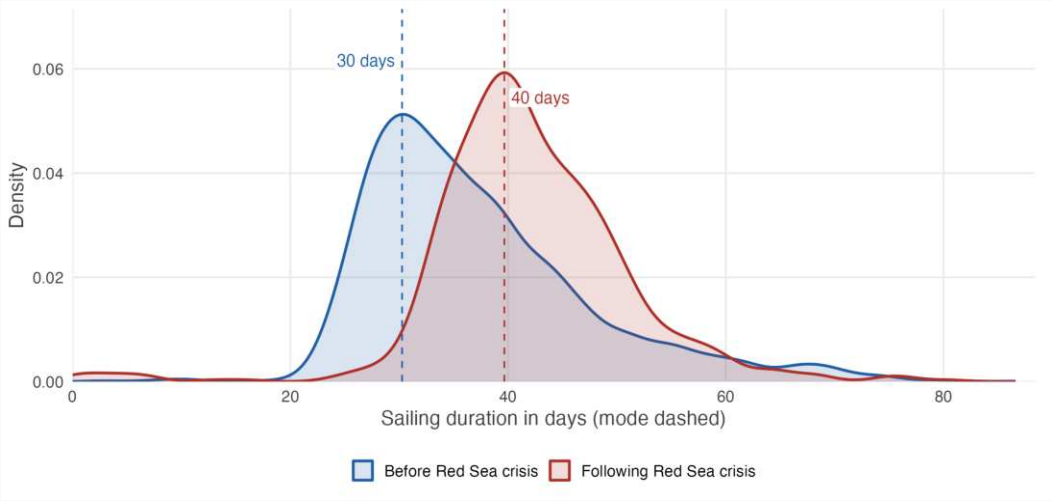


Liner connectivity moved away from the Red Sea



Thin lines: single ports; thick lines: group total (sum of port indices, rebased). Source: UNCTAD Port Liner Shipping Connectivity Index (quarterly).

Travel duration: China → Netherlands



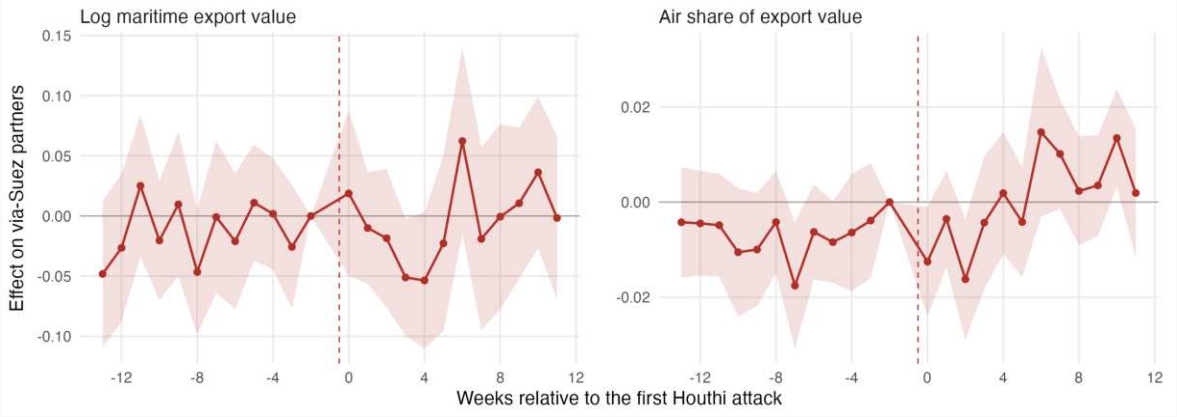
Turkish firms: difference-in-differences

	(1) Log maritime export value	(2) Air share of export value
Via Suez × Post	0.0048	0.0065**
	(0.0129)	(0.0025)
Observations	405,777	1,023,191
Within R^2	0.000	0.000
Firm × partner FE	Yes	Yes
Week FE	Yes	Yes

Firm × partner and week fixed effects; standard errors clustered by partner.



