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The Economic Impact of Persian Gulf Shipping Disruptions on India's Export Competitiveness

An Augmented Structural Gravity, PPML, and Sectoral Panel ARDL Investigation

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Abstract:

Maritime chokepoints across the Persian Gulf and the adjacent Western Indian Ocean—specifically the Strait of Hormuz, the Gulf of Oman, and the Bab el-Mandeb corridor—serve as the primary arteries for India's westbound merchandise trade. Recurrent geopolitical disruptions, naval interdictions, asymmetric drone and missile attacks on commercial vessels, and war-risk insurance surges have exposed Indian exporters to severe logistical frictions. This paper investigates the economic impact of Persian Gulf and Western Indian Ocean shipping disruptions on India's sectoral export competitiveness across 12 major two-digit Harmonized System (HS) merchandise categories and 45 destination economies from 2010:Q1 to 2026:Q3. Methodologically, we integrate an Augmented Structural Gravity Model estimated via Poisson Pseudo-Maximum Likelihood (PPML) with a Dynamic Common Correlated Effects Pool Mean Group (DCCE-PMG) Panel ARDL framework and Balassa's Normalized Revealed Comparative Advantage (NRCA) index. Empirical findings demonstrate that a 10% surge in the Persian Gulf Maritime Disruption and Freight Index (PGMDFI) contracts India's aggregate bilateral export volume to Gulf Cooperation Council (GCC), European, and North American markets by 2.84% in the short run and 4.62% in the long run. Furthermore, each additional transit day induced by vessel rerouting (such as Cape of Good Hope diversions) imposes an ad-valorem tariff equivalent (AVE) of 0.82% to 1.35% on time-sensitive Indian exports. Disaggregated sectoral estimates reveal acute vulnerability in low-margin, working-capital-intensive industries—including textiles and apparel, agricultural perishables (Basmati rice and marine products), and engineering goods—while pharmaceuticals and specialty chemicals exhibit greater price-pass-through resilience. We conclude with strategic policy recommendations focusing on the India–Middle East–Europe Economic Corridor (IMEC), Chabahar port integration, national sovereign war-risk insurance pools, and export credit interest subvention.

Keywords: Persian Gulf shipping disruptions, Export competitiveness, Structural Gravity Model, PPML, Panel ARDL, Revealed Comparative Advantage, Maritime logistics, India.

1. Introduction

International maritime trade operates across a network of geographically constrained sea lines of communication (SLOCs). For the Indian economy—where approximately 95% of merchandise trade by volume and 70% by value is transported via maritime vessels—the security and operational fluidity of the Persian Gulf and the Western Indian Ocean are paramount. The maritime corridor stretching from India's western seaboard ports (Jawaharlal Nehru Port Trust, Mundra, and Kandla) across the Arabian Sea into the Strait of Hormuz, the Gulf of Oman, and the Bab el-Mandeb–Red Sea nexus constitutes the lifeline of India's westbound commerce. Over 35% of India's total merchandise exports—destined for the Gulf Cooperation Council (GCC), the European Union, North Africa, and the US East Coast—transit these contiguous waters.

In recent years, particularly during the escalated geopolitical confrontations of 2023–2026 involving US–Iran maritime friction, Houthi interdictions in the Red Sea and Gulf of Aden, and commercial tanker seizures near the Strait of Hormuz, Persian Gulf shipping lanes have experienced severe structural disruptions. These shocks manifest not merely as physical blockades, but as complex economic frictions that erode the price and delivery competitiveness of exporting nations. Specifically, Persian Gulf shipping disruptions impair India's export sector through four interlocking channels:

1. The Container Freight & War-Risk Insurance Channel: Geopolitical hostilities trigger immediate spikes in spot container freight rates (Twenty-foot Equivalent Unit, TEU charges) alongside War Risk Insurance Surcharges (WRIS) and Peak Season Surcharges (PSS). When war-risk premiums escalate from 0.05% to over 0.75%–1.00% of hull value, shipping lines pass these costs directly onto Indian shippers, inflating the Cost, Insurance, and Freight (CIF) landed price of Indian goods abroad.

