APRIL 2026 | Executive Brief

Strait of Hormuz:

Supply Chain Cascade Analysis

Macrocosm Group

EXECUTIVE SUMMARY

On February 28, 2026, Iran closed the Strait of Hormuz, removing approximately 21% of global petroleum supply and 25% of global LNG trade from world markets in a matter of days. This paper uses Macrocosm's proprietary supply chain shock model to trace how an energy shock in the Persian Gulf propagates through the global economy, sector by sector and week by week, across 80 countries (plus rest of world). At a global level, our predicted economic impacts are broadly aligned with those published in other outlets. However, we go beyond aggregate predictions to show the dynamics of shock propagation with higher granularity across sectors, geographies, and time.

Four findings emerge from our analysis:

1. **Cascade severity grows nonlinearly: a 15-week conflict produces 2.4x the economic loss of an 8-week one, despite being less than twice as long.**
Strategic petroleum reserves buffer the first weeks of disruption. Once depleted (typically between weeks 4 and 13) cascade effects accelerate rapidly across sectors — even those with no direct Gulf exposure.

2. **Strategic petroleum reserves — which act as a buffer against shocks — are a powerful predictor of economic damage.**
Economies with fewer than five weeks of oil reserves face peak sector losses up to 50x greater than those with more than 13 weeks. Observing this impact requires modeling physical material flows, not just price effects.

3. **In the most exposed countries, nearly every economic sector faces meaningful disruption within 15 weeks — even those with no direct Gulf energy exposure.**
More than 70% of economic sectors in the most exposed countries face output losses exceeding 5%. This includes electronics in Taiwan, automotive manufacturing in Vietnam, and construction in India.

4. **Peak disruption arrives after the Strait reopens, not before.**
Recovery extends years beyond the closure itself. In a protracted conflict scenario, some sectors in Vietnam require up to 2.5 years to recover and some in the UAE take more than three years to recover (assuming no investment or policy change).

BACKGROUND

On February 28, 2026, US-Israeli strikes on Iranian military facilities triggered the closure of the Strait of Hormuz. Commercial traffic collapsed by 95% within two weeks, and by mid-March, the closure had removed approximately 21% of global petroleum consumption and 25% of global LNG trade from world markets. This closure is the largest energy supply disruption in recorded history, surpassing the 1973 Arab oil embargo in absolute volume.

The consequences extend far beyond energy markets. The critical questions are: which economies are most exposed, which sectors cascade first, how fast disruption spreads once reserve buffers run out, and how long recovery takes after the Strait reopens. Existing analysis answers some of these questions, but not at the resolution needed to address all four. Most models route disruptions through price signals; in contrast, Macrocosm's proprietary model focuses on quantities. Our model traces physical shortfalls through input-output linkages across 49 sectors and 80 countries (plus rest-of-world, or ROW), week by week. The model also distinguishes critical from non-critical inputs (e.g., a manufacturing facility cannot operate without electricity, but can absorb the loss of non-essential services). This structure, combined with country-specific reserve drawdown dynamics, allows the model to capture the nonlinear acceleration that occurs once buffers are exhausted.

Macrocosm's model draws on the best available global input-output data, though some limitations apply. Aggregation of data at the sectoral level means that certain commodities — including aluminum, helium, sulfur, and urea — are not resolved individually. Moreover, several Gulf states are consolidated into ROW, limiting the ability to estimate the impact for several economies in the Persian Gulf[1].

Within these bounds, the model generates something no aggregate analysis can: a week-by-week view of where disruption hits first, how fast it spreads, and how long it lingers, resolved to the level of individual sectors and countries. A standard equilibrium model tells you the impact after markets have cleared. It cannot tell you which economy falls in first, which industries cascade next, when the critical window for intervention closes, or whether recovery takes months or years. Because Macrocosm models physical quantities moving through actual supply linkages, it makes the transmission mechanism visible, and therefore, actionable. Tracing the causal sequence through the network shows where intervention has leverage and when it needs to happen to matter.

WHAT OUR MODEL SHOWS

We modeled three conflict duration scenarios: an 8-week rapid resolution, a 15-week central scenario, and a 39-week protracted conflict. Each scenario includes a 10-week[2] mine-clearance delay after ceasefire before the Strait reopens, followed by gradual infrastructure reconstruction. In aggregate, our results are consistent with the range of published estimates: a survey of 44 economic impact forecasts for the 2026 closure finds GDP impacts ranging from -0.1% to -6% of

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[1] For example, Iran, Iraq, Oman, Qatar, Kuwait, and Bahrain.

