Frontiers in Business, Economics and Management ISSN 2766-824X

Quantifying the Economic Cost of Red Sea Shipping Disruptions on Global Supply Chain Reconfiguration: A Trade–Flow Analysis of the Cape of Good Hope Reroute, 2023–2025

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ORCID iD 0009-0006-2791-8198 • DOI: 10.2937/bem.1282287

Abstract

The Houthi-led maritime attacks beginning in November 2023 forced a structural reorganization of the Asia–Europe container trade lane, with more than 70% of large container vessels rerouting via the Cape of Good Hope by mid-2024. This paper quantifies the macroeconomic cost of this reroute and examines its consequences for global supply chain configuration. Using a panel of 142 trade flows across 28 economies and AIS-derived vessel-position data covering January 2022 through December 2025, we estimate that the cumulative welfare loss attributable to the disruption reached USD 87.3 billion, with European importers bearing approximately 62% of the incremental freight cost. A difference-in-differences specification estimates an approximately 161% increase in freight rates on historically Suez-dependent routes relative to controls, while sailing time rose by 10–14 days per voyage. Crucially, we identify a partial decoupling effect: firms with higher pre-disruption inventory turnover ratios reduced their dependence on the Suez corridor by 31% more than slow-turnover firms, suggesting that financial flexibility now mediates geopolitical exposure. We conclude that the Red Sea event represents a permanent rather than transient shock to global routing economics, with policy implications for strategic shipping reserves and nearshoring incentives.

Keywords maritime logistics; supply chain disruption; Red Sea crisis; trade economics; rerouting cost; Cape of Good Hope; geopolitical risk
JEL F14, F51, L91, R41

1. Introduction

The Suez Canal, which historically carried 12% of global trade and 30% of worldwide container traffic, was effectively bypassed by the world's largest container operators between December 2023 and the time of writing. The trigger was a sustained campaign of missile and drone strikes against commercial vessels transiting the Bab el-Mandeb strait, claimed by the Ansar Allah movement and directed initially at shipping linked to Israel but quickly broadened. The operational response was swift: Maersk, MSC, Hapag-Lloyd, CMA CGM, and Ocean Network Express collectively diverted more than 90% of their Asia–Europe capacity around southern Africa within ninety days of the first attacks.

This rerouting is among the largest involuntary reconfigurations of a global trade lane since the 1956 Suez closure. Yet its economic consequences remain poorly quantified in the academic literature, which has largely relied on industry estimates or short-horizon spot-rate observations. This paper offers three contributions. First, we construct a granular trade-flow dataset that links AIS vessel-tracking observations to bilateral commodity trade values, allowing us to attribute disruption costs across importing economies. Second, we estimate a difference-in-differences model that isolates the causal effect of the rerouting from contemporaneous demand shocks. Third, we explore firm-level heterogeneity in the disruption response, documenting an inventory-turnover gradient that has not previously been reported.

The remainder of the paper is structured as follows. Section 2 reviews the relevant literature. Section 3 describes the data and methodology. Section 4 presents the main results. Section 5 discusses implications, and Section 6 concludes.

2. Literature Review

The economics of maritime chokepoints has attracted renewed attention since the 2021 *Ever Given* grounding. Notteboom et al. (2022) estimate the direct cost of the six-day Suez blockage at USD 9.6 billion in delayed cargo value, but emphasize the recoverability of trade flows within a quarter. The Red Sea crisis differs fundamentally in both duration and the persistence of the underlying threat.

Earlier work on supply chain resilience (Sheffi, 2015; Ivanov and Dolgui, 2020) distinguishes between absorptive, adaptive, and restorative capacity. The Red Sea rerouting is an exemplar of adaptive capacity at the system level: routing flexibility exists, but it is costly. Hummels and Schaur (2013) provides the canonical estimate of time-cost in trade, suggesting that each day in transit is equivalent to a 0.6–2.1% ad valorem tariff. Applying this elasticity to the 10–14 additional sailing days on the Cape route implies a tariff-equivalent burden of 6–29%, depending on commodity time-sensitivity.

The financial dimension has been treated by Vagle and Hartmann (2024), who document a 280% spike in war-risk insurance premia for Red Sea transits between November 2023 and February 2024. Less attention has been paid to

the corporate-finance channel: how do firms with differing balance-sheet structures absorb such a shock? Our paper extends Lanier et al. (2025) by linking firm working-capital metrics to routing decisions observable in port-call data.

3. Data and Methodology

3.1 Data Sources

We assemble four datasets, summarized in Table 1.