Turkish firms: exports via Suez



Reference: two weeks before the first attack. Firm × partner and week FE; 95% CIs, clustered by partner.

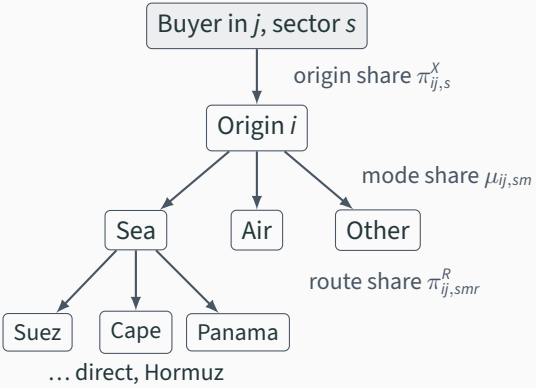
Taking stock

- AIS: ships reroute fast and at scale
  - → Red Sea: 106 ships/day before, ∼40 in 2024; Cape: 13 before, ∼40 in 2024
  - → China → Netherlands voyages ∼10 days longer; freight rates spike, then ease
- Turkish firms: exports via Suez dip a few weeks after the first attacks
  - → short-lived, apart from a shift toward air
- Trade dependent on the Red Sea back after ∼6 months
- Why? Cape is a feasible detour, and the Suez toll absorbs much of the cost gap



Model

Three choices of a buyer



- Each choice a CES / logit share, own elasticity

  $\rightarrow$ origins: θ_s; modes: η^M_s; routes: η^R_s

- Trade flow from i to j by mode m on route r:

$$X_{ij,smr} = \pi^R_{ij,smr}\, \mu_{ij,sm}\, \pi^X_{ij,s}\, E_{j,s}$$

  $\rightarrow$ $E_{j,s}$: spending of j on sector s

Congestion and capacity constraints

- Freight is a share χ_s of delivered cost; route cost has four parts:

$$d_{ij,smr} = \underbrace{\bar{d}_{ij,smr}}_{\text{geography}} \cdot \underbrace{\left(\frac{\Xi_{mr}}{\bar{\Xi}_{mr}}\right)^{\chi_s \lambda_s^R}}_{\text{local congestion}} \cdot \underbrace{\left(\frac{\Psi}{\bar{\Psi}}\right)^{\chi_s \gamma_s^G}}_{\text{global capacity}} \cdot \underbrace{\phi_{mr}^{\chi_s}}_{\text{transit fee}}$$

- Ξ_{mr}: traffic through Suez or Panama

  $\rightarrow$ open-ocean routes do not congest

- Ψ: world sea ton-km

  $\rightarrow$ longer routes tie up ships and raise freight rates everywhere



Local congestion and global capacity

Local congestion:



→ Route usage ↑ → costs ↑

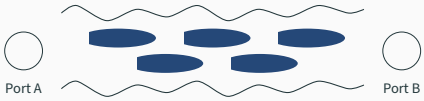
Global capacity constraints:

→ Route length ↑ → costs ↑

Local congestion and global capacity

Local congestion:





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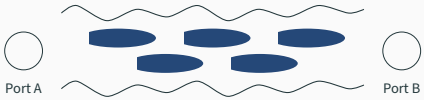
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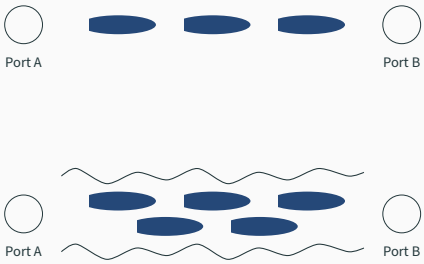
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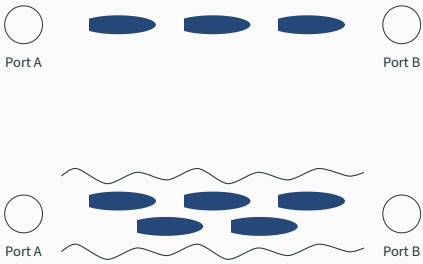
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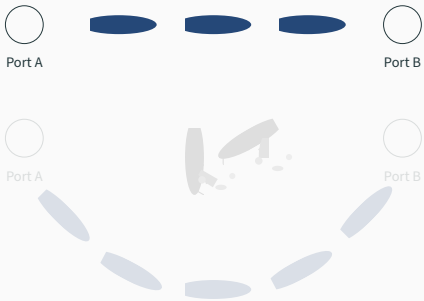
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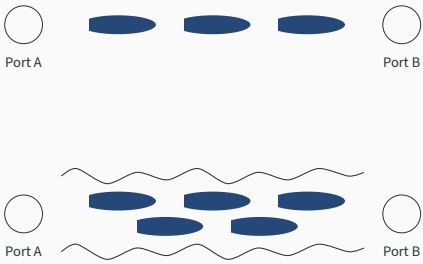
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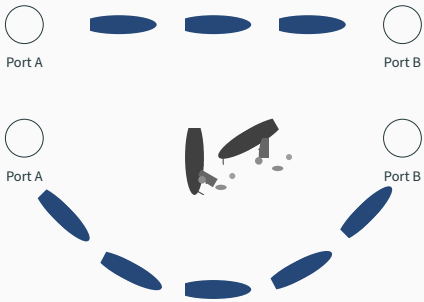
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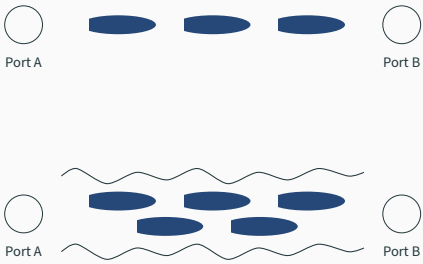
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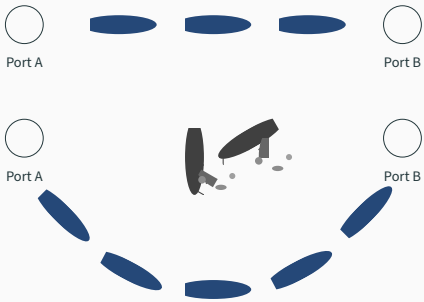
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Endogenous transit fees: intuition

- Short route S with fee F, long route L without; trade T fixed

$$\pi_S^R(F) = \frac{(d^S + F)^{-\eta}}{(d^S + F)^{-\eta} + (d^L)^{-\eta}}, \qquad \text{revenue} = F\,\pi_S^R(F)\,T$$

- With $d^S = 0$ and $\eta > 1$: $\quad F^\star = d^L\,(\eta - 1)^{-1/\eta} \longrightarrow d^L$ as $\eta \to \infty$

  $\rightarrow$ fee captures the cost advantage of the short route

  $\rightarrow$ closure destroys mainly this rent, not shippers' surplus

- Outside option sets the fee: the Cape for Suez, nothing for Hormuz



Calibration

A full quantitative trade model

- Caliendo–Parro with input–output links, plus modes, routes and transit fees
- **GTAP 11**: 160 countries $\times$ 65 sectors, base year 2017

  $\rightarrow$ headline results
- **OECD ICIO 2022**: 81 countries $\times$ 50 sectors