[2] In all scenarios, shipping through the Strait resumes gradually rather than all at once after ceasefire: about half of pre-crisis capacity returns within two weeks (escorted convoys on known safe routes), four-fifths by week six, and full normalization by week twenty (as additional lanes are cleared and war-risk insurance premiums come down). Published estimates for full recovery span 4-26 weeks; our profile sits near the middle. Slower recovery assumptions would increase 2026 impacts, particularly for the 8-week and 15-week scenarios.

world GDP. Macrocosm's central scenario (1.21% annualized gross output loss, 15 weeks) falls between the OECD downside (0.50pp GDP) and IMF WEO adverse (0.80pp GDP) scenarios after gross-output-to-GDP conversion. The 39-week scenario (2.49%) is comparable to the IMF WEO severe and Dallas Fed 3-quarter estimates. Four findings stand out.

1 Cascade severity grows nonlinearly: a 15-week conflict produces 2.4x the economic loss of an 8-week one, despite being less than twice as long.

The impact of a Hormuz closure does not scale linearly with duration. Impacts during the first weeks of closure are buffered by strategic petroleum reserves[3], but once those reserves are exhausted (typically in weeks 4-13), supply shortfalls rapidly cascade through electricity and chemical supply chains into sectors with no direct Gulf exposure. A 15-week conflict generates 2.4x the annualized economic loss of an 8-week conflict despite being less than twice as long.