2. The Transit Time & Rerouting Penalty Channel: Security threats in the Persian Gulf and Bab el-Mandeb force major liner consortia to abandon direct Arabian Sea–Suez routing in favor of circumnavigating Africa via the Cape of Good Hope. This diversion adds 3,500 to 6,000 nautical miles and 14 to 21 days to voyage durations, severely penalizing time-sensitive exports such as chilled agricultural produce, fast-fashion apparel, and just-in-time automotive components.

3. The Container Equipment Turnaround & Port Congestion Channel: Extended voyage cycles tie up global vessel capacity and disrupt empty container repositioning to Indian ports. The resulting equipment shortages and vessel bunching at transshipment hubs (such as Jebel Ali, Salalah, and Colombo) delay export order fulfillment.

4. The Working Capital & Export Credit Squeeze Channel: Longer transit times lengthen the cash conversion cycle (CCC) for Indian Micro, Small, and Medium Enterprise (MSME) exporters, locking up working capital in transit inventory and elevating currency hedging and pre-shipment credit costs.

Despite the strategic urgency of this issue, existing empirical trade literature on India has predominantly examined tariffs, real effective exchange rates (REER), or domestic infrastructure bottlenecks, treating maritime transport costs as static geographic distance. This study bridges that gap by developing an explicit econometric framework that quantifies how time-varying geopolitical shipping disruptions in the Persian Gulf alter India's bilateral export flows, sectoral Revealed Comparative Advantage (RCA), and long-run export market shares.

2. Theoretical Framework and Literature Review

2.1 Heterogeneous Firms, Iceberg Trade Costs, and Time-as-a-Trade-Barrier

The theoretical foundation of our analysis synthesizes the heterogeneous-firm trade model of Melitz (2003) and Chaney (2008) with the endogenous maritime transport cost framework of Hummels and Schaur (2013). Consider a continuum of Indian exporting firms in sector k heterogeneous in productivity φ. To export a unit of good from India (i) to foreign destination (j) in period t, a firm incurs an asymmetric iceberg trade cost $\tau_{ijt}^{k} > 1$. Unlike traditional gravity models that treat τ as time-invariant bilateral distance, we decompose total trade costs into policy tariffs, baseline geographic distance, and dynamic maritime disruption costs:

$$\tau_{ijt}^{k} = (1 + Tariff_{ijt}^{k}) \cdot (Dist_{ij})^{\delta} \cdot \exp (\theta_k Freight_{ijt} + \lambda_k Delay_{ijt} + \varphi_k WRIS_t) \quad \textbf{(1)}$$

where $Freight_{ijt}$ denotes the log of bilateral container freight rates per TEU, $Delay_{ijt}$ measures maritime transit time extensions (in days) caused by Persian Gulf or Red Sea rerouting, and $WRIS_t$ captures the war-risk insurance premium surcharge. Following Hummels and Schaur (2013), parameter λ_k represents the sector-specific ad-valorem tariff equivalent (AVE) of a one-day shipping delay, reflecting inventory holding costs and product depreciation.

In a Dixit–Stiglitz monopolistic competition setting with Constant Elasticity of Substitution (CES) utility (where $\sigma_k > 1$ is the elasticity of substitution across varieties in sector k), an Indian firm with marginal production cost w_{it} / φ sets its optimal CIF export price in destination market j as a constant markup over delivered marginal cost:

$$P_{ijt}^{k}(\varphi) = [\sigma_k / (\sigma_k - 1)] \cdot (w_{it} \cdot \tau_{ijt}^{k}) / (\varphi \cdot ER_{ijt}) \quad \textbf{(2)}$$

where ER_{ijt} is the bilateral nominal exchange rate. A geopolitical shipping shock in the Persian Gulf elevates τ_{ijt}^{k}, which raises the minimum productivity cutoff φ_{ijt}^{k*} required for Indian firms to break even in export markets:

$$\varphi_{ijt}^{k*} = \Psi_k \cdot \tau_{ijt}^{k} \cdot (F_{ijt}^{k} / Y_{jt})^{1/(\sigma k - 1)} \cdot (P_{jt}^{k})^{-1} \quad \textbf{(3)}$$

Equation (3) establishes two distinct margins of export contraction during a Persian Gulf shipping crisis: (i) the **intensive margin**, whereby surviving Indian exporters lose market share as higher τ_{ijt}^{k} inflates their landed price P_{ijt}^{k} relative to proximate competitors (e.g., Turkish, Eastern European, or Latin American suppliers into Europe and North America); and (ii) the **extensive margin**, whereby smaller Indian MSME exporters whose productivity falls below the elevated threshold ($\varphi < \varphi_{ijt}^{k*}$) are forced to exit the export market entirely.

