Navigating Shocks:

The Ripple Effects of Shipping Route Closures

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Introduction

"The Power to Destroy a Thing Is the Absolute Control Over It"



Map of a Chokepoint



How much Trade did the Houthis Destroy?

- 30% of containerized trade goes through the Red Sea... Should we expect a large effect of Houthi attacks in Bab al-Mandab?
- **Not All Maritime Chokepoints are Alike**
  - Suez, Malacca and Panama: long but feasible detours.
  - Hormuz and Danish straits: no alternative maritime route.
  - Some chokepoints collect **tolls**.

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- Build a model with monopoly tolls across maritime routes
  - **A permanent closure** of Bab al-Mandab mainly costs Egypt its canal revenue.
  - Extend the model to Hormuz: Gulf countries carry the burden of a toll

Related Literature

- **Maritime Trade Technology**
  Hummels (2007); Jacks and Pendakur (2010); Bernhofen et al. (2016); Pascali (2017).
- **Maritime disruptions and transport networks**
  Feyrer (2021); Dunn and Leibovici (2025); Fuchs et al. (2026); Fuchs and Wong (2026).
- **Gravity, trade costs and sourcing**
  Head and Mayer (2014); Caliendo and Parro (2015); Bakker et al. (2026)*; Conconi et al. (2026)*.
- **Tolls and endogenous freight costs**
  Hummels et al. (2009); Asturias (2020); Brancaccio et al. (2020);
  Wong (2022); Cristoforoni et al. (2025).
- **Supply-chain risk and diversification**
  Bourany et al. (2026)*; Akarsu and Aktuğ (2026)*.
- **Strategic inputs and geoeconomic restrictions**
  Aguilar et al. (2026)*; Chen (2026)*; Li, Sui and Xue (2026)*; Scheckenhofer et al. (2026)*.

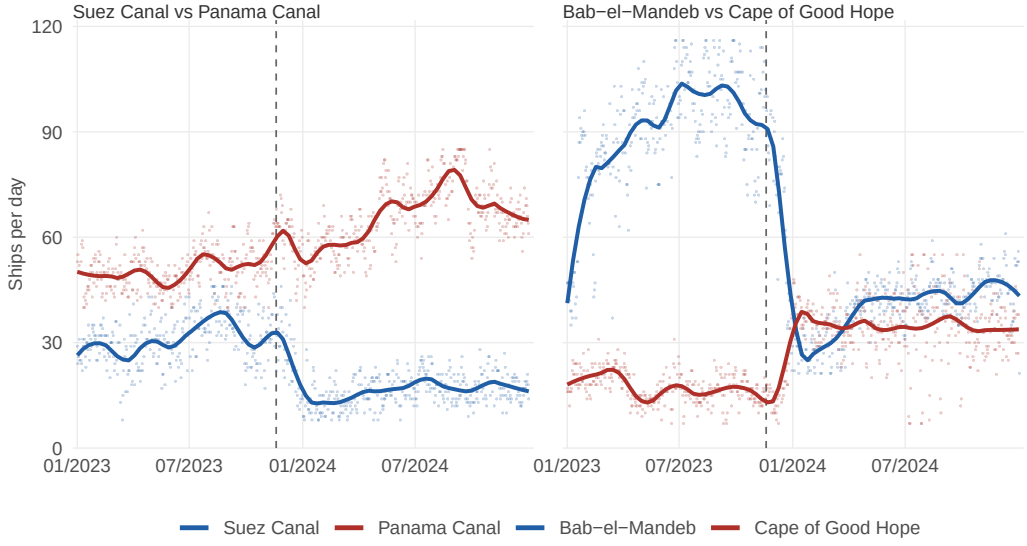
* Papers on this conference's programme.