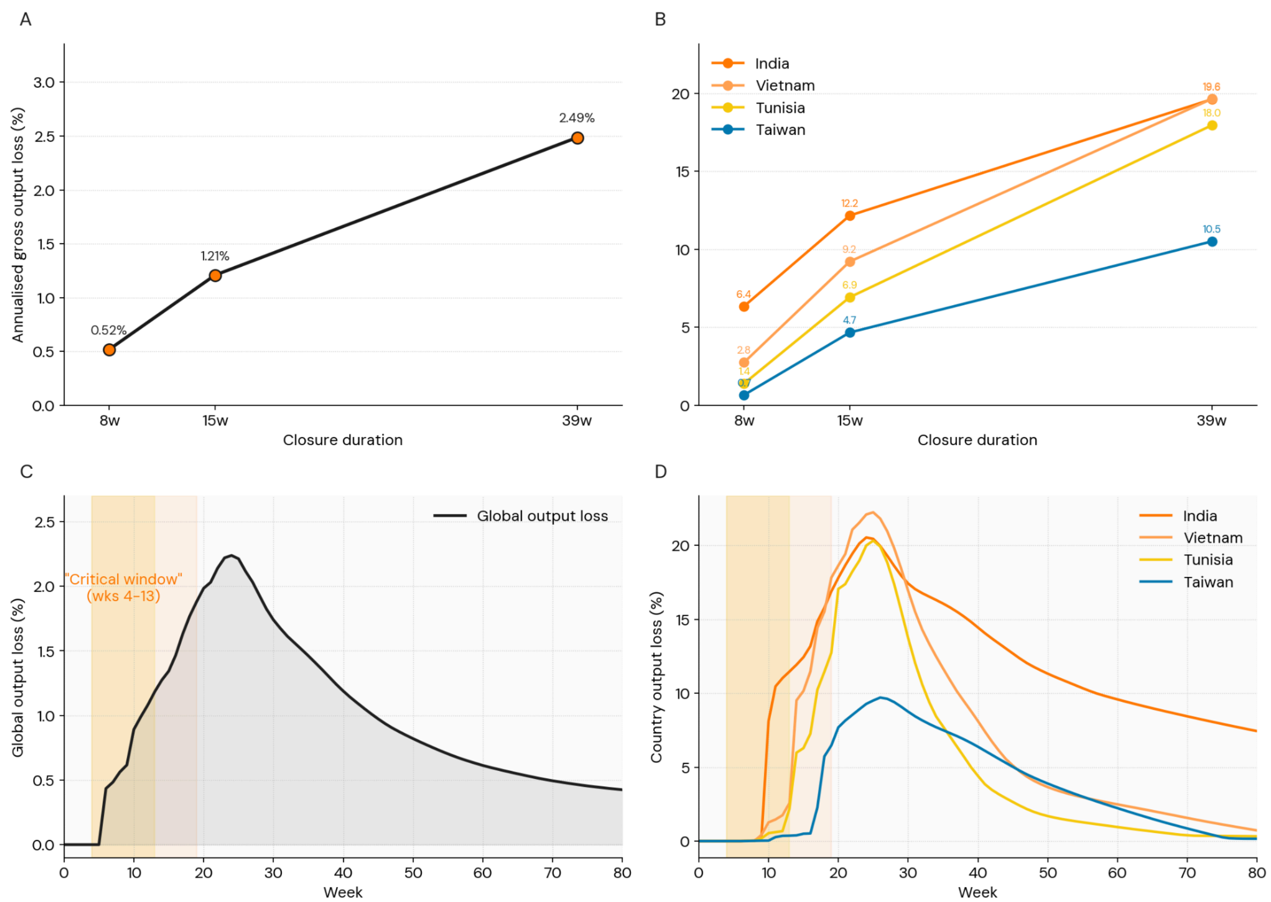

Figure 1. Annualized output losses grow faster than closure duration in the early scenarios. A.) A 15-week conflict produces 2.4x the global loss of an 8-week one despite being less than twice as long. B.) Country-level losses are an order of magnitude larger for the most exposed economies. The weekly trajectories reveal why: C.) global output loss rises smoothly, D.) masking abrupt cliff-edge disruptions at the country level once strategic reserves are depleted. For countries with fewer than five weeks of reserves, the critical window to act runs from weeks 4 to 13; for better-reserved economies, it extends to around week 20.

[3] Throughout this piece, the term “strategic petroleum reserves” includes both strategic petroleum reserves (SPR) and crude inventories. This matches the IEA definition.

For organizations, this creates a defined response window. Companies that activate contingency sourcing, qualify alternative suppliers, or secure critical input inventories before reserve depletion will experience meaningfully lower disruption than those in reactive posture[4]. While not modeled here, coordinated actions could help produce a softer landing.

2 Strategic petroleum reserves — which act as a buffer against shocks — are a powerful predictor of economic damage, but only up to a threshold.

Understanding which economies are most exposed requires modeling how physical shortfalls propagate, not just how prices move. Structural variables, especially the amount of strategic petroleum reserves and access to pipeline bypass infrastructure, contribute to the severity of economic impact.

The size of strategic reserves is a strong predictor of country-level cascade exposure in the model results, but it operates as a threshold variable rather than a linear one. Countries holding fewer than five weeks of strategic reserves face rapidly escalating disruption once the initial shock depletes their buffers. Countries with greater than 13 weeks of strategic reserves are largely insulated under the central scenario. The difference in outcomes between these two groups is not marginal. India, with 1.5 weeks of strategic reserves, experiences 20.3% peak output loss across a 15-week closure, whereas Japan, with 28 weeks of reserves, experiences almost no disruption across the same period. Differences in reserve volumes yield a 50-fold difference in sector-level loss rates between two of the world's largest economies.

Bypass infrastructure also plays an influential role. Within the Gulf itself, Saudi Arabia's estimated damages are lower than the UAE's, partly because the East-West pipeline (or Petroline) to Yanbu provides an overland route that allows ~4.5M bpd[5] of oil to bypass the Strait. The UAE also has a bypass route — the ADCOP[6] pipeline to Fujairah — but it has a lower capacity (~1.5M bpd) and has experienced multiple closures due to drone attacks. This is reflected in the UAE’s higher peak loss (40.2% vs. 14.5% for Saudi Arabia) in the central scenario.

Both variables — reserve depth and bypass access — are observable before a shock occurs and are quantifiable at the country and facility level. For organizations seeking to assess, price, or hedge exposure to disruptions of this magnitude, they are the logical starting point.

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[4] Pichler et. al, 2024. https://doi.org/10.1016/j.jebo.2024.106750

[5] The East-West pipeline has a nominal capacity of ~7M bpd, but in practice the capacity is limited to ~4.5M bpd based on tanker and jetty availability.

[6] Abu Dhabi Crude Oil Pipeline.