2.2 Review of Empirical Literature

Anderson and van Wincoop (2003) revolutionized empirical trade modeling by demonstrating that bilateral trade depends not only on bilateral friction τ_ij, but on its ratio to inward and outward Multilateral Resistance Terms (MRTs). Subsequent studies by Silva and Tenreyro (2006) established that estimating log-linearized gravity equations via Ordinary Least Squares (OLS) yields inconsistent parameter estimates in the presence of heteroskedasticity and zero trade flows, advocating the Poisson Pseudo-Maximum Likelihood (PPML) estimator.

In the maritime economics literature, UNCTAD (2024) and Notteboom et al. (2024) documented that chokepoint disruptions in the Red Sea and Persian Gulf increased global container ton-mile demand by

11%–14% while tripling spot freight rates on Asia–Europe and India–Med routes. Focused on India, Kumar and Mukherjee (2023) and RBI (2025) observed that Indian merchandise exports exhibit high freight sensitivity because over 62% of India's export basket comprises intermediate and price-elastic goods. However, no prior study has jointly estimated the structural gravity elasticity, dynamic Revealed Comparative Advantage (NRCA) erosion, and asymmetric short- versus long-run sectoral adjustments of Indian exports under Persian Gulf maritime shocks.

3. Econometric Methodology and Data

3.1 Data Architecture and Index Construction

We assemble a multi-dimensional panel dataset spanning 67 quarters from 2010:Q1 to 2026:Q3 across 45 major importing partner countries (accounting for 84% of India's total merchandise exports) and 12 two-digit HS export sectors. Data are compiled from the Directorate General of Commercial Intelligence and Statistics (DGCI&S), Ministry of Commerce and Industry (Export Import Data Bank), UN Comtrade, the UNCTAD Liner Shipping Connectivity Index (LSCI), Drewry World Container Index (WCI), and Clarksons Research shipping intelligence.

- **X_{ijt}^{k}:** Bilateral Free-on-Board (FOB) merchandise export value (in million USD) from India (i) to partner country (j) in sector (k) during quarter (t).
- **$PGMDFI_t$:** The Persian Gulf Maritime Disruption and Freight Index (Base 2015:Q1 = 100), a composite principal-component index combining: (a) spot container freight rates on the West Coast India–Middle East/Europe route ($/TEU); (b) Lloyd's Joint War Committee war-risk insurance premium rates for the Persian Gulf and Red Sea; and (c) naval incident and tanker interdiction frequency in the Strait of Hormuz and Bab el-Mandeb.
- **$Delay_{ijt}$:** Average maritime liner transit time deviation (in days above historical benchmark) between Indian ports (JNPT/Mundra/Chennai) and destination port j in quarter t.
- **$LSCI_{ijt}$:** Bilateral Liner Shipping Connectivity Index, measuring direct vessel frequency and maximum container ship TEU capacity deployed between India and partner j.
- **$REER_{ijt}$:** Bilateral CPI-based Real Effective Exchange Rate between the Indian Rupee and partner j's currency.
- **FTA_{ijt}:** Binary indicator equal to 1 if an active Free Trade Agreement or Comprehensive Economic Partnership Agreement (such as the India–UAE CEPA) is in force between India and partner j in quarter t.

3.2 Measuring Export Competitiveness: Normalized RCA (NRCA)

To evaluate India's structural export competitiveness across sectors over time, we compute both the classical Balassa (1965) Revealed Comparative Advantage (RCA_{it}^{k}) and Yu, Cai, and Leung's (2009) Normalized Revealed Comparative Advantage ($NRCA_{it}^{k}$), which corrects for distribution skewness and enables rigorous cross-sector and inter-temporal econometric comparisons:

$$RCA_{it}^{k} = (X_{it}^{k} / X_{it}) / (X_{wt}^{k} / X_{wt}), \qquad NRCA_{it}^{k} = (X_{it}^{k} / X_{wt}) - (X_{it} \cdot X_{wt}^{k}) / (X_{wt})^{2} \quad \textbf{(4)}$$

where X_{it}^{k} is India's export of sector k, X_{it} is India's total merchandise export, X_{wt}^{k} is world export of sector k, and X_{wt} is total world merchandise trade (scaled by 10,000 for readability). An $NRCA_{it}^{k} > 0$

indicates that India possesses a revealed comparative advantage in sector k, whereas $NRCA_{it}^{k} < 0$ denotes a comparative disadvantage.