The Red Sea Crisis

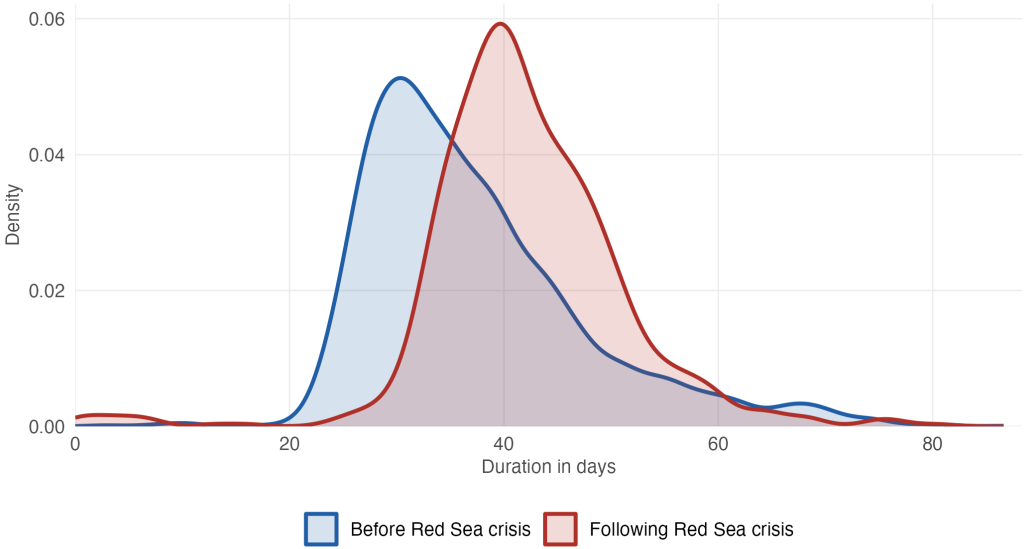
Data

- **Shipping**: AIS trajectories and port calls for 6,032 container vessels, August 2021–August 2024.
- **Trade**: U.S. Census and Eurostat Comext, monthly HS6 $\times$ partner $\times$ transport mode.
- **Firms**: Panjiva Turkish customs, firm $\times$ partner $\times$ week exports.