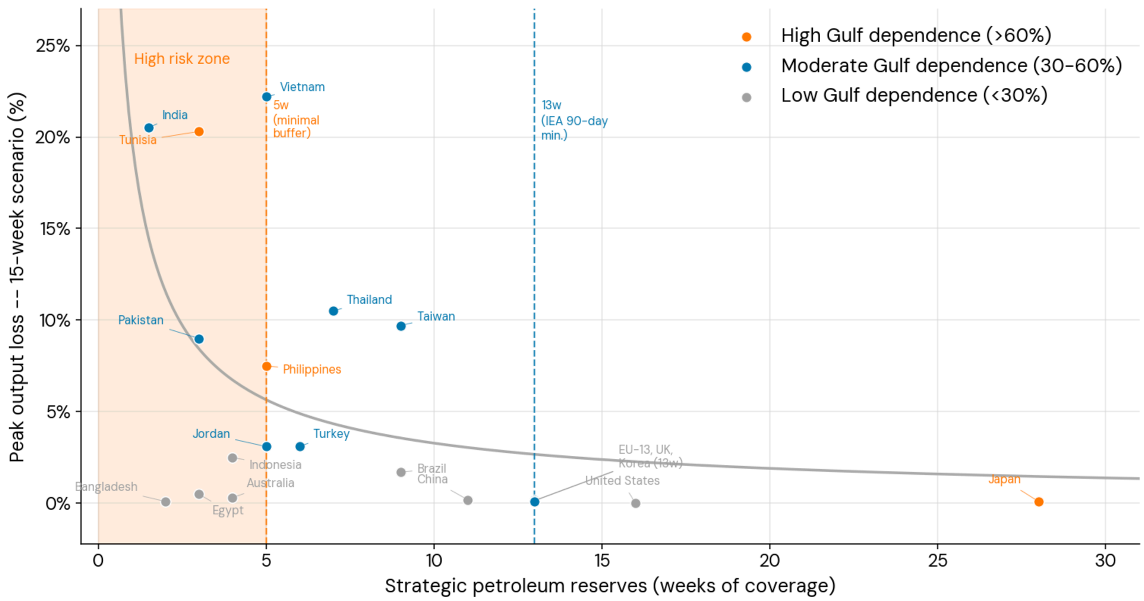

Figure 2. Peak output loss versus size of strategic petroleum reserves, 15-week closure scenario. Countries with less than five weeks of strategic reserves (left of orange dashed line) face much higher peak losses than those exceeding the IEA 90-day mandatory minimum (right of blue dashed line) — up to 50x when comparing India to Japan. Color encodes each country's share of oil and gas imports sourced from the Gulf. The grey curve is a fitted reserves-loss gradient.

3 In the most exposed countries, nearly every economic sector faces meaningful disruption within 15 weeks — even those with no direct Gulf energy exposure.

In the most affected economies, the breadth of impact is striking: 35 of 49 sectors in India, 45 of 49 in Vietnam, and 44 of 49 in Tunisia experience output losses exceeding 5% within 15 weeks. 5% loss can materially disrupt operations, strain supply contracts, and trigger insurance claims. The transmission mechanism is not rising fuel costs but physical supply failure as petroleum shortfalls cut LNG and fuel oil deliveries, electricity generation falters, and losses in manufacturing, services, and agriculture cascade in sequence.

The implications extend well beyond energy-intensive industries. Electronics in Taiwan, the automotive sector in Vietnam, construction in India, and air transport across Southeast Asia all face double-digit output losses despite having no direct Gulf energy exposure. For risk managers and underwriters, this is the critical insight: exposure to this shock is not determined by energy intensity but rather by position in the supply chain relative to electricity and chemical feedstock inputs, and by the size of strategic reserves of the economies where key suppliers operate.

The U.S. and European economies fall outside the high-risk zone in all three scenarios, insulated by domestic production and reserve depth. Their exposure is primarily through price, which this model does not capture.