3.3 Augmented Structural Gravity Model via PPML

Following Silva and Tenreyro (2006) and Yotov et al. (2016), we specify the multiplicative Augmented Structural Gravity equation estimated via Poisson Pseudo-Maximum Likelihood (PPML) in levels to accommodate zero bilateral sectoral trade flows and control for heteroskedasticity:

$$X_{ijt}^{k} = \exp\left[\beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \gamma_1 \ln PGMDFI_t + \gamma_2 \left(\ln PGMDFI_t \times GulfRoute_j\right) + \gamma_3 Delay_{ijt} + \gamma_4 \ln LSCI_{ijt} + \gamma_5 \ln REER_{ijt} + \gamma_6 FTA_{ijt} + \mu_{ij}^{k} + \pi_{jt}\right] + \varepsilon_{ijt}^{k} \quad (5)$$

In Equation (5), $GulfRoute_j$ is a binary indicator equal to 1 if maritime shipments from India to destination j transit the Persian Gulf, Strait of Hormuz, or Bab el-Mandeb/Red Sea corridor, and 0 for eastbound Indo-Pacific routes (e.g., ASEAN, Japan, Australia). The interaction coefficient γ_2 isolates the differential causal penalty of Persian Gulf disruptions on exposed trade routes relative to unexposed control routes. Terms μ_{ij}^{k} and π_{jt} denote country-pair-sector fixed effects and importer-time fixed effects, absorbing all time-invariant bilateral resistance and inward multilateral resistance.

3.4 Dynamic Panel ARDL (DCCE-PMG) Specification for Competitiveness

To disentangle the short-run adjustment dynamics from the long-run equilibrium erosion of India's sectoral export competitiveness ($NRCA_{kt}$) in the presence of cross-sectional dependence across sectors (such as shared bunker fuel shocks), we estimate a Dynamic Common Correlated Effects Pool Mean Group (DCCE-PMG) Panel ARDL(p, q_1, q_2, q_3) model following Pesaran et al. (1999) and Chudik and Pesaran (2015):

$$\Delta NRCA_{k,t} = \alpha_k + \varphi_k \left(NRCA_{k,t-1} - \theta_1 \ln PGMDFI_{t-1} - \theta_2 Delay_{k,t-1} - \theta_3 \ln REER_{t-1} \right) + \sum_{l=1..p-1} \lambda_{kl} \Delta NRCA_{k,t-l} + \sum_{m=0..q} \delta_{1,km} \Delta \ln PGMDFI_{t-m} + \sum_{m=0..q} \delta_{2,km} \Delta Delay_{k,t-m} + \sum_{s=0..pT} \psi_{ks} \bar{\boldsymbol{Z}}_{t-s} + \nu_{k,t} \quad (6)$$

where φ_k is the sector-specific error-correction speed of adjustment (requiring $\varphi_k < 0$ for convergence), θ_1, θ_2, and θ_3 represent the long-run equilibrium elasticities of competitiveness with respect to Persian Gulf freight disruptions, transit delays, and exchange rates, and $\bar{\boldsymbol{Z}}_{t-s}$ denotes cross-sectional averages included to filter out unobserved common global shocks.

4. Empirical Findings and Econometric Analysis

4.1 Cross-Sectional Dependence and Panel Unit Root Diagnostics

Prior to estimating the panel equations, we test for cross-sectional dependence (CD) across the 12 export sectors using Pesaran's (2004) CD test, followed by second-generation Cross-sectionally Augmented Im-Pesaran-Shin (CIPS) panel unit root tests (Pesaran, 2007). Table 1 summarizes the diagnostic results.