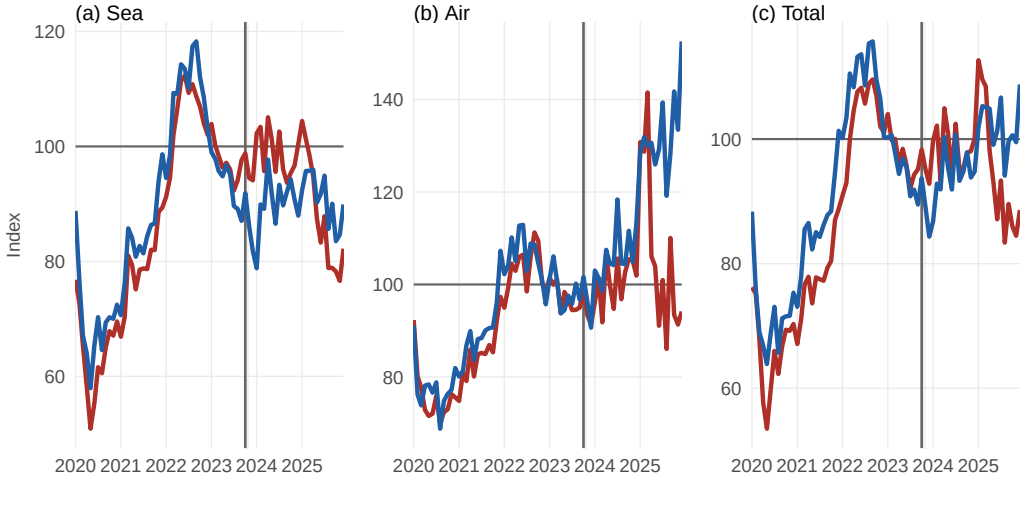
Traffic Reroutes around the Cape



Longer Travel Times: China to the Netherlands



Visual Diff-in-Diff



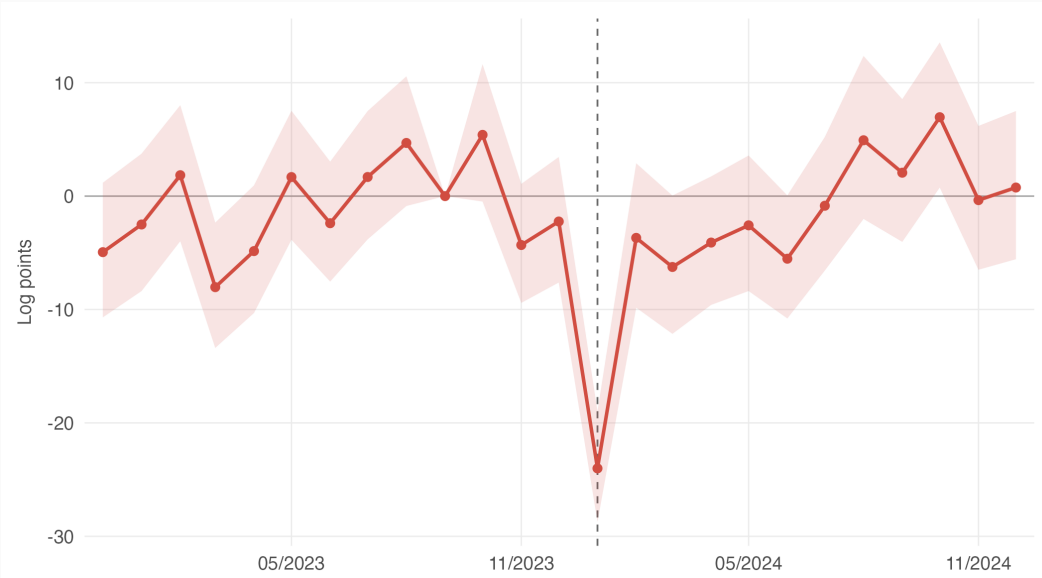
Exposure to the Red Sea Closure

$$D_{ij} = \frac{d_{ij}^{c} - d_{ij}^{o}}{9{,}000}, \qquad X_{ijs} = D_{ij} \times \pi_{ijs}^{sea}.$$

- D_{ij}: extra sea distance when Bab al-Mandab closes.
  - Computed at port level, weighted by pair-ports, with Gaffuri algorithm (2022)
  - π_{ijs}^{sea}: predicted sea share from 2022 transport-mode patterns.
- We run a triple difference equation to estimate β_τ :

$$y_{ijst} = \sum_{\tau \neq -1} \beta_\tau \mathbb{I}\{t = \tau\} \left(D_{ij} \times \pi_{ijs}^{sea} \right) + \sum_{\tau \neq -1} \theta_\tau \mathbb{I}\{t = \tau\} D_{ij} + \sum_{\tau \neq -1} \lambda_\tau \mathbb{I}\{t = \tau\} \pi_{ijs}^{sea} + \alpha_{ijs} + \alpha_{jst} + \alpha_{it} + \varepsilon_{ijst},$$

A Transitory Effect on Trade



Turkish Firms: Data and Event Study

- Panjiva Turkish customs: shipment-level exports with firm identifiers, value and transport mode.
- Aggregated to firm f $\times$ partner country j $\times$ week t.

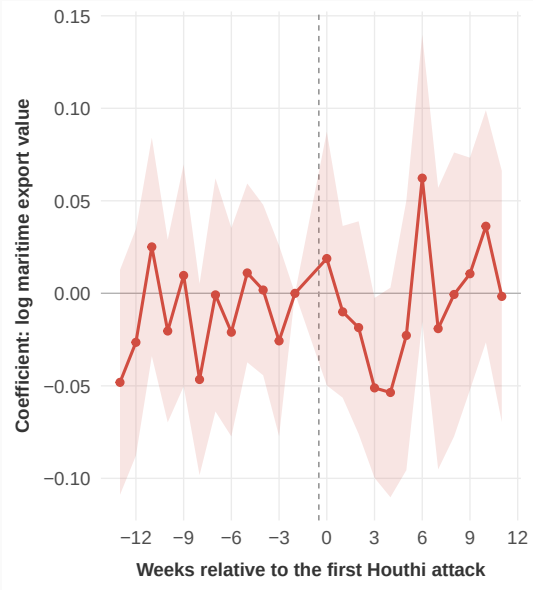
$$y_{fjt} = \sum_{\tau \neq -1} \beta_\tau \, \mathbb{I}\{t = \tau\} \times \mathrm{ViaSuez}_j + \alpha_{fj} + \alpha_t + \varepsilon_{fjt}.$$

y_{fjt}: log maritime export value, or air share of total export value.