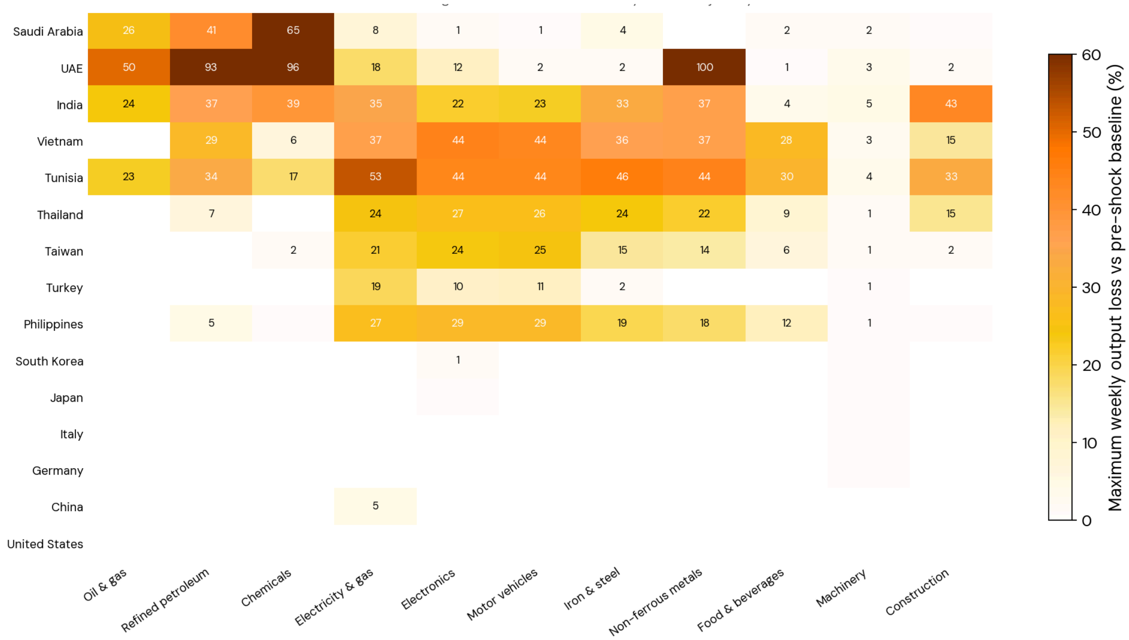

Figure 3. Peak sector-level output losses (%) across 15 countries during a simulated 15-week closure scenario. UAE and Saudi Arabia face near-total losses in oil, refined petroleum, and chemicals; cascade effects extend to electronics, motor vehicles, and construction in import-dependent economies including India, Vietnam, Tunisia, and the Philippines.

4 Peak disruption arrives after the Strait reopens, not before

The relationship between closure duration and economic impact is not synchronous. Under the central 15-week scenario, global output losses peak at week 20 — six weeks after the conflict ends and well into the recovery period. Under a protracted 39-week conflict, peak losses do not arrive until week 44. By the time disruption reaches its maximum, organizations focused on the closure itself have already moved on.

Recovery timelines vary sharply by country and sector. Under the central 15-week scenario, UAE oil & gas extraction does not return to baseline within the three-year simulation window. Vietnam's food & beverage sector and Turkey's automotive manufacturing sector show the same pattern. These are not marginal industries; they represent the core export and employment base of each economy.

The operational implication is significant. Contingency plans anchored to closure duration will systematically underestimate actual disruption length. The relevant planning horizon is not when the Strait reopens but when the supply chain stabilizes, which in some cases, can extend to years.

