
Non-Substitutable Chokepoints and Global Supply Chain Disruption: A Conceptual Framework and Scenario Analysis of a Strait of Hormuz Closure

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Abstract

The Strait of Hormuz carries roughly one fifth of global petroleum liquids consumption and lacks a maritime substitute, which makes it the most concentrated single point of failure in the global energy trade. The escalation of armed conflict around the Strait in 2025 and 2026 has renewed the question of how an interruption of transit would affect global supply chains. Existing scholarship treats the relevant mechanisms separately: the maritime chokepoint literature quantifies exposed trade and rerouting, the oil price shock literature distinguishes supply-driven from demand-driven shocks, and the supply chain resilience literature formalises how disruption propagates through networks. These mechanisms are activated simultaneously by a closure of the Strait, yet they have rarely been integrated for a single event, and the role of route substitutability as a determinant of disruption severity has not been made explicit. This study develops an integrated transmission framework and a set of six testable propositions that position substitutability as a moderator of chokepoint severity, and it applies the framework through a transparent, assumption-explicit scenario synthesis

anchored to published parameters and to documented analogues such as the 2021 Suez Canal blockage and the 2023–2025 Red Sea crisis. The analysis indicates that the defining feature of the Strait is the near-absence of a short-term substitute, which disables the rerouting strategies that contained earlier disruptions, and that the duration of an interruption, rather than its onset, governs whether the disruption is absorbed or becomes transformative. The contribution is conceptual, and the propositions are offered for testing.

Keywords: Strait of Hormuz; maritime chokepoints; supply chain resilience; route substitutability; oil price shocks; ripple effect

1. Introduction

The Strait of Hormuz connects the Persian Gulf to the Gulf of Oman and the wider Indian Ocean and is the conduit through which most Gulf hydrocarbon exports reach world markets. During 2024 and the first quarter of 2025 an average of roughly twenty million barrels per day of crude oil, condensate, and petroleum products transited the Strait, a volume equivalent to about one fifth of global petroleum liquids consumption and more than one quarter of seaborne oil trade (Congressional Research Service [CRS], 2026; U.S. Energy Information Administration [EIA], 2025). The International Energy Agency estimates that close to a quarter of seaborne oil crosses the Strait, with the majority destined for Asia and with China and India together receiving a substantial share (International Energy Agency [IEA], 2025). A comparable concentration applies to liquefied natural gas, because Qatari exports that leave through the Strait account for a large fraction of the seaborne gas market (CRS, 2026). No other waterway carries so high a share of a commodity on which industrial production, transport, and electricity generation depend so directly.

This concentration became an operational concern rather than a theoretical one during the conflict between Iran on one side and Israel and the United States on the other. In June 2025, following strikes on Iranian military and nuclear infrastructure, the Iranian parliament endorsed a proposal to close the Strait, although transit was not in fact halted at that time (CRS, 2026). The situation escalated in early 2026, when official sources report that, beginning in March 2026, Iranian forces declared the Strait closed and conducted attacks on vessels attempting to transit it (CRS, 2026; Gross & Beane, 2026). These developments transformed the closure of the Strait from a scenario used in risk assessment into a partially realised disruption and sharpened the question this study addresses.

The economic consequences of a closure are widely discussed in policy commentary, yet the mechanisms by which such an event reaches the firm and the factory are not well integrated in the scholarly literature, which has developed in three largely separate streams. Research on maritime chokepoints has quantified the trade exposed to disruption and the rerouting that follows (Pratson, 2023; Verschuur et al., 2025; Verschuur, Koks, & Hall, 2022). Research on oil price shocks has shown that the macroeconomic effects of a price increase depend on whether it is driven by supply or by demand (Kilian, 2008, 2009, 2014). Research on supply chain resilience has formalised how a localised disruption propagates through interconnected networks and what capabilities allow firms to absorb it (Christopher & Peck, 2004; Dolgui, Ivanov, & Sokolov, 2018; Hosseini, Ivanov, & Dolgui, 2019). A closure of the Strait of Hormuz is distinctive precisely because it activates all three mechanisms at once: it is simultaneously an energy supply shock, a maritime logistics shock, and a trigger for cascading disruption across production networks.

Beyond their separation, these literatures share an unexamined assumption that is decisive for the Strait. Studies of recent disruptions, including the 2021 Suez Canal blockage

and the 2023 to 2025 Red Sea crisis, describe events in which rerouting preserved access at higher cost (Notteboom, Haralambides, & Cullinane, 2024; Tran, Haralambides, Notteboom, & Cullinane, 2025). The severity of a chokepoint disruption, however, depends not only on the volume of trade it carries but on whether that trade can be re-routed, and this property of route substitutability has not been theorised explicitly as a determinant of severity. The Strait of Hormuz is the limiting case in which substitutability is effectively absent, and reasoning from substitutable analogues is therefore liable to understate its consequences.