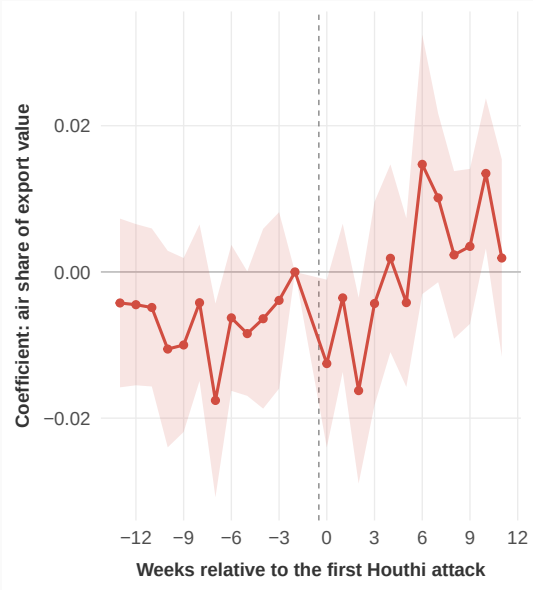
$\mathrm{ViaSuez}_j$: pre-crisis maritime route crosses Bab al-Mandab.

α_{fj}: firm–partner fixed effects; α_t: week fixed effects.

Turkish Firms: Maritime Export Value



Suggestive Evidence of a Shift toward Air



Taking Stock

- **Large initial effects on imports** in customs data, consistent with evidence of initial delays
- For Turkey, one of the most affected countries, reduction in exports 5 weeks later
- **Short-lived effects** apart from modality subsitution
  - Maritime trade through the Red Sea not affected after 6 months.
- Our explanation: interaction of Bab al-Mandab with Suez Canal toll authorities

Model

A Toll on the Shorter Route

Two routes, an additive fee F, and fixed bilateral trade T_{ij}.

$$\pi_{ij}(F) = \frac{(d_{ij}^S + F)^{-\mu}}{(d_{ij}^S + F)^{-\mu} + (d_{ij}^L)^{-\mu}}, \qquad T(F) = F\,\pi_{ij}(F)\,T_{ij}.$$

For $d_{ij}^S = 0$ and $\mu > 1$,

$$F^\star = (d_{ij}^L - d_{ij}^S)(\mu - 1)^{-1/\mu} \quad \longrightarrow \quad d_{ij}^L - d_{ij}^S \qquad \text{as } \mu \to \infty.$$

- The monopolist captures the shorter route's surplus.

Quantitative Trade Model

Multi-country, multi-sector trade with input–output linkages *à la* Caliendo and Parro 2015.

Choice	Share	Substitution elasticity
Origin i	$\pi_{ij,s}$	θ_s
Mode m: sea, air, other	$\mu_{ij,sm}$	η_s^M
Route r within mode	$\pi_{ij,smr}$	η_s^R

$$X_{ij,smr} = \pi_{ij,smr}\,\mu_{ij,sm}\,\pi_{ij,s}\,E_{j,s}.$$

Route Choice and Mode Choice

$$\pi_{ij,smr} = \frac{d_{ij,smr}^{-\eta_s^R}}{\sum_{\rho \in \mathcal{M}_{ijm}} d_{ij,sm\rho}^{-\eta_s^R}}, \qquad \mu_{ij,sm} = \frac{d_{ij,sm}^{-\eta_s^M}}{\sum_{\nu \in \mathcal{N}_{ij}} d_{ij,s\nu}^{-\eta_s^M}}.$$

- Switching to air differs from rerouting around the Cape.
- The transport wedge enters the sourcing decision.

Freight Costs, Congestion and Capacity

Freight share χ_s determines pass-through to delivered prices:

$$d_{ij,smr} = f_{ij,smr}^{\chi_s}.$$

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

Rerouting raises congestion and demand for shipping capacity.

Monopoly Toll-Setting

$$\phi_q^\star \in \arg\max_{\phi_q \geq 1} \Pi_q(\phi_q; \phi_{-q}), \qquad \Pi_q = \sum_{i,j,s} (1 - \phi_q^{-\chi_s}) X_{ijs,q}.$$

- Tolls affect routes, transport modes and sourcing.
- Revenue accrues to the collector country.
- Each authority sets its toll in isolation in the baseline.

