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Special Issue: Geopolitical Confrontation, Resource Chokepoints, and Global Macroeconomic Disruption

2026

Edited by the Department of Economics
Four peer-reviewed undergraduate research papers

Special Issue: Geopolitical Confrontation, Resource Chokepoints, and Global Macroeconomic Disruption

Department of Economics, St. Paul's Cathedral Mission College

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Editorial Preface

The military hostilities erupting across West Asia have challenged standard open-economy macroeconomic models and transformed structural trade assumptions. What began as tactical military operations rapidly mutated into maritime interdictions along vital international transit corridors, centered on the Strait of Hormuz, the Bab-el-Mandeb, and the Suez Canal. The crisis serves as a comprehensive case study in supply-side macroeconomic shocks, labor mobility disruptions, non-cooperative game theory, and multi-tier industrial supply-chain dependencies.

This volume compiles four extended, peer-reviewed undergraduate research papers prepared by students from the Department of Economics at St. Paul's Cathedral Mission College. Each paper investigates a distinct analytical domain:

- **Article I** formalizes the baseline macro-financial shock, cost-push transmission mechanisms, and risk-averse portfolio realignments.
- **Article II** evaluates cross-border labor dynamics, examining the welfare shocks of mass return migration, remittance drains, and structural labor market disequilibria.
- **Article III** provides a strategic and trade-corridor perspective, evaluating the disruption of transcontinental transit initiatives (IMEEC and INSTC) alongside a formal game-theoretic escalation model.
- **Article IV** investigates industrial and humanitarian second- and third-order spillover effects, tracing downstream shortages across synthetic petrochemicals, East Asian semiconductor fabrication, and agricultural fertilizer networks.

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Article I: Macroeconomic Shockwaves, Cost-Push Dynamics, and Financial Contagion

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Abstract

This paper analyzes the transmission of the West Asian geopolitical crisis into global macroeconomic indicators and financial markets. By incorporating energy as an intermediate input into a formal aggregate supply framework, we examine the macroeconomic mechanics of stagflation. We trace the transmission of geopolitical risk premiums into global equity depreciations, bond yield curve compressions, foreign exchange volatility, and the limitations of emergency public policy interventions such as strategic petroleum reserve drawdowns.

1. Geopolitical Context and Energy Architecture

West Asia occupies an indispensable position in the international economic order, holding roughly 48% of global proven crude oil reserves and nearly 40% of natural gas reserves. Its maritime chokepoints—most prominently the Strait of Hormuz and the Suez Canal—serve as central arteries for international commerce. Approximately 20 million barrels per day (bpd), representing nearly 34% of global seaborne crude trade and 20% of global liquefied natural gas (LNG), pass through the narrow waters of the Strait of Hormuz. Roughly 44% of these exports are destined for the expanding industrial centers of China and India, representing nearly one-fifth of total global energy demand.

The geographic reality that Iran directly flanks the northern coastline of the Strait of Hormuz turns any localized military escalation into a global supply threat. Escalating hostilities involving Iran, Israel, and the United States, alongside sustained instability across Lebanon and Palestine, have compromised commercial transit. Because short-run energy demand exhibits extreme price inelasticity, even minor maritime interruptions or speculative threat assessments lead to steep price spikes, destabilizing supply chains and generating immediate inflationary pressures across advanced and developing economies.

2. The Theoretical Framework: Energy-Augmented Production and Cost-Push Stagflation

Standard neoclassical production models define domestic output (Y) as a functional relation of physical capital (K) and labor (L). However, modeling real-world supply disturbances requires incorporating imported energy (E) as an essential, non-substitutable intermediate input:

$$Y = F(K, L, E)$$

In this formulation, energy directly conditions total factor productivity and marginal production costs. The aggregate supply relation can be formalized as:

$$AS = f\big(P - \text{Cost}(P_E)\big)$$

where P is the aggregate price level and P_E represents the prevailing price of imported energy inputs.

An exogenous geopolitical shock that inflates P_E directly raises the marginal cost of production across all domestic industries. This causes a leftward contraction of the short-run Aggregate Supply curve ($SRAS_1 \rightarrow SRAS_2$):

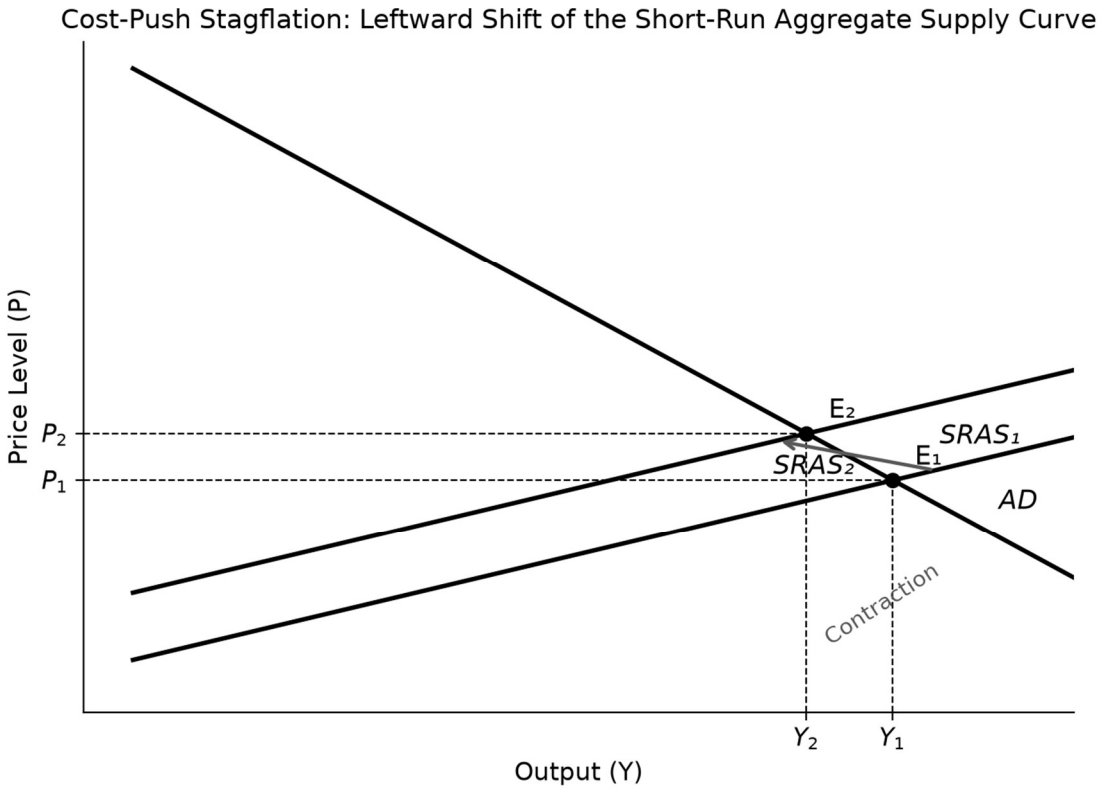

Figure 1. Cost-push stagflation: a leftward shift of the short-run aggregate supply curve raises the price level from P_1 to P_2 while output contracts from Y_1 to Y_2.