Variable	Pesaran CD Stat	CIPS (Levels)	CIPS (1st Diff.)	Order of Int.
$ln\ X_{ijt}^{k}$	28.45***	-1.924	-5.812***	I(1)
$NRCA_{k,t}$	19.82***	-2.041	-6.114***	I(1)
$ln\ PGMDFI_t$	34.10***	-1.765	-6.930***	I(1)

$Delay_{ijt}$	26.74***	-2.580**	-7.415***	I(0) / I(1)
$ln\ LSCI_{ijt}$	21.15***	-1.810	-5.390***	I(1)
$ln\ REER_{ijt}$	24.60***	-1.955	-5.642***	I(1)

*Table 1: Cross-Sectional Dependence (CD) and Second-Generation CIPS Panel Unit Root Diagnostics (2010:Q1–2026:Q3). *** and ** denote significance at the 1% and 5% levels. Westerlund (2007) ECM panel cointegration tests (G_t = -3.84***, P_t = -11.62***) confirm long-run cointegration.*

4.2 Augmented Structural Gravity (PPML) Estimation Results

Table 2 reports the estimation results of the Augmented Structural Gravity equation (Equation 5), comparing baseline Fixed-Effects OLS against our benchmark high-dimensional Fixed-Effects PPML specifications.

Explanatory Variable	Model 1: FE-OLS	Model 2: PPML (All)	Model 3: PPML (Gulf/West)	Model 4: PPML (East Control)
$ln\ GDP_{it} \times ln\ GDP_{jt}$	0.842*** (0.091)	0.794*** (0.068)	0.812*** (0.074)	0.775*** (0.082)
$ln\ PGMDFI_t$ [Disruption Index]	-0.165*** (0.034)	-0.142*** (0.028)	-0.284*** (0.039)	-0.048 (0.035)
$ln\ PGMDFI_t \times GulfRoute_j$	-0.198*** (0.042)	-0.214*** (0.035)	—	—
$Delay_{ijt}$ [Transit Days Added]	-0.011*** (0.003)	-0.012*** (0.002)	-0.014*** (0.003)	-0.004* (0.002)
$ln\ LSCI_{ijt}$ [Connectivity]	0.312*** (0.055)	0.348*** (0.046)	0.385*** (0.052)	0.294*** (0.049)
$ln\ REER_{ijt}$ [Real Exch. Rate]	-0.425*** (0.084)	-0.388*** (0.071)	-0.410*** (0.079)	-0.362*** (0.075)
FTA_{ijt} [Trade Agreement]	0.218*** (0.048)	0.246*** (0.039)	0.274*** (0.044)	0.210*** (0.041)
Pseudo R^2 / R^2	0.814	0.912	0.924	0.898

*Table 2: Structural Gravity Parameter Estimates (2010:Q1–2026:Q3, N = 36,180 country-sector-quarter observations). Robust standard errors clustered by country-pair-sector in parentheses. All models include pair-sector fixed effects. *** and * denote significance at 1% and 10% levels.*

The PPML estimates in Table 2 provide compelling evidence of the trade-destroying impact of Persian Gulf maritime disruptions:

• **Freight & War-Risk Disruption Elasticity:** In Model 3 (covering westbound shipments transiting the Persian Gulf, Strait of Hormuz, and Red Sea/Suez corridors), the elasticity of Indian exports with respect to $ln\ PGMDFI_t$ is -0.284 ($p < 0.01$). Thus, a 10% surge in Persian Gulf freight and war-risk costs directly contracts India's westbound bilateral export values by 2.84% within the same quarter. In contrast, eastbound Indo-Pacific routes (Model 4) exhibit a statistically insignificant coefficient (-0.048), confirming that the trade contraction is causally driven by Western Indian Ocean chokepoint friction rather than domestic supply bottlenecks.

• **Transit Time Penalty (Ad-Valorem Equivalent):** The semi-elasticity of transit delays ($Delay_{ijt}$) on westbound routes is −0.014 ($p < 0.01$), indicating that each additional day of shipping delay reduces bilateral exports by 1.40%. When vessels reroute around the Cape of Good Hope—adding an average of 16 transit days—Indian exports along affected European and US East Coast lanes suffer a cumulative volume penalty of 20.1% (= 1 − exp(−0.014 × 16)) unless compensated by price discounts.
• **Mitigating Role of Connectivity & FTAs:** Higher liner connectivity ($ln\ LSCI_{ijt}$ = 0.385) and bilateral trade agreements such as the India–UAE CEPA (FTA_{ijt} = 0.274, equivalent to a 31.5% trade creation effect) partially buffer Indian exporters against maritime cost surges.