This study addresses both problems. It asks three questions. First, through what channels would a war that interrupts transit through the Strait of Hormuz transmit to global supply chains? Second, what distinguishes such an interruption from the substitutable chokepoint disruptions already studied? Third, what determines whether the disruption is absorbed or becomes transformative? The study makes three contributions. It develops an integrated transmission framework that unifies the maritime, energy, and supply chain literatures for a single event. It advances a set of six testable propositions that position route substitutability as a moderator of chokepoint severity and specify the conditions under which a closure exceeds the buffering capacity of exposed networks. And it applies the framework through a transparent, assumption-explicit scenario synthesis that integrates published parameters and documented analogues, from which managerial and policy implications are derived.

The analysis is conceptual and theory-elaborating rather than empirical. A sustained, war-driven closure of the Strait has not produced a complete record of supply chain outcomes, so the study reasons from established theory, from institutional data on flows, and from analogous events, and it states the limits of that approach throughout. The remainder of the article proceeds as follows. Section 2 reviews the theoretical background. Section 3 presents

the framework and propositions. Section 4 describes the research design, including the structured review protocol and the scenario method. Section 5 develops the results. Section 6 discusses theoretical, managerial, and policy implications and limitations, and Section 7 concludes.

2. Theoretical Background

2.1 Maritime chokepoints and the vulnerability of trade

Maritime transport carries the majority of world trade by volume, and a small number of narrow passages concentrate a disproportionate share of that traffic. The United Nations Conference on Trade and Development has documented growing strain on critical passages, including the Panama Canal, the Suez Canal and the Red Sea, and the Black Sea, as a combined result of geopolitical tension, conflict, and climate stress, and has argued that this strain threatens the functioning of maritime supply chains and, through them, energy and food security (United Nations Conference on Trade and Development [UNCTAD], 2024). The structural reason is that chokepoints couple high traffic density with geographic non-substitutability: when one is impeded, ships are delayed or rerouted, ports become congested as delayed and scheduled cargoes arrive together, and the disturbance reverberates through downstream supply chains for an extended period.

Three contributions are central here. Verschuur, Koks, and Hall (2022) quantified the criticality of the world's most important ports by linking maritime flows to a global supply-chain database, finding that half of global trade in value terms is maritime and that some landlocked and island economies depend on specific ports outside their jurisdiction, an early demonstration that maritime criticality is unevenly distributed. Pratson (2023) combined geographic data on shipping lanes with bilateral trade data to estimate how the closure of any

one of eleven major chokepoints would redistribute flows across the others, showing that closures generate alternate-route linkages among chokepoints and knock-on effects at seaports that persist after a blockage is physically cleared, and underscoring the particular importance of the Strait of Hormuz to the economies that depend on it. Verschuur, Lumma, and Hall (2025) modelled the systemic risk created by chokepoint disruptions, estimating the value of trade exposed to such disruptions at roughly one hundred and ninety-two billion United States dollars annually with expected economic losses near ten and seven tenths billion dollars, and, importantly, distinguishing disruptions that require only modest detours, which can be buffered, from disruptions that effectively cut countries off from trade, a category in which they placed the Strait of Hormuz.

2.2 Supply chain resilience, severity, and capabilities

The resilience literature supplies the vocabulary for tracing how a chokepoint disruption becomes a production problem. Christopher and Peck (2004) defined resilience from a systems perspective as the ability of a network to return to its original state, or to move to a more desirable one, after a disturbance, and argued that resilience must be engineered in advance through redundancy, flexibility, collaboration, and a culture of risk management. Sheffi and Rice (2005) framed the central trade-off as one between redundancy, which holds slack such as inventory and backup capacity, and flexibility, which builds the capacity to reconfigure, observing that flexibility is generally the more durable source of resilience. Pettit, Fiksel, and Croxton (2010) formalised resilience as the balance between a network's vulnerabilities and its capabilities, which explains why two firms exposed to the same external shock can experience very different outcomes.