At the initial equilibrium price level P_1, an excess demand gap forms because production becomes unviable at previous margins. The new macroeconomic equilibrium is established at a lower output level ($Y_2 < Y_1$) and an elevated aggregate price level ($P_2 > P_1$). This dynamic generates cost-push stagflation—a stagnation of real economic growth accompanied by persistent consumer price inflation.

This presents central banks with a classical monetary dilemma. Increasing policy rates to rein in headline inflation dampens aggregate demand (AD), risking a deeper domestic recession. Conversely, keeping interest rates loose to protect output risks entrenching inflation expectations and accelerating domestic currency depreciation.

3. Empirical Macro-Financial Transmission Channels

The escalation immediately affected global asset classes through several distinct financial transmission mechanisms:

Global Equity Re-pricing. Bourses reacted to the dual threats of margin compression and tightening interest rates. Developed-market indices fell sharply, led by drops of over 400 points in the Dow Jones Industrial Average and approximately 0.7% in the S&P 500, while European and Asian benchmark indices dropped by 1% to 2%. Upstream oil and gas equities diverged, benefiting from inventory appreciation and wider refining margins.

Foreign Exchange Dynamics and Capital Flight. International investors rotated capital into dollar-denominated assets, pushing up the US Dollar Index. For net energy-importing emerging economies, this currency movement proved especially damaging; their domestic currencies depreciated against the dollar, compounding the rising cost of imported oil and triggering a cycle of imported inflation.

Yield Curve Compression. Sovereign debt markets priced in rising credit and inflation risks. Investors favored short-dated US Treasury bills over long-duration sovereign bonds to limit exposure to inflation-induced monetary tightening. This flight to liquidity compressed yield curves, creating the inverted curve patterns that historically precede broader economic contractions.

Safe-Haven Commodity Allocation. Capital shifted toward traditional physical hedges, driving sustained rallies in spot gold and silver prices as investors hedged against geopolitical tail-risks and fiat purchasing-power erosion.

4. International Policy Responses and Strategic Reserve Limits

To blunt rising spot energy prices, member countries of the International Energy Agency (IEA) initiated coordinated emergency measures, led by the release of 172 million barrels from the US Strategic Petroleum Reserve (SPR) as part of a broader 400-million-barrel global drawdown.

While these strategic releases provided short-term liquidity to physical crude markets, empirical macroeconomics shows their structural limitations. Emergency reserves are designed to manage temporary logistical frictions, not prolonged structural deficits. Against a chokepoint like the Strait of Hormuz handling approximately 20 million bpd, an intervention of 400 million barrels provides the equivalent of only 20 days of disrupted flow. Because strategic reserves do not alter long-term supply fundamentals, their market effect declines over an extended conflict, leaving economies exposed to cost-push pressures until new shipping lanes, alternative pipeline networks, and renewable substitutes are established.

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Article II: Geopolitical Crisis as a Structural Supply Shock to Global Labor Markets

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Abstract

This study investigates how geopolitical instability in West Asia disrupts global labor markets, focusing on migrant employment and cross-border remittance flows. Using a Keynesian open-economy framework, we model how project cancellations in host countries trigger large-scale return migration and lower household incomes in developing economies. The analysis demonstrates how these return flows strain labor markets in countries like India, reducing aggregate consumption through multiplier effects and worsening disguised unemployment in unorganized sectors.

1. Introduction: The Microeconomic Core of Migrant Mobility

Discussions of geopolitical crises typically focus on energy benchmarks, maritime shipping lanes, and headline inflation. However, human capital mobility is an equally significant, and often overlooked, channel through which regional instability spreads across the world economy. Over several decades, West Asian economies have absorbed millions of migrant workers, predominantly from South and Southeast Asian countries such as India, Bangladesh, Nepal, and the Philippines.

This movement of workers created an international division of labor: lower-income economies with labor surpluses supplied workers to Gulf economies facing labor shortages to support their infrastructure, construction, oil extraction, and low-tier service industries. These sectors are labor-intensive, meaning their expansion and day-to-day operations depend directly on a steady supply of migrant labor.

When armed conflict, falling business confidence, and capital flight disrupt this system, the economic foundation of regional labor demand contracts. Canceled infrastructure projects, suspended public contracts, and safety risks cause immediate reductions in workforce requirements. The resulting labor market impacts extend far beyond the Gulf region, transmitting negative economic shocks directly back into source-country households.