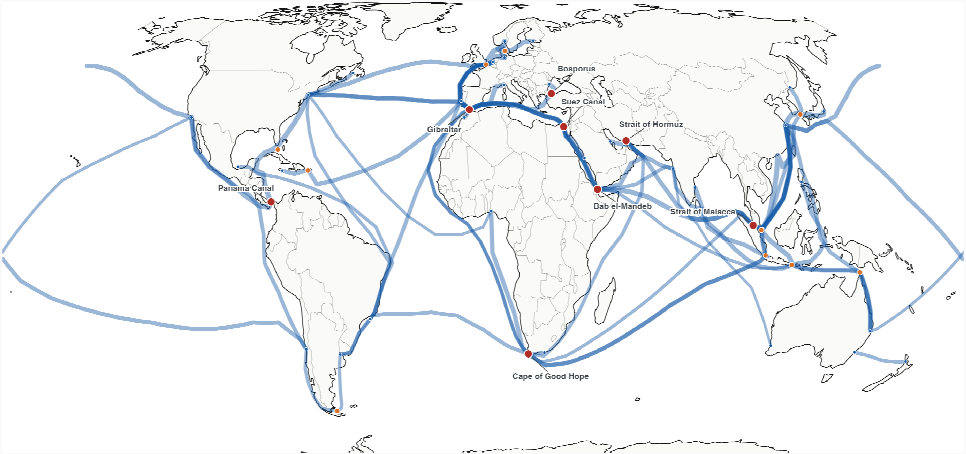
  $\rightarrow$ same results (correlation of welfare changes 0.999)
- 3 modes (sea, air, other) $\times$ 8 sea routes

  $\rightarrow$ Suez, Cape, Panama, direct; each also via Hormuz

  $\rightarrow$ $\approx$40 million route shares: origin $\times$ destination $\times$ sector $\times$ mode $\times$ route
- Route shares: AIS trips of 6,032 container ships; shortest sea paths for bulk and energy



Baseline: container routes



Container shipping routes from AIS vessel tracks (Kiel Trade Indicator).

Calibration

Accounts	GTAP 11: 160 countries, 65 sectors, 2017
Route shares	Container: AIS trips; bulk, energy and pairs without trips: shortest sea paths across port pairs, weighted by tanker/bulk port calls and distance$^{-1.5}$
Mode shares	BACI 2022 HS6 flows by predicted mode, summed to pair $\times$ sector
Trade elasticities θ_s	Fontagné et al. (2022)
Mode elasticities η_s^M	Ko et al. (2026): 0.7–9.7; pooled 2.87
Freight shares χ_s	Sector-specific; trade-weighted mean $\simeq$ 0.09
Route congestion λ_s^R	0.135, canal routes only
Fleet capacity γ_s^G	0.44, on sea ton-km
Latent Cape ρ	0.22, from pairs using both Suez and the Cape

Canal revenues

Match Suez revenue with $\eta_S^R = 250$.

	Model revenue	Observed revenue	Fee ϕ
Suez	\$10.2bn	\$10.25bn (2023)	1.28
Panama	\$3.0bn	\$3.18bn (2024)	1.14