Substitution and Market Power in Partial Equilibrium

$$\frac{\partial e_{js}}{\partial \ln \phi_q} = -\chi_s \left(\eta_s^R V_R^{js} + \eta_s^M V_M^{js} + \theta_s V_X^{js} \right).$$

- V_R: variance of monopoly exposure across routes, conditional on origin and mode.
- V_M: across modes, conditional on origin.
- V_X: across origins.

- Direct partial equilibrium: wages, aggregate expenditure shares etc. fixed.
- η^R is larger. No substitute route implies $V_R = 0$, implying higher market power.

Calibration

Calibration

Accounts	GTAP 11: 160 countries, 65 sectors, 2017.
Route and mode shares	AIS trips; predicted modes by pair and sector.
Trade elasticities θ_s	Fontagné et al. (2022).
Mode elasticities η_s^M	Ko et al. (2025): 0.4–11.4; fallback 2.44.
Freight shares χ_s	Sector-specific; trade-weighted mean $\simeq 0.09$.
Route congestion λ_s^R	0.135.
Capacity	Global: $\gamma_s^G = 0.44$; mode-specific: $\gamma_s^M = 0$.

All confidence intervals for γ_s^G include zero.

Canal Revenues and Route Substitution

Match Suez revenue with $\eta_s^R = \mu^d = 350$.

	Model revenue	Observed revenue	Fee ϕ
Suez	\$10.5bn	\$10.25bn (2023)	1.59
Panama	\$3.62bn	\$3.18bn (2024)	1.16

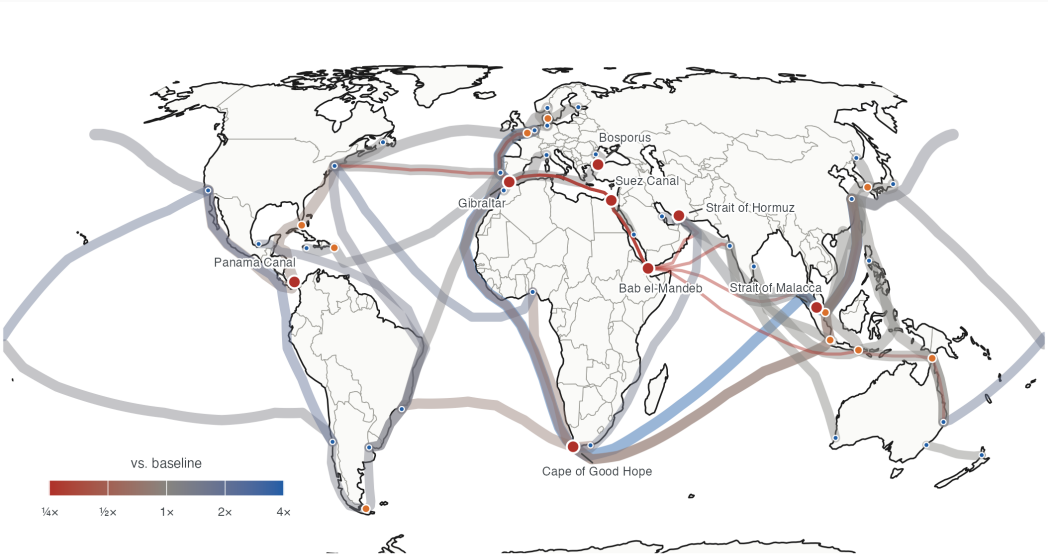
- Panama is an untargeted check when monopoly optimizes its revenue.