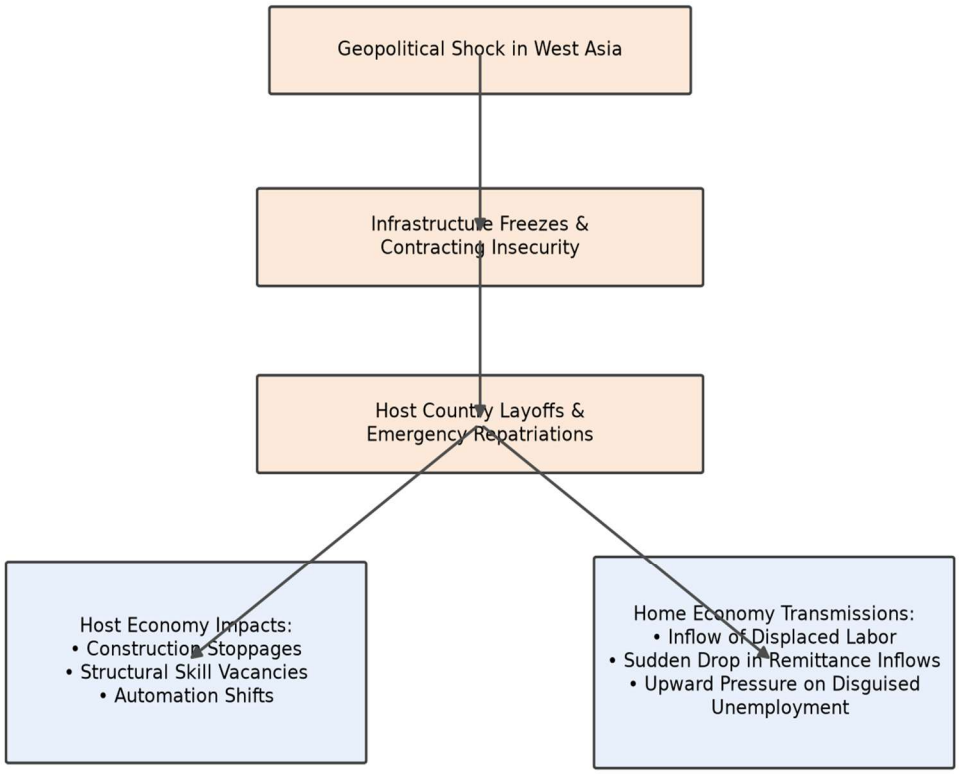

Figure 2. The transmission of a geopolitical shock into host-economy and home-economy labor market impacts.

2. The Remittance Transmission Mechanism and Aggregate Demand

For developing economies, remittance inflows provide a stable source of foreign exchange that directly supports household consumption, educational investment, and health spending. When migrant workers face sudden job losses, wage cuts, or emergency repatriation, these remittance flows drop sharply.

To evaluate the resulting macroeconomic effect, we use a basic Keynesian consumption framework:

$$C = \bar{C} + c(Y_d)$$

where $\bar{C}$ represents autonomous consumption, c is the marginal propensity to consume $(0 < c < 1)$, and Y_d is disposable household income.

In remittance-dependent economies, disposable income is heavily influenced by foreign transfers (R), such that $Y_d = Y_{domestic} - T + R$. When remittances fall by ΔR, household

disposable income contracts, causing a proportional decline in private consumption expenditure ($\Delta C = c \cdot \Delta R$).

Because consumption makes up a large share of aggregate demand ($AD = C + I + G + NX$), this initial reduction works through the standard Keynesian multiplier:

$$\Delta Y = \left(\frac{1}{1 - c(1 - t) + m}\right) \Delta R$$

where t represents the marginal tax rate and m represents the marginal propensity to import.

Because lower-income households that receive remittances typically display a high marginal propensity to consume (c), the decline in transfers triggers an amplified reduction in domestic economic activity. As household spending falls, local consumer-facing businesses see reduced revenue, prompting them to trim staff and curb investment, which spreads the initial external shock across the broader domestic economy.

Beyond immediate consumption, falling remittances also weaken longer-term human capital development. Households frequently allocate a portion of remittance receipts toward schooling, preventative healthcare, and small business capital. When these inflows shrink, families cut discretionary spending, which hurts long-term productivity and potential output growth.

3. Labor Market Disequilibrium and Structural Unemployment

The rapid return of thousands of migrant workers generates an immediate supply shock in home-country labor markets. In the short run, domestic labor demand (D_L) cannot expand fast enough to absorb this sudden influx of workers (ΔS_L):

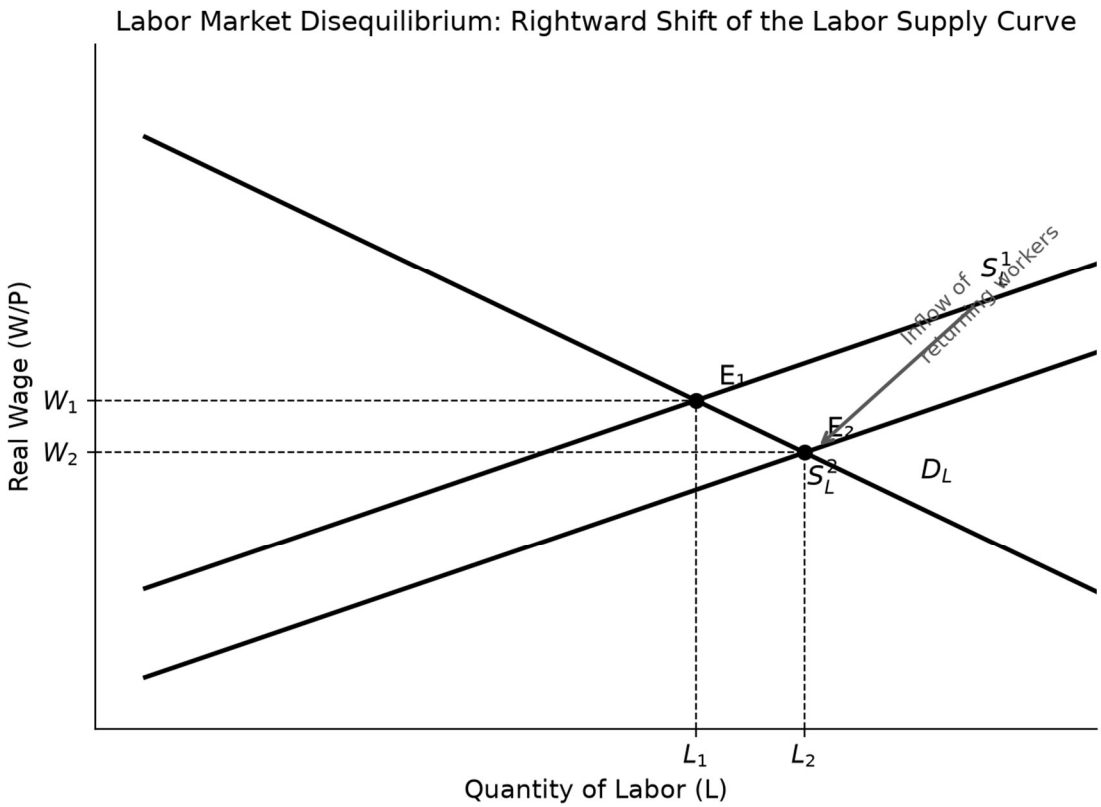

Figure 3. A rightward shift of the labor supply curve from S_1 to S_2 creates excess labor supply at the prevailing real wage W_1, exerting downward pressure on wages toward W_2.