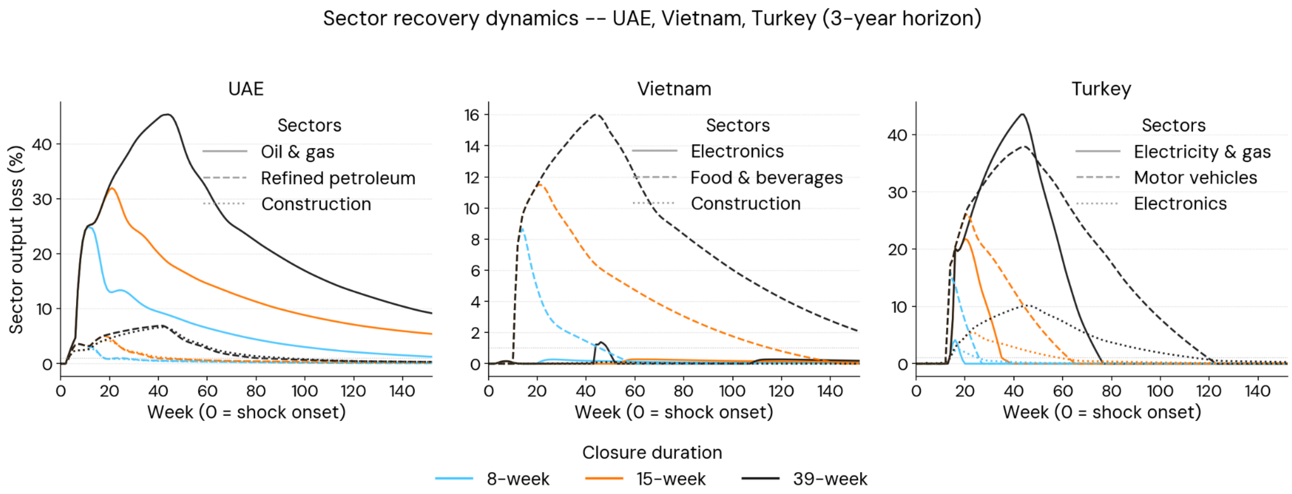

Figure 4. Full three-year recovery trajectories for select sectors in UAE, Vietnam, and Turkey across all three scenarios (8-week, 15-week, and 39-week closure).

CONCLUSION

The Hormuz closure is not a once-in-a-generation event. Geopolitical shocks and energy supply disruptions are realities of an increasingly volatile world. Just as the COVID-19 pandemic brought existing supply chain fragilities into sharp relief, the Hormuz closure is shedding light on network vulnerabilities that long predated February 28th.

Our analyses reflect a well-known property of complex networks: small shocks to critical nodes propagate in ways that are non-linear, delayed, and difficult to reverse. The global supply chain is no different. What looks like an energy disruption in week one is a manufacturing disruption in week thirteen even in countries that import no Gulf oil at all. The cascades may seem random, but they are not; they follow the structure of the network.

At Macrocosm, we map that structure. Cascades follow observable network linkages, deplete measurable reserves, and arrive on a predictable schedule. Understanding that sequence is what turns exposure into something that can be assessed, priced, and acted on while the response window is still open.

Appendix: Model Architecture & Validation

A1 | MODEL OVERVIEW

Macrocosm's supply chain model is an agent-based model (ABM) operating at weekly temporal resolution across 3,969 sector-country pairs — defined as 80 country entities (plus the rest of the world, ROW) × 49 industries (ISIC Rev. 4) from the OECD Inter-Country Input-Output (ICIO) tables, 2025 edition, reference year 2022. Each sector acts as a firm: it produces output, holds inventories of input goods, places orders to replenish stock, and faces capacity constraints from exogenous shocks.

The framework used here extends the Hallegatte (2008) ARIO model[7] and the Pichler et al. (2022) dynamic out-of-equilibrium input-output framework[8]. Both are published in the peer-reviewed academic literature and applied to earthquake, pandemic, and energy shock scenarios.

The ABM has also been applied at a firm-level for 1.5M firms in Japan, and validated against the 2011 Tōhoku earthquake and the 2016 Kumamoto earthquake. Here we apply it at the sectoral level because we do not yet have firm-to-firm global linkages.

Production function

Output of each sector at each time step is the minimum of three constraints: (1) productive capacity set by the shock time series, (2) demand for its output from other sectors and final consumers, and (3) input availability, determined by inventories of critical inputs relative to their technical input coefficients. Criticality applies at the level of the good: for each critical good, output falls proportionally when that good is in short supply, and no other critical good can substitute for it. Within a given critical good, however, supply from different country sources is substitutable — sectors can reroute orders to alternative foreign suppliers of the same good when a particular origin is disrupted. Non-critical inputs can either be important, and not bind output strongly while still causing a mild drop in output, as described in Pichler et al. (2022), or non-important and not affect output at all.

This classification of critical/non-critical inputs is drawn from an IHS Markit classification used in Pichler et al. (2022). For each given producing industry, inputs were classified by sector experts into critical (hard constraint), important (soft constraint), and unimportant inputs (no weekly constraint).

Inventories and strategic petroleum reserves

Strategic petroleum reserve data (IEA, country sources) is used to set country-specific B06 inventory targets (e.g., Japan 28 weeks, South Korea 26 weeks, India 1.5 weeks).