Counterfactuals

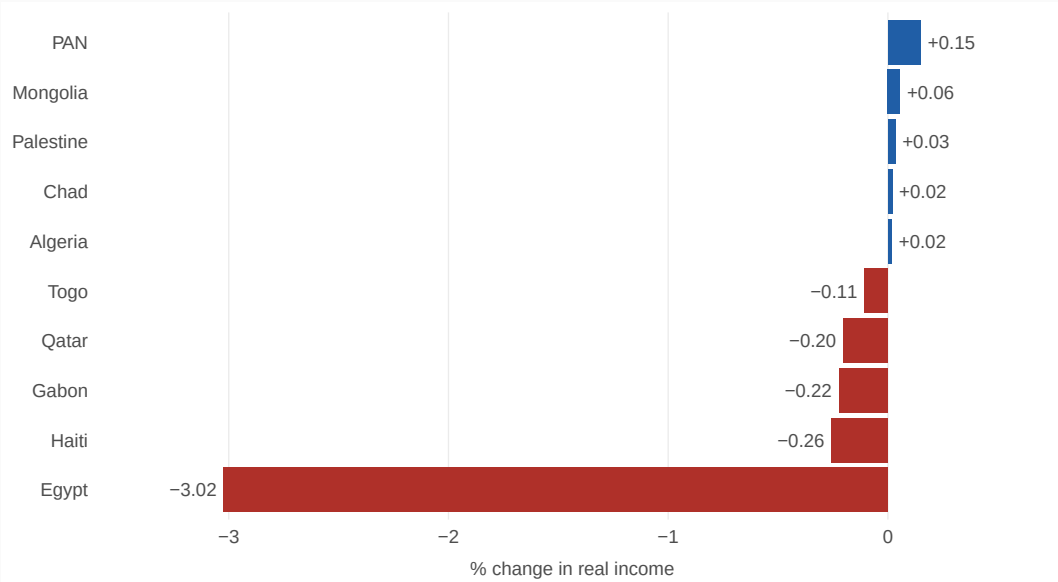
Counterfactuals

- **Red Sea**: permanent closure of the Suez route.
- **Hormuz**: 35% surcharge on exposed freight. Revenue split equally between Iran and Oman.
- Suez and Panama fees stay at their calibrated values.
- Static equilibria after rerouting; no recovery dynamics.