This sudden rightward shift of the labor supply curve from S_L^1 to S_L^2 creates an excess supply of labor at the prevailing real wage W_1. To clear the market, real wages face downward pressure toward W_2. In labor markets with institutional rigidities, wage stickiness, and limited formal hiring, this adjustment often shows up as deteriorating working conditions and a shift toward informal employment.

Returning workers are frequently forced into casual labor, street vending, or informal manual jobs lacking social protections, contracts, or retirement benefits. This shift expands the unorganized sector, which reduces state direct tax receipts and lowers economy-wide labor productivity.

At the same time, this structural mismatch creates friction. Returning workers with experience in specialized large-scale infrastructure projects, modern commercial construction, or industrial operations may not find matching opportunities in their home economies, where industrial investment is growing more slowly. This creates structural unemployment: available job vacancies require skill sets, geographic mobility, or wage expectations that do not align with the returning workforce.

4. Disguised Unemployment in Developing Economies

The absorption problem is particularly acute in developing economies like India, where the rural economy and unorganized service sector already deal with disguised unemployment. In many agrarian settings, the number of people working on family farms exceeds what is technically needed to farm the land efficiently:

$$MP_L \approx 0$$

The marginal physical product of an additional laborer approaches zero. When displaced migrant workers return to their home villages, they are frequently absorbed into these family agricultural plots or low-productivity local services. While official employment metrics may count these individuals as employed, total output (Q) does not see a meaningful increase:

$$\Delta Q = MP_L \cdot \Delta L \approx 0$$

This pattern masks the true economic cost of the shock. Instead of open, measured unemployment, the labor market experiences lower overall productivity and reduced per-capita earnings across rural households.

5. Long-Run Adjustments: Automation and Migration Realignment

Over the medium to long term, this crisis could accelerate structural transformations across both sending and host economies:

Host-Economy Automation. Facing geopolitical instability, high repatriation expenses, and fluctuating security risks, Gulf firms are likely to accelerate capital-labor substitution. Investing in automated construction machinery, pre-fabricated modular infrastructure, and AI-enabled logistics helps lower their reliance on large expatriate workforces.

Reorienting Migration Corridors. Labor-sending economies will need to diversify their bilateral labor arrangements away from over-reliance on West Asia. Establishing institutional pathways to supply skilled technical and caregiving labor to aging societies in Europe and East Asia (such as Japan and South Korea) can help insulate domestic households from localized geopolitical shocks.

Domestic Active Labor Market Policies. Developing countries face an increasing need to implement targeted vocational retraining programs. Retraining returning workers in industrial manufacturing, green energy installation, and public civil works helps reallocate labor into productive, formal jobs rather than letting it slip into disguised unemployment.

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Article III: Strategic Corridors, Supply Inelasticity, and Game-Theoretic Escalation Dynamics

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Abstract

This paper analyzes how the 2026 West Asian conflict affects international trade networks, focusing on the disruption of transcontinental transit initiatives including the India–Middle East–Europe Economic Corridor (IMEEC) and the International North–South Transport Corridor (INSTC). We combine microeconomic price-elasticity models of crude oil supply disruptions with a non-cooperative game-theoretic framework to evaluate actor behavior. The analysis shows how uncoordinated strategic decision-making leads to a Pareto-inferior Nash Equilibrium that sustains elevated energy prices and disrupts global trade corridors.

1. The Trigger Events and Microeconomics of Crude Supply Disruptions

The regional crisis escalated sharply following coordinated US and Israeli airstrikes on Iranian strategic infrastructure, which provoked retaliatory drone and missile strikes alongside naval interdictions along primary Gulf shipping lanes. The Strait of Hormuz—a maritime chokepoint handling over 20 million bpd (roughly 20% of global petroleum liquids and 30% of global liquefied natural gas)—faced immediate operational disruptions. Tanker boardings, mine-laying operations, and elevated threat levels caused an initial 40% contraction in commercial traffic through the waterway.

To evaluate the resulting price behavior, we look at the short-run price elasticity of crude oil demand (ϵ_d):

$$\epsilon_d = \frac{\%\Delta Q_d}{\%\Delta P}$$

Empirical research shows that short-run demand for crude oil is highly inelastic, with $|\epsilon_d| \approx 0.2$. Because oil serves as a foundational intermediate input with few immediate substitutes, consumers and industrial firms cannot rapidly adjust consumption patterns when prices fluctuate. Rearranging the relationship to solve for price changes yields:

$$\%\Delta P = \frac{\%\Delta Q_s}{|\epsilon_d|}$$

Under this inelastic response, an exogenous 10% drop in seaborne crude supply yields an approximate 50% surge in the spot price:

$$\%\Delta P = \frac{10\%}{0.2} = 50\%$$

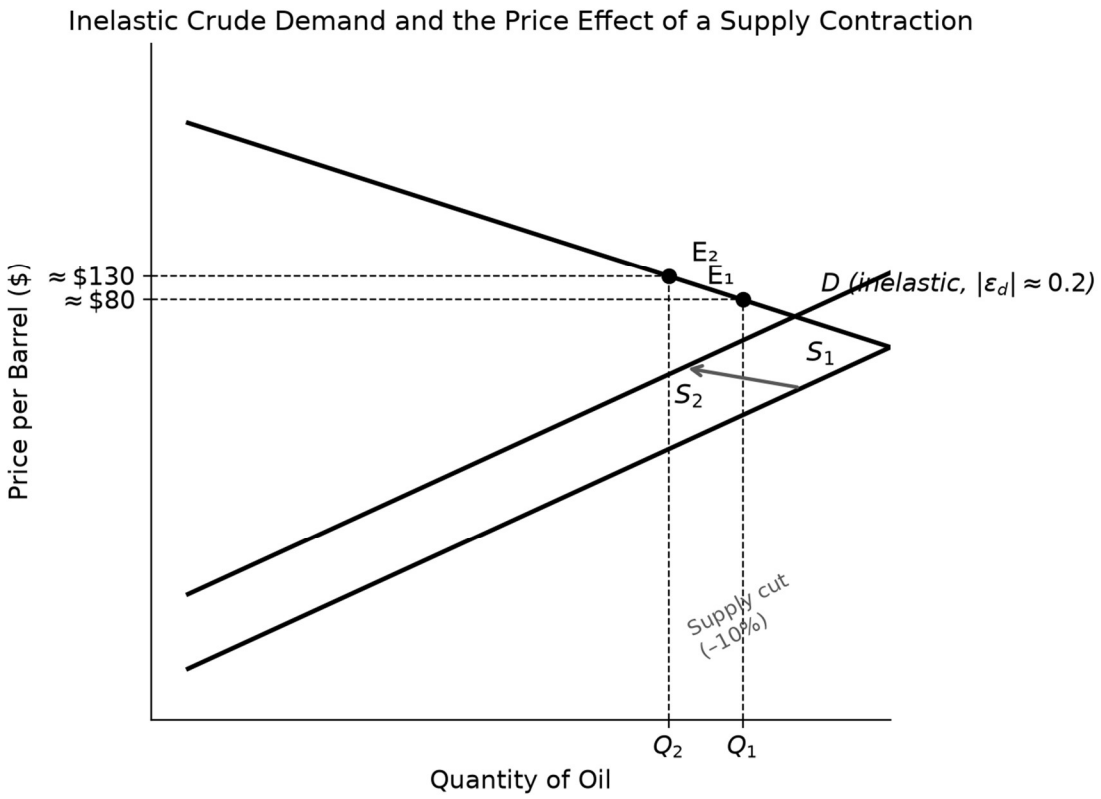

Figure 4. With highly inelastic short-run demand, a contraction in crude supply produces a disproportionately large price increase.

This extreme price sensitivity explains why crude benchmarks like Brent surged from pre-crisis baselines of $70–80/bbl to volatile trading ranges of $103–130/bbl. The supply contraction creates large economic drag on importing nations, inflating input expenses and causing significant supply-side friction throughout the global economy.

2. Transcontinental Trade Corridors Under Stress: IMEEC vs. INSTC

Beyond energy shipments, the conflict disrupted several planned and active transcontinental trade corridors designed to improve supply chain resilience.

The India–Middle East–Europe Economic Corridor (IMEEC). Unveiled as an integrated multimodal sea-rail network connecting India to Europe through the United Arab Emirates, Saudi Arabia, Jordan, and Israel, IMEEC was designed to lower logistics costs, cut transit times by 40%, and provide an alternative to the Suez Canal.

The 2026 military crisis, however, disrupted the corridor's progress. Maritime security threats around the Persian Gulf, direct missile engagements across the Levant, and escalating political divisions among participating nations halted key infrastructure projects. War-risk insurance premiums for commercial vessels operating in the region surged by over 300%, while ongoing security risks made long-term capital financing for ports and rail segments difficult to secure.

The International North–South Transport Corridor (INSTC). The INSTC, an established 7,200 km multimodal network linking India, Iran, Russia, and Central Asia via sea, rail, and road networks, was designed to bypass traditional European sea lanes. The conflict directly exposed the structural risks of over-relying on a single geographic node—in this case, Iran.

Kinetic strikes on Iranian infrastructure, operational disruptions at the Port of Chabahar, and rail closures along the Bandar Abbas–Tehran corridor added 45 to 60 days to standard cargo transit times. Trade between India, Central Asia, and Russia in bulk commodities such as fertilizers and pharmaceuticals faced disruption, resulting in estimated monthly trade losses of $40 to $60 million and forcing shippers back to longer routes around the Cape of Good Hope.

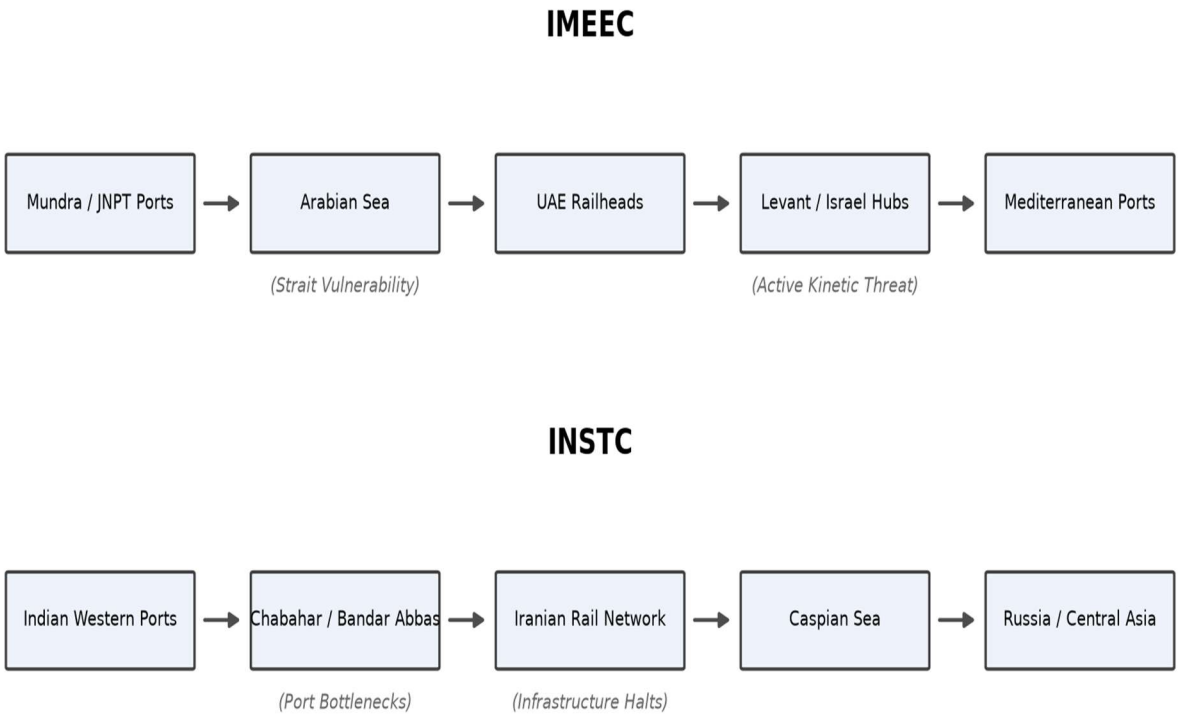

Figure 5. Schematic of the IMEEC and INSTC corridors and the vulnerability nodes disrupted by the conflict.