[7] Hallegatte, 2008. https://onlinelibrary.wiley.com/doi/10.1111/j.1539-6924.2008.01046.x
[8] Pichler et al. 2022. https://www.sciencedirect.com/science/article/pii/S0165188922002317

Shock calibration

Ten country-sector pairs are shocked across oil and gas extraction, petroleum refining, chemicals/petrochemicals, and non-ferrous metals for Saudi Arabia, UAE, and the rest of the world. Each sector's shock time series combines three multiplicative components: (1) Hormuz transit fraction (e.g., the share of production that cannot bypass via pipeline); (2) infrastructure damage curves with piecewise-linear reconstruction after ceasefire; and (3) well shut-in dynamics, with a 2-4-week storage-fill delay before wells shut in, and a piecewise-linear restart curve whose speed and permanent-loss ceiling depend on the shut-in duration. The damage curves were extrapolated by considering Gulf infrastructure that was either destroyed during the conflict or that heavily depends on passage through the Strait of Hormuz.

Logistics and adaptive ordering

Shipments pass through a transport model with transit times ranging from 0 weeks (services) to approximately 3 weeks (bulk commodities, Gulf to East Asia). The trade network is static at 2022 OECD ICIO levels. An optional adaptive ordering parameter controls reallocation, allowing to model how sectors can source away from disrupted suppliers; our main results use low adaptation. The same qualitative results hold for more realistic levels of adaptation, albeit with more complex dynamics: while the adaptive ordering enables better adaptation to disruption for some countries, it also increases competitive pressure on other countries, which can result in additional losses.

Limitations

The model does not include price dynamics, demand response to price changes, or endogenous supply response from non-affected producers. All losses are measured as gross output at pre-shock prices — a quantity-side metric most informative for the first 4–13 weeks when physical constraints dominate. Gross output is not directly comparable to GDP; value added is approximately 50% of gross output globally, and gross-output to value-added shares vary significantly across sectors and countries.

A2 | MODEL VALIDATION

Model credibility

The global sector-level model used in this analysis is built on an established ABM framework: inventory buffering, input criticality thresholds, and cascade propagation through production networks that reproduce observed economic behavior under real supply chain shocks. These mechanics have been demonstrated at firm level across ~1.5 million Japanese firms in the 2011 Tōhoku and 2016 Kumamoto earthquakes, and at economy-wide scale through the Oxford Martin School team's COVID-19 economic impact forecasting.[9] The Hormuz analysis applies the same propagation mechanics at global sector resolution. While the model is new to this geography and shock type; the underlying physics are well established.

Hormuz scenario — calibration checks (as of April 2026)

At the time of writing, approximately seven weeks of observed data are available. Monthly industrial production statistics for March 2026 are not yet published by any major statistical agency and are expected in May–June 2026. Outputs were checked against currently available data (Table A2.1).

[9] Pichler et al. 2022. https://www.sciencedirect.com/science/article/pii/S0165188922002317

Table A2.1. Model outputs compared to observed outcomes

Check	Model output	Observed outcome	Status
India (most affected non-Gulf)	Model rank: 1st non-Gulf	LPG crisis within 2 wks; allocations cut 80%; emergency gas orders	Consistent
Philippines (heavily affected)	Model rank: heavily affected	First national energy emergency declared globally (March 24)	Consistent
Pakistan (heavily affected)	Model rank: heavily affected	4-day government workweek; 50% mandatory remote work	Consistent
Japan (near-zero)	28-week reserves; near-zero cascade	80M barrels SPR released; 124 days retained; minimal disruption	Consistent
South Korea (moderate)	13-week SPR; moderate exposure	Record 22.46M barrels released; Won fell; prices capped	Consistent
United States (near-zero)	Domestic production; near-zero impact	Gasoline prices rose; no material industrial disruption	Consistent

Modeling philosophy

Macrocosm's estimates tend to sit at the upper end of comparable-duration published numbers. This reflects a deliberate modeling choice rather than a claim of superiority: our framework assumes Leontief technology and does not represent prices, so all adjustment occurs through quantities. This is an extreme case, and unrealistic on its own. The dominant alternative in the literature (CES-based general-equilibrium models) sits at the opposite extreme: markets clear through prices, and by construction there is no role for inventory depletion, reserve drawdowns, or rationing as a policy instrument. Reality lies between the two. Prices do respond to a shock of this magnitude, but quantity constraints, inventory exhaustion, and allocation decisions also bind: mechanisms that price-clearing models cannot represent. We view the Macrocosm and CES approaches as complementary bounds: ours emphasizes the quantity-side frictions that dominate the first weeks of a disruption, when reserves and rationing are the binding margins, while CES models capture the price-mediated substitution that dominates once adjustment horizons lengthen.