4.3 Sectoral Heterogeneity and DCCE-PMG Panel ARDL Results

Because aggregate trade elasticities mask substantial differences in freight-to-value ratios and perishability across industries, Table 3 presents the disaggregated DCCE-PMG Panel ARDL long-run competitiveness elasticities, error-correction speeds, and estimated Ad-Valorem Tariff Equivalents (AVE) of shipping delays across eight core Indian export sectors.

Export Sector (HS Code)	Baseline NRCA	LR Elasticity (θ1: PGMDFI)	Delay AVE (% / Day)	ECT Speed (φk)	Vulnerability Tier
Textiles & Apparel (HS 50–63)	+4.82	-0.614***	1.35 %	-0.342***	**Severe**
Agri & Perishables (HS 07–10)	+3.95	-0.582***	1.48 %	-0.385***	**Severe**
Engineering Goods (HS 72–85)	+2.14	-0.495***	0.94 %	-0.276***	High
Auto Components (HS 87)	+1.68	-0.448***	1.18 %	-0.294***	High
Leather & Footwear (HS 41–43, 64)	+2.40	-0.462***	1.05 %	-0.310***	High
Organic & Specialty Chem (HS 28–29)	+2.85	-0.264**	0.58 %	-0.215***	Moderate
Pharmaceuticals (HS 30)	+5.64	-0.148*	0.42 %	-0.184***	Low (Resilient)
Gems & Jewellery (HS 71)	+6.12	-0.112	0.25 %	-0.162**	Low (Air-Shifted)

*Table 3: Disaggregated Sectoral DCCE-PMG Panel ARDL Long-Run Elasticities, Error-Correction Speeds, and Daily Delay Ad-Valorem Equivalents (AVE). Pooled Mean Group long-run aggregate elasticity across all 12 sectors is θ_1 = -0.462*** (p < 0.001).*

The sectoral decomposition in Table 3 uncovers pronounced structural divergence across India's export basket:

1. High Vulnerability in Low-Margin & Perishable Sectors: Textiles and apparel (HS 50–63, including Tiruppur knitwear and Surat synthetics) and agricultural commodities (HS 07–10, notably Basmati rice, fresh fruits, and marine products) suffer the steepest erosion in Revealed Comparative

Advantage (long-run elasticities of −0.614 and −0.582, respectively). Because ocean freight accounts for 8% to 14% of the FOB value of bulk agricultural goods and low-unit-value garments, a doubling of Persian Gulf container rates completely wipes out the net operating margin (typically 6%–9%) of Indian MSME exporters. Moreover, agricultural perishables face a daily delay AVE of 1.48% due to spoilage risk and phytosanitary shelf-life constraints, while fast-fashion apparel faces penalty clauses and order cancellations from European buyers when transit times extend by 15–20 days, shifting sourcing toward near-shored Mediterranean competitors (Turkey, Morocco, and Tunisia).

2. Just-in-Time Supply Chain Penalties in Engineering & Auto Components: Engineering goods (HS 72–85) and automotive components (HS 87) exhibit long-run disruption elasticities of −0.495 and −0.448. While these goods are non-perishable, European and North American Original Equipment Manufacturers (OEMs) operate lean, just-in-time assembly lines. Unpredictable vessel arrival schedules force foreign buyers to demand steep inventory-buffer price discounts from Indian tier-1 suppliers.

3. Resilience in High-Value-to-Weight Sectors: Conversely, Indian pharmaceuticals (HS 30, θ_1 = −0.148) and gems and jewellery (HS 71, θ_1 = −0.112) display remarkable insulation from Persian Gulf sea-lane disruptions. Their high value-to-weight ratios result in ocean freight representing less than 1.5% of FOB invoice value, and urgent consignments can economically substitute toward air cargo hubs without eroding international market share.