3. Game-Theoretic Analysis of the Conflict

The interaction of regional belligerents and global powers can be structured as a non-cooperative game under incomplete information. Consider a simplified game matrix

between Iran and the US/Israel coalition, where each actor chooses between strategic escalation and de-escalation:

Iran's Strategy Space: $S_{\text{Iran}} = \{\text{Retaliate (Block Chokepoint)},\text{Absorb (Diplomatic Restraint)}\}$.

Coalition Strategy Space: $S_{\text{Coalition}} = \{\text{Escalate (Strikes/Blockade Enforcement)},\text{De-escalate (Diplomatic Offramps)}\}$.

The payoffs represent relative gains and losses, accounting for sovereign deterrence, internal stability, domestic political standing, and estimated macroeconomic fallout (measured in trillions of dollars of global economic drag and fiscal outlays):

Iran Coalition	De-escalate (Diplomacy)	Escalate (Kinetic Strikes)
Absorb (Restraint)	(+1.0, +1.0) — Pareto-optimal cooperative outcome; global stability	(−2.0, +0.5) — Unilateral coalition advantage; Iran deterrence degraded
Retaliate (Blockade)	(+0.5, −1.0) — Asymmetric energy leverage; coalition supply shock	(−1.5, −2.0) — **Nash Equilibrium**; Pareto-inferior outcome; sustained stagflation drag

Strategic Equilibrium Analysis. If the Coalition de-escalates, Iran secures +1.0 by absorbing or +0.5 by retaliating. However, under the threat of future strikes, deterrence theory often shifts the preference toward retaliation.

If the Coalition escalates, Iran faces a payoff of −2.0 by absorbing (accepting a perceived loss of domestic security and military posture) versus −1.5 by retaliating (imposing asymmetric costs through maritime disruptions). Consequently, Retaliate becomes Iran's strictly dominant strategy: $-1.5 > -2.0$.

For the Coalition, if Iran retaliates, escalating yields a payoff of −2.0 compared to −1.0 under de-escalation, assuming purely immediate economic costs. However, when accounting for geopolitical deterrence and long-term security objectives, the Coalition treats escalation as a dominant response to counter perceived threats.

Outcome. The strategic interaction settles into a dominant-strategy Nash Equilibrium of (Retaliate, Escalate). This reflects a classic Prisoner's Dilemma. While the cooperative outcome of (Absorb, De-escalate) is Pareto-superior—yielding mutual benefits of (+1.0, +1.0)—the lack of binding enforcement mechanisms, strategic distrust, and domestic political pressures trap both actors in an escalated state. This uncoordinated equilibrium imposes higher costs on the global economy, sustaining crude oil prices near $130/bbl and dragging global GDP down by an estimated 1.5%.

Escaping this Pareto-inferior equilibrium typically requires repeated-game interactions, credible third-party mediation (such as coordinated diplomatic efforts by major energy-importing nations like India and China), or structured de-escalation agreements capable of realigning the payoff matrix.

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Article IV: The Hidden Economics of War: Polymers, Semiconductor Vulnerabilities, and Global Food Security

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Abstract

This paper analyzes the second- and third-order economic disruptions generated by the 2026 West Asian conflict. Moving beyond direct hydrocarbon price inflation, we trace how input shortages spread through intermediate processing industries. We examine three interconnected sectors: the doubling of polymer prices and its impact on manufacturing supply chains; the vulnerability of East Asian semiconductor foundries caused by LNG power costs and sulfur shortages; and the disruption of the global Haber-Bosch nitrogen fertilizer supply, which directly threatens international agricultural yields.

1. Beyond the First-Order Shock: The Modern Industrial Web

Public discourse surrounding geopolitical conflict often focuses primarily on the immediate energy price spike—the visible price paid for fuel at the pump. In a modern interconnected industrial economy, however, raw hydrocarbons serve not merely as combustible fuel, but as foundational chemical building blocks. When a conflict disrupts supply in a key region, the impact spreads through a chain of downstream manufacturing sectors:

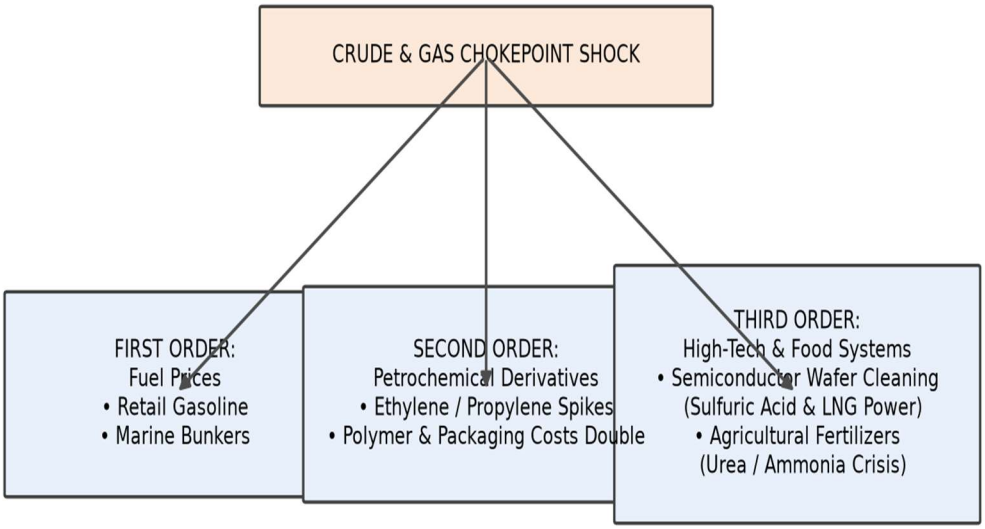

Figure 6. The cascading first-, second-, and third-order effects of a crude and gas chokepoint shock.

These downstream supply disruptions can be grouped into distinct phases:

- **First-Order Effects:** Direct spikes in headline benchmark crude and natural gas prices.
- **Second-Order Effects:** Rapid price inflation across refined petrochemical derivatives, industrial solvents, and commercial plastics.
- **Third-Order Effects:** Production bottlenecks in advanced manufacturing (such as microchips) and global agricultural supply chains (such as synthetic fertilizers), which threaten broader economic activity and food security.