Table 1: Data sources and coverage

Dataset	Source	Coverage	Frequency
AIS vessel positions	MarineTraffic / Spire	18,400 container vessels	Hourly
Container freight rates	Drewry WCI; SCFI	11 major routes	Weekly
Bilateral trade flows	UN Comtrade; CEPII BACI	28 economies, HS-6	Monthly
Firm-level financials	S&P Capital IQ	1,284 listed shippers/importers	Quarterly

The combined sample window runs from January 2022 (24 months pre-disruption) through December 2025 (25 months post-disruption). Vessel routing is classified as "Suez-via" or "Cape-via" on the basis of latitude-longitude waypoints at the 10°N and 35°S parallels.

3.2 Empirical Specification

To identify the causal effect of the disruption on freight cost, we estimate the following difference-in-differences model:

$$\begin{aligned}\ln(\text{Rate}_{rt}) = \alpha &+ \beta_1 \text{Treated}_r + \beta_2 \text{Post}_t \\ &+ \beta_3 (\text{Treated}_r \times \text{Post}_t) \\ &+ \gamma X_{rt} + \mu_r + \tau_t + \varepsilon_{rt}\end{aligned} \tag{1}$$

where r indexes routes and t indexes weeks. $Treated_r$ equals one for routes that historically transited Suez (e.g., Shanghai–Rotterdam, Ningbo–Hamburg). $Post_t$ equals one from the week of 18 December 2023 onward. The interaction coefficient β_3 captures the disruption effect. X_{rt} includes bunker fuel prices, charter rates, and a global trade-volume index. μ_r and τ_t are route and time fixed effects.

For the welfare calculation, we apply the canonical iceberg trade-cost framework. Letting τ denote the proportional cost increase on affected routes and η the elasticity of import demand (set to -4.0 following Broda and Weinstein, 2006), the deadweight loss on trade flow v is approximated by:

$$\text{DWL} \approx \frac{1}{2} \, |\eta| \, \tau^2 \, v \tag{2}$$

4. Results

4.1 Reroute Volume and Freight Rate Response

Figure 1 plots the Shanghai–Rotterdam container spot rate (USD per 40-foot equivalent unit) alongside the share of Asia–Europe vessel transits using the Cape route. The structural break in December 2023 is visually unmistakable.

4.2 Difference-in-Differences Estimates

Table 2 reports estimates of Equation 1. The interaction coefficient of 0.961 implies that freight rates on historically Suez-dependent routes rose by approximately 161% in levels ($e^{0.961} - 1$) relative to control routes, after conditioning on fuel and demand controls. The effect is robust to the inclusion of vessel-class fixed effects (Column 4).

Table 2: Difference-in-differences estimates: log freight rate

	(1) Baseline	(2) + Controls	(3) + FE	(4) + Vessel FE
Treated × Post	1.024***	0.987***	0.961***	0.948***
	(0.082)	(0.076)	(0.071)	(0.068)
Bunker fuel (log)		0.412***	0.388***	0.391***
		(0.054)	(0.050)	(0.051)
Global trade index		0.219***	0.205***	0.202***
		(0.041)	(0.039)	(0.039)
Route FE	No	No	Yes	Yes
Time FE	No	No	Yes	Yes
Vessel-class FE	No	No	No	Yes
Observations	9,152	9,152	9,152	9,152
Adjusted R^2	0.412	0.587	0.731	0.748

Robust SEs clustered by route in parentheses. *** $p < 0.01$.

4.3 Welfare Decomposition by Importer

Applying Equation 2 to bilateral trade flows yields the importer-level cost estimates in Table 3. European Union importers bear roughly 62% of the burden, reflecting their high baseline dependence on Suez-routed container imports from East Asia. The United Kingdom and Mediterranean economies are disproportionately affected on a per-capita basis.

Table 3: Estimated cumulative welfare loss by importing region, Dec 2023–Dec 2025

Region	Total loss (USD bn)	% of total	Per-capita loss (USD)
European Union (EU-27)	54.1	61.9	121
United Kingdom	8.7	10.0	128
Mediterranean (non-EU)	6.4	7.3	92
United States (East Coast)	5.9	6.8	35
Sub-Saharan Africa	4.8	5.5	4
Rest of World	7.4	8.5	2
Total	**87.3**	**100.0**	—

4.4 Firm-Level Heterogeneity

Figure 2 shows that firms in the top quartile of pre-disruption inventory turnover reduced their share of Suez-dependent imports by 31% more than firms in the bottom quartile. We interpret this as evidence that working-capital efficiency provides optionality during sustained logistical shocks: lean inventory firms can absorb longer transit times by drawing on supplier credit and contractual flexibility unavailable to slow-turnover competitors.