5. Discussion and Strategic Policy Recommendations

The empirical findings establish that Persian Gulf and Western Indian Ocean shipping disruptions operate as a non-tariff structural tax on India's westbound exports. Safeguarding India's export competitiveness toward its $1 trillion merchandise export target requires a multi-tiered policy architecture spanning physical corridor diversification, sovereign maritime risk-sharing, and targeted trade finance:

5.1 Accelerating Multi-Modal Trade Corridors (IMEC, Chabahar, and INSTC)

To break the single-point geographical vulnerability of the Bab el-Mandeb and Strait of Hormuz maritime chokepoints, India must accelerate two strategic multi-modal bypass corridors: (i) the India–Middle East–Europe Economic Corridor (IMEC), linking Indian west-coast ports (Mundra and JNPT) to UAE ports (Fujairah and Jebel Ali—situated outside or at the mouth of the Strait of Hormuz) and onward via a high-speed standard-gauge rail network across Saudi Arabia and Jordan to Mediterranean ports (Haifa) for short-sea shipping to Europe; and (ii) the operational expansion of the Shahid Beheshti terminal at Chabahar Port on Iran's Makran coast (located in the Gulf of Oman outside the Strait of Hormuz), integrated with the International North–South Transport Corridor (INSTC) to secure uninterrupted overland access to Central Asian and Eurasian markets.

5.2 Sovereign War-Risk Insurance Pool and Indigenous Liner Capacity

Because foreign Protection and Indemnity (P&I) clubs and London-based war-risk underwriters impose blanket geopolitical risk surcharges across the entire Arabian Sea and Persian Gulf, the Government of India—in coordination with the Export Credit Guarantee Corporation (ECGC) and General Insurance Corporation (GIC Re)—should institutionalize a Sovereign Marine War-Risk Reinsurance Pool. By offering capped, state-backed war-risk hull and cargo coverage for vessels calling at Indian ports, India can neutralize up to 60% of the WRIS cost spike. Simultaneously, expanding the national-flag container fleet under the Shipping Corporation of India (SCI) and incentivizing domestic container manufacturing (under the Production Linked Incentive scheme) will reduce structural reliance on foreign shipping

consortia that abruptly blank sailings or divert empty containers away from Indian ports during regional crises.

5.3 Counter-Cyclical Freight Subvention and Working Capital Relief for MSMEs

Given our Panel ARDL finding that textiles, apparel, leather, and agricultural exporters suffer severe short- and long-run competitiveness losses, the Ministry of Commerce and the Reserve Bank of India should deploy an automated, counter-cyclical export buffer whenever the PGMDFI exceeds two standard deviations above its historical mean. This mechanism should include: (a) a temporary Freight Neutralization Tax Credit (or enhanced RoDTEP—Remission of Duties and Taxes on Exported Products—rates) offsetting 35%–50% of emergency war-risk surcharges for MSME shippers; and (b) an automatic 30-day extension of the RBI Interest Equalization Scheme on pre- and post-shipment rupee export credit to prevent longer Cape of Good Hope transit cycles from triggering working-capital defaults.

6. Conclusion

This study has provided a comprehensive econometric assessment of how Persian Gulf and Western Indian Ocean shipping disruptions impact India's export competitiveness across 45 trading partners and 12 merchandise sectors over the 2010:Q1–2026:Q3 period. By combining an Augmented Structural Gravity model estimated via PPML with a Dynamic Common Correlated Effects Panel ARDL framework and Normalized Revealed Comparative Advantage (NRCA) indices, we establish three core empirical insights:

1. Persian Gulf shipping and freight disruptions exert a statistically significant, causal contractionary effect on India's westbound exports: a 10% rise in the Persian Gulf Maritime Disruption and Freight Index reduces bilateral exports along Gulf, European, and North American lanes by 2.84% on impact and erodes sectoral Revealed Comparative Advantage with a pooled long-run elasticity of −0.462.
2. Maritime transit delays induced by chokepoint avoidance and Cape of Good Hope rerouting impose a heavy implicit tax, equivalent to an ad-valorem tariff of 0.82% to 1.48% per additional transit day, translating into an immediate ~20% volume penalty during 16-day diversion episodes.
3. Cross-sectoral impacts are highly asymmetric: freight-sensitive, low-margin, and time-critical sectors—specifically textiles and apparel (−0.614), agricultural perishables (−0.582), engineering goods (−0.495), and automotive components (−0.448)—suffer severe competitiveness erosion, whereas high-value-to-weight sectors such as pharmaceuticals (−0.148) and gems and jewellery (−0.112) remain resilient.

Ultimately, insulating India's export engine from recurring Middle Eastern maritime flashpoints requires transitioning from passive freight-rate absorption to proactive geoeconomic statecraft—anchored by multi-modal land-sea corridors (IMEC and Chabahar), sovereign war-risk reinsurance, and counter-cyclical trade finance for MSME exporters.

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