2. The Polymer Contagion: The Plastic Price Explosion

The petrochemical industry relies directly on naphtha and ethane crackers that utilize crude oil and natural gas derivatives to synthesize base monomers, including ethylene and propylene. As West Asian supplies tightened, the prices of these chemical feedstocks escalated rapidly.

In India, raw plastic polymer granule prices doubled, jumping from ₹80 per kilogram to approximately ₹160 per kilogram over a matter of weeks. Major petrochemical suppliers, facing higher feedstock costs and volatile shipping rates, passed these increases along to downstream manufacturers.

This increase directly impacted plastic processing clusters, such as the small and medium enterprise (SME) industrial centers in Gujarat. These manufacturing firms operate on thin profit margins and could not absorb a 100% surge in raw material costs.

Because industrial polymers provide essential packaging materials across fast-moving consumer goods (FMCG), pharmaceuticals, food logistics, and agriculture, packaging costs rose from an average of 5–7% of total product cost to nearly 15%. Consumer goods firms responded through two primary strategies:

- **Direct Consumer Price Increases:** Passing packaging cost increases on to retail prices, adding to general consumer price inflation.
- **Shrinkflation:** Keeping retail price points unchanged while reducing package weights and product volumes, which lowers consumer purchasing power without altering headline shelf prices.

3. Advanced Technology Bottlenecks: Taiwan and the Semiconductor Chokepoint

Advanced semiconductor manufacturing represents one of the most sensitive nodes in the global economy. While fabrication facilities are concentrated primarily in East Asia—most notably in Taiwan—their day-to-day operations depend on chemical inputs and energy supplies sourced from West Asia.

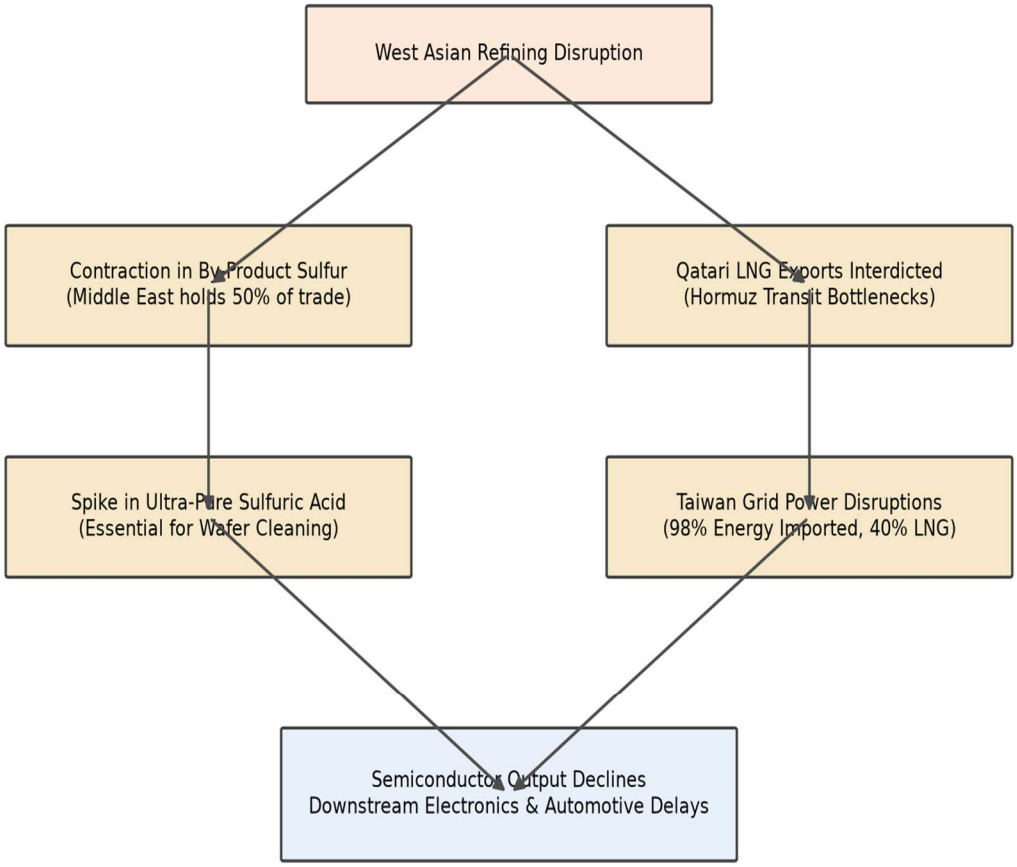

Figure 7. How refining disruption and LNG transit bottlenecks combine to depress semiconductor output.

The LNG Energy Dependency. Modern fabrication plants require steady, uninterruptible electrical power. Micro-fluctuations or voltage irregularities can compromise entire batches of silicon wafers. Taiwan relies heavily on external energy, importing roughly 98% of its total domestic energy supplies, with liquefied natural gas generating approximately 40% of its base-load electricity. A large share of this LNG is sourced from Qatar and passes through the Strait of Hormuz. Maritime disruptions in the Persian Gulf created immediate fuel import concerns for the island, leading to elevated industrial power costs that raised operational expenses for fabrication facilities.

The High-Purity Sulfuric Acid Bottleneck. Silicon wafer production requires continuous wet chemical cleaning stages to strip microscopic contaminants between photolithography steps. This process requires large volumes of semiconductor-grade, ultra-pure sulfuric acid (H_2SO_4).

Globally, approximately 90% of elemental sulfur is recovered as an industrial by-product of oil refining and natural gas processing, designed to remove sulfur compounds from commercial fuels. West Asia accounts for nearly half of all seaborne elemental sulfur trade.

The slowdown in regional refining and shipping operations reduced global sulfur availability, pushing sulfur prices up by 17% and creating supply bottlenecks for chemical purifiers. Because foundries hold limited on-site inventories of hazardous wet chemicals, prolonged shipping delays create production bottlenecks that affect the broader electronics, telecommunications, and automotive industries.

4. The Humanitarian Dimension: Global Food and Fertilizer Security

While rising energy and tech input costs create economic headwinds, the disruption of the international fertilizer supply carries severe humanitarian risks.