- Only Suez revenue is targeted; Panama revenue is an out-of-sample check



Counterfactuals

Counterfactual: Red Sea crisis

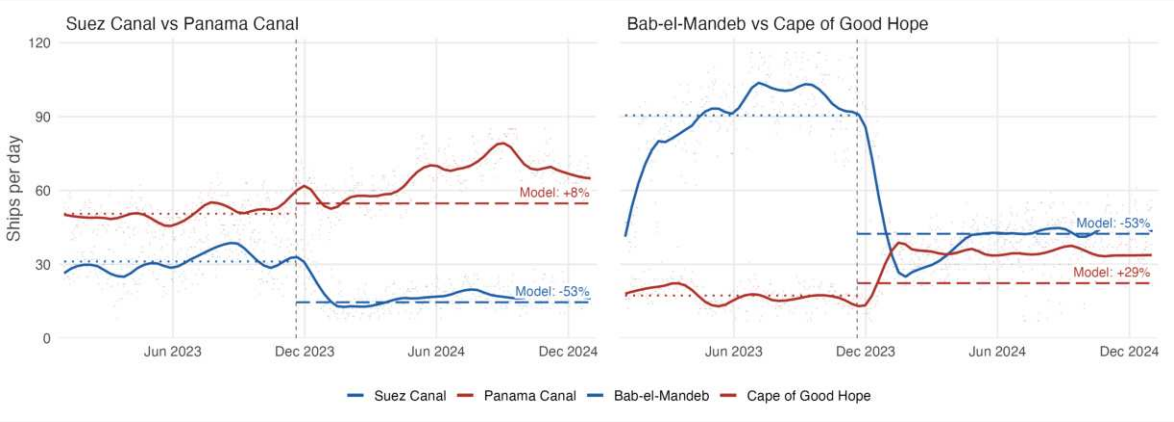
- Suez freight cost $+35\%$

  $\rightarrow$ matches the AIS drop at Bab al-Mandab (-53%)

- Suez and Panama fees stay at calibrated values
- Static equilibrium after rerouting; no recovery dynamics
- Backup: permanent Red Sea closure, Hormuz transit fee

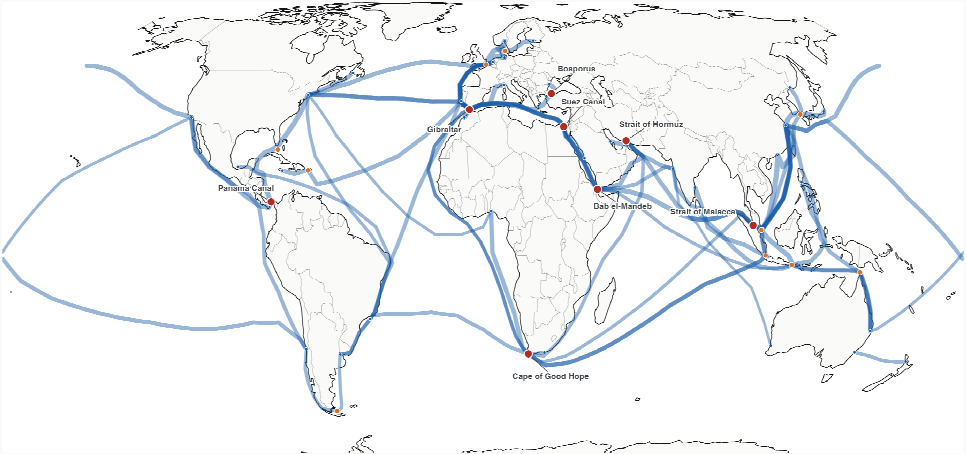


Red Sea crisis: observed rerouting



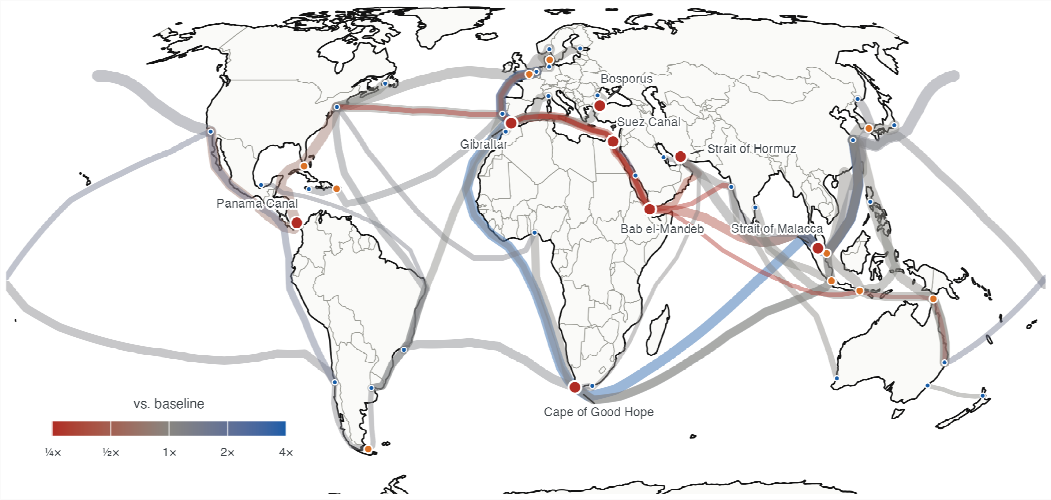
AIS ship counts per day. Dotted: 2023 mean. Dashed: model, Suez freight +35% (change in sea trade value). The Cape also carries much non-Suez bulk trade, so its rise is smaller in the model.