A Permanent Red Sea Closure



The Bulk of the Loss Falls on Egypt

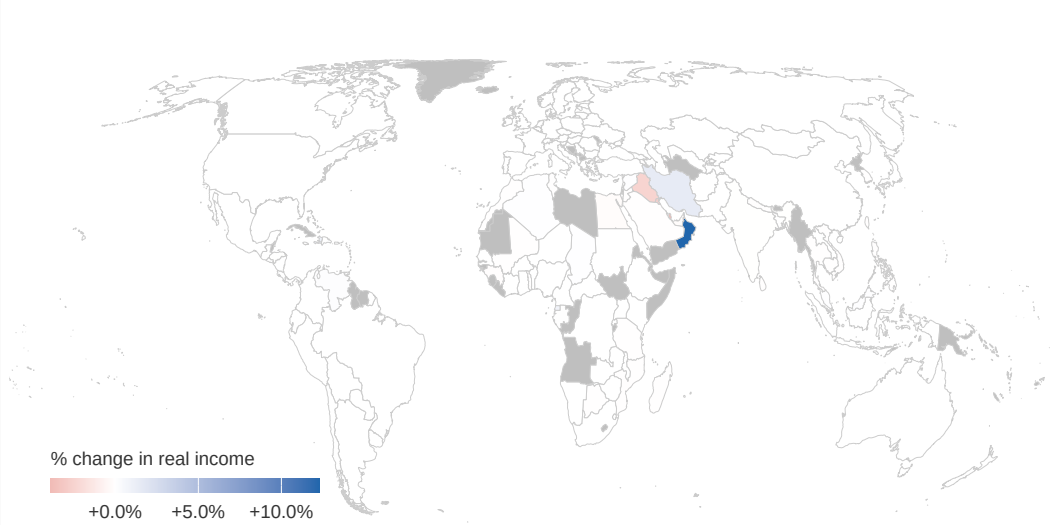


Rents Concentrate the Loss on the Collector

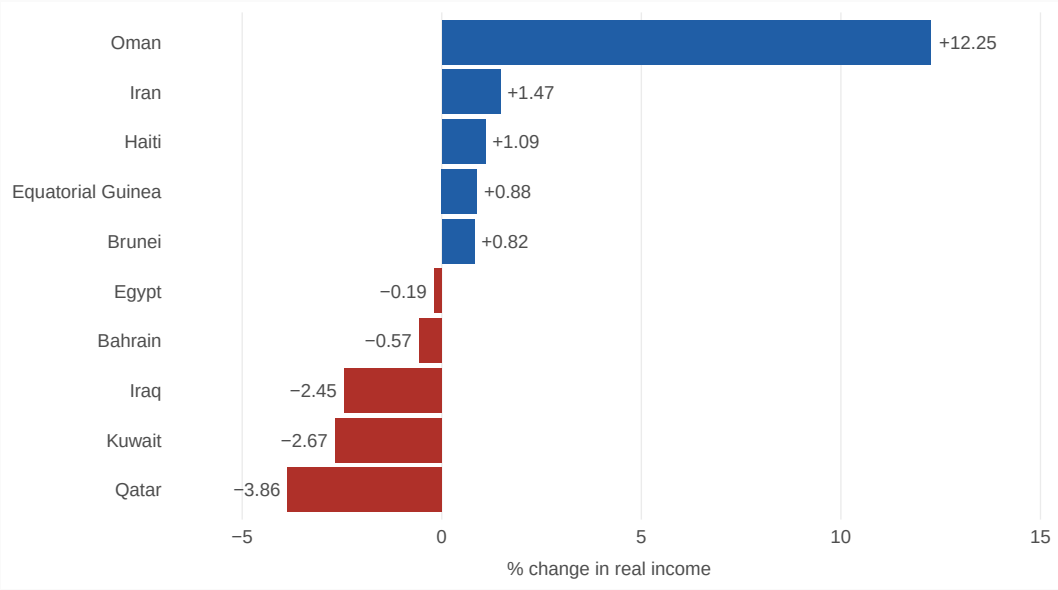
Real income, %	With fees	Without fees
Egypt	−3.02	−0.18
Qatar	−0.20	−1.09
United Arab Emirates	−0.04	−0.21
Gabon	−0.22	−0.64
Malta	−0.05	−0.22

Without fees: Suez and Panama $\phi = 1$, with no transit rents.

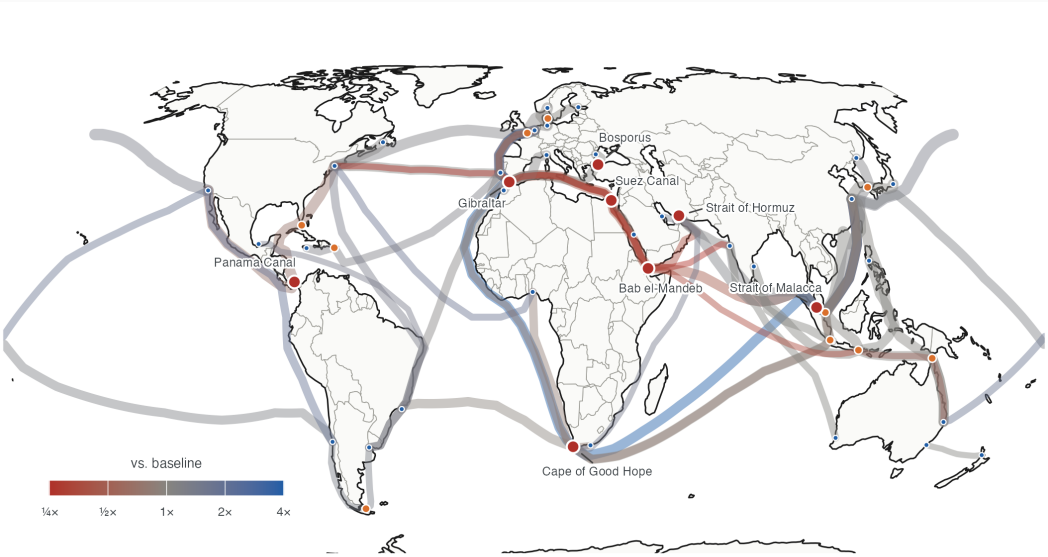
A Transit Fee in the Strait of Hormuz



The Gulf Bears the Cost of the Hormuz Fee



Spillovers across Chokepoints



Hormuz: Fees, Trade and Revenue

Freight surcharge	5%	35%	50%
Hormuz-transiting trade	−19.0%	−60.2%	−66.7%
Toll revenue	$4.8bn	$14.6bn	$17.0bn

Revenue flattens between the 35% and 50% exogenous freight fees.

Conclusion

Chokepoints Are Heterogeneous

- Short-lived local impacts of maritime disruption on trade between affected pairs
- Circumnavigation not that costly when we also avoid a toll
- Welfare relevance cannot be read off transit volumes.
- Red Sea: monopoly model shows losses are concentrated on Egypt.
- Hormuz: tolls without alternatives expose the economies behind them.