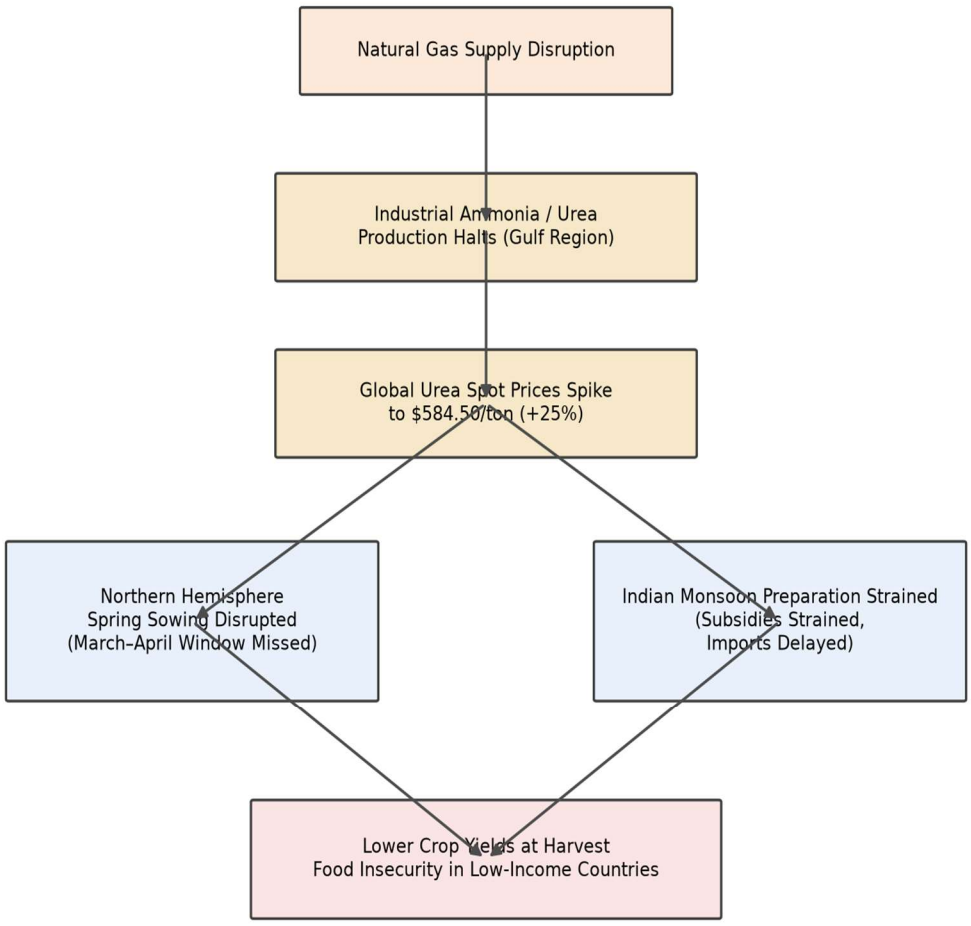

Figure 8. From natural gas disruption to urea price spikes, missed planting windows, and food insecurity.

The Natural Gas–Ammonia Synthesis Link. Synthetic nitrogen fertilizers are manufactured through the energy-intensive Haber-Bosch process:

$$N_2 + 3H_2 \xrightarrow{\text{Catalyst, High } P,T} 2NH_3$$

Methane (CH_4) from natural gas provides both the hydrogen feedstock and the primary thermal energy required to drive this chemical reaction. Gulf economies, notably Qatar and Saudi Arabia, have used their domestic natural gas resources to become major global producers and exporters of nitrogenous fertilizers, primarily synthesized urea.

Supply Disruptions and Market Reactions. As regional conflicts affected energy infrastructure and maritime transit, fertilizer production and exports slowed. By late March, global urea futures jumped to $584.50 per ton, representing an increase of roughly 25% in a few weeks. Because fertilizers represent up to 50% of the total operating costs for major grain production, higher prices quickly altered farm-level economics.

The Planting Window Vulnerability. The timing of this supply shock created distinct operational risks:

- **Northern Hemisphere Spring Sowing (March–April):** Farmers in North America and Europe require timely delivery of nitrogenous fertilizers. Confronted with high input costs and delivery bottlenecks, agricultural operations often reduce application rates, which directly lowers crop yields at harvest.
- **South Asian Monsoon Preparation (May–June):** Major agrarian economies like India depend on pre-positioned fertilizer stocks to support the Kharif crop cycle. Delays in seaborne shipments strain public agricultural subsidy budgets and complicate farm-level planning.

Unlike crude oil, where governments maintain strategic reserves to cushion supply disruptions, few countries hold large strategic reserves of agricultural fertilizers. Because agricultural production follows fixed seasonal cycles, missed planting windows cannot be quickly compensated for later in the year. Lower fertilizer application rates translate directly into reduced harvests of staple crops such as wheat, rice, and maize, elevating the risk of global food price inflation and deepening food insecurity in import-dependent developing nations.

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Consolidated Macroeconomic Impact Matrix

Analytical Domain	Primary Shock Vector	Microeconomic Mechanism	Aggregate Macroeconomic Effect	Key Vulnerable Node
Primary Energy	Strait of Hormuz partial naval interdiction	Inelastic demand ($\|\epsilon_d\| \approx 0.2$) drives 50% price rise per 10% supply cut	Cost-push stagflation, monetary tightening dilemmas, output drag	Net oil-importing economies, Euro Area, India
Labor Markets	Project freezes and emergency repatriation	Influx of workers expands informal labor supply ($S_L > D_L$)	Remittance drop triggers Keynesian consumption multiplier contraction	Rural and semi-urban households in South Asia
Transit Corridors	Drone strikes and high marine insurance costs (+300%)	Logistics routes divert to Cape of Good Hope, adding 15–20 days	Delayed bilateral investments, freight fee hikes, trade imbalances	IMEEC sea-rail linkages, INSTC network
Petrochemicals	Upstream naphtha and ethane supply shortages	Raw polymer granules double in cost from ₹80/kg to ₹160/kg	Packaging costs rise to ~15% of product expenses, retail shrinkflation	SME manufacturing clusters, retail packaging
Advanced Tech	Refining slowdown and Qatari LNG transit risks	17% price spike in elemental sulfur limits ultra-pure cleaning acid	Wafer fabrication halts, microchip shortages, tech supply inflation	East Asian semiconductor fabrication plants
Global Agriculture	Natural gas feedstocks disrupted at regional hubs	Urea spot prices jump by 25% to $584.50 per ton	Lower fertilizer application during spring planting reduces global harvests	Grain-dependent emerging economies, monsoon agriculture