Baseline: container routes

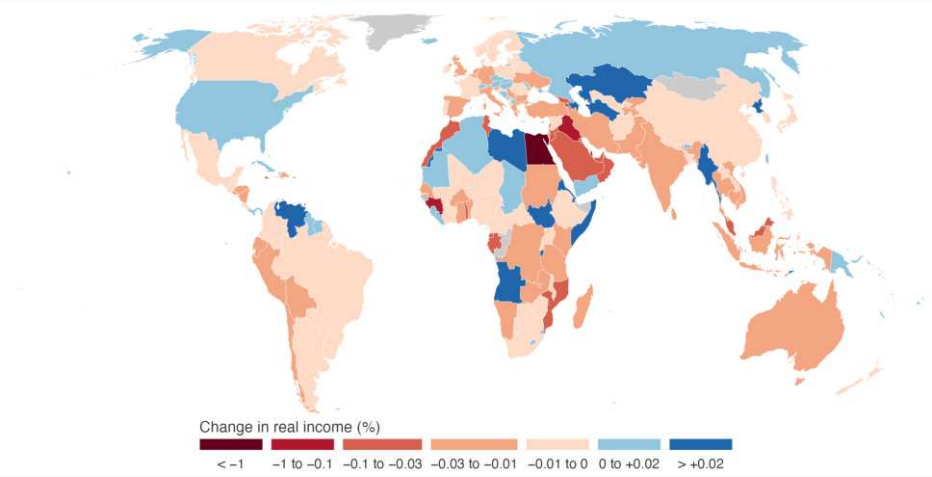


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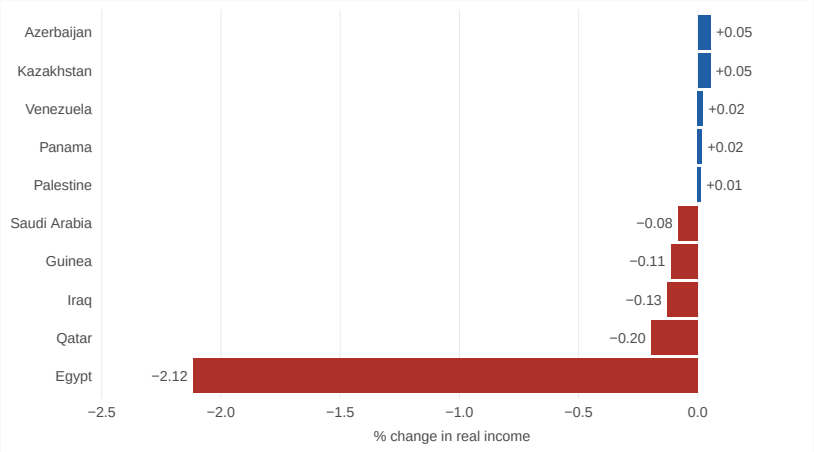
Red Sea crisis: rerouting



Red Sea crisis: welfare



Red Sea crisis: most affected



Suez freight cost +35%. Not shown: Haiti, Congo, Mongolia, Brunei (income near zero).

Conclusion

Takeaways

- Maritime chokepoints are *heterogeneous*
- Trade between affected pairs recovers within months

  → the Cape is not that costly when it also avoids a toll
- Welfare effects cannot be read off transit volumes

  → Red Sea: losses concentrate on Egypt, the toll collector

  → Hormuz: a toll without alternatives falls on the economies behind it



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