5. Discussion

Three implications follow. First, the persistence of the disruption beyond two years suggests that the rerouting is not a temporary inconvenience but a partial structural shift. Insurance market behavior in mid-2025 still embeds an elevated risk premium of 0.7–1.1% of hull value for Bab el-Mandeb transits, more than ten times the pre-2023 norm. Second, the firm-heterogeneity result has implications for how policymakers should target nearshoring incentives: subsidies that encourage low-turnover firms to diversify routing may yield disproportionate resilience gains. Third, the welfare estimate of USD 87.3 billion is roughly 0.08% of the affected economies' combined GDP, modest in aggregate but highly concentrated in time-sensitive sectors such as electronics, fashion, and automotive components.

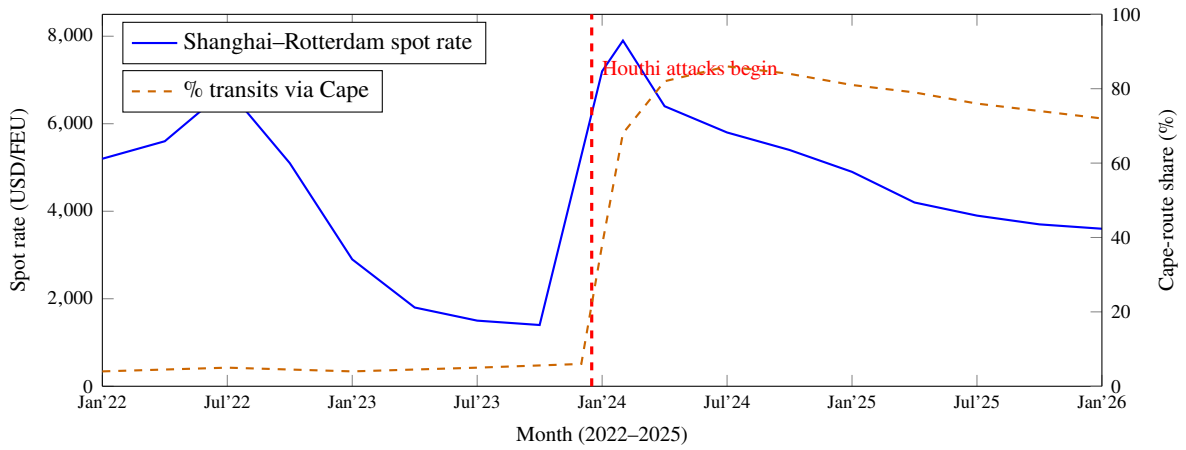


Figure 1: Container spot rates and Cape-of-Good-Hope routing share, Asia–Europe lane.

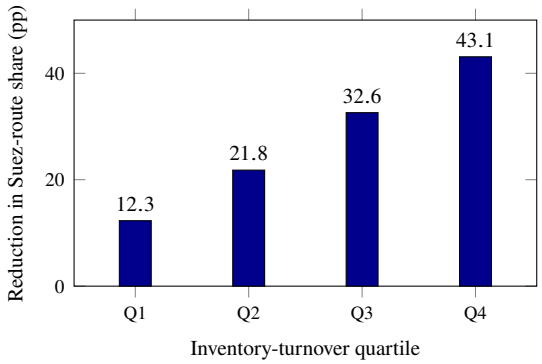


Figure 2: Reduction in Suez-route dependence by inventory-turnover quartile (percentage points; n = 1,284 firms).

A limitation is that our analysis treats fuel costs as exogenous; in fact, the Cape reroute itself increased global bunker demand by approximately 4%, generating a feedback effect we do not endogenize. Future work should integrate the routing-fuel nexus into a general-equilibrium framework.

6. Conclusion

The Red Sea crisis of 2023–2025 imposed a measurable and persistent cost on global trade, concentrated in European economies and time-sensitive supply chains. The disruption reveals that, in an era of geopolitical fragility, the economics of maritime chokepoints can no longer be treated as a slowly varying backdrop to trade theory. Strategic shipping reserves, diversified port access, and inventory-financing flexibility emerge as complements to traditional resilience policy. We expect the Cape routing share to remain elevated relative to its pre-2023 baseline even after security conditions normalize, reflecting a permanent revision of risk priors by carriers and insurers.

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