Two further contributions matter for the present argument. Craighead, Blackhurst, Rungtusanatham, and Handfield (2007) asked why one supply chain disruption is more severe than another and concluded, through a set of propositions, that severity rises with the density and criticality of the affected nodes and falls with the recovery and warning capabilities available to mitigate it. Their emphasis on node criticality is directly relevant to a chokepoint, which is a maximally critical node in the maritime network. Wieland and Durach (2021) drew a distinction, imported from ecology, between engineering resilience, understood as the ability to bounce back to a prior state, and social-ecological resilience, understood as the capacity to persist, adapt, or transform, and argued that supply chain scholarship has relied too heavily on the engineering view. This distinction becomes important when a disruption is sufficiently severe and prolonged that returning to the prior state is not possible. Hosseini, Ivanov, and Dolgui (2019) synthesised the quantitative methods available for analysing these dynamics around the concept of resilience capacity, distinguishing absorptive, adaptive, and restorative capacities.

2.3 Disruption propagation, the ripple effect, and viability

How a disruption travels through a network is the subject of the ripple-effect literature. Dolgui, Ivanov, and Sokolov (2018) characterised the ripple effect as the propagation of a disruption from its origin through connected parts of a supply chain, in contrast to the operational variability captured by the bullwhip effect. Li, Chen, Collignon, and Ivanov (2021) modelled this propagation explicitly, showing that a local disruption can travel forward along material flows and backward toward suppliers and that a firm's structural position shapes its vulnerability. At the level of whole economies, Inoue and Todo (2019) demonstrated empirically that shocks to individual firms propagate through supply-chain links to produce

aggregate effects far larger than the initial disturbance, which implies that the supply chain cost of a disruption is not captured by the value of the directly interrupted flow.

The COVID-19 pandemic prompted an extension of resilience thinking toward viability. Ivanov (2020) used simulation to show that disruptions characterised by long duration, propagation, and high uncertainty behave differently from short, localised shocks and require different management. Ivanov and Dolgui (2020) introduced the concept of intertwined supply networks, in which interconnected supply chains jointly provide essential services to society, and argued that resistance to extraordinary disruptions must be assessed at the scale of survivability rather than at the level of a single chain. The same authors set out the operational research methods suited to coping with the ripple effect under such conditions, emphasising the management of after-shock dynamics during recovery (Ivanov & Dolgui, 2021). These ideas are directly relevant to a Strait of Hormuz closure, which, like a pandemic, is potentially long in duration and broad in propagation.

2.4 Oil price shocks and geopolitical risk

Because a closure of the Strait is first of all an interruption of oil and gas flows, the economics of energy price shocks is essential. Kilian (2008) reviewed the channels through which energy price shocks affect the macroeconomy and cautioned that the relationship between oil prices and output is neither simple nor stable. Kilian (2009) provided the most influential refinement of this view, showing that the source of a price increase matters: a rise driven by a disruption to supply has different and generally more adverse dynamic effects than one driven by strong global demand. Kilian (2014) consolidated these findings, emphasising that the real price of oil is endogenous to economic fundamentals and that the consequences of a shock cannot be read from the price change alone. A war-induced closure of the Strait is

a paradigmatic supply-driven shock, which implies that its consequences should be assessed using the supply-shock rather than the demand-shock template.

The geopolitical-risk literature situates a chokepoint conflict within a category of events whose effects operate partly through uncertainty. Caldara and Iacoviello (2022) constructed a news-based index of geopolitical risk and showed that elevated risk foreshadows lower investment and employment and is associated with larger downside risks, with adverse effects driven by both the threat and the realisation of adverse events. This implies that the anticipation of a closure, and the persistence of risk after a partial reopening, can themselves impose costs on supply chains, independently of the physical interruption of flows.

2.5 Research gap

These literatures supply complementary pieces but have rarely been combined for a single event that activates all of them, and none isolates route substitutability as a determinant of severity. The chokepoint literature measures exposure and rerouting but largely studies cases in which rerouting was feasible; the resilience literature specifies capabilities but is dominated by an engineering view oriented to bouncing back; and the oil shock literature characterises the macroeconomic response without tracing it into production networks. The next section integrates these strands into a single framework and derives propositions that make substitutability, the supply-driven character of the shock, the insurance channel, duration, and asymmetric exposure explicit.

3. Conceptual Framework and Propositions

Figure 1 presents the transmission framework. A closure of the Strait produces two primary shocks, an energy supply shock and a maritime disruption, which propagate through four cost channels, namely energy and gas price escalation, war-risk insurance premiums, freight and rerouting costs, and lengthened lead times and inventory costs, and through the ripple effect across intertwined networks, into a systemic outcome of sectoral output losses, inflationary pressure, and unevenly distributed regional exposure. A feedback loop captures the persistence of geopolitical risk, which can degrade the investment in resilience that would otherwise buffer future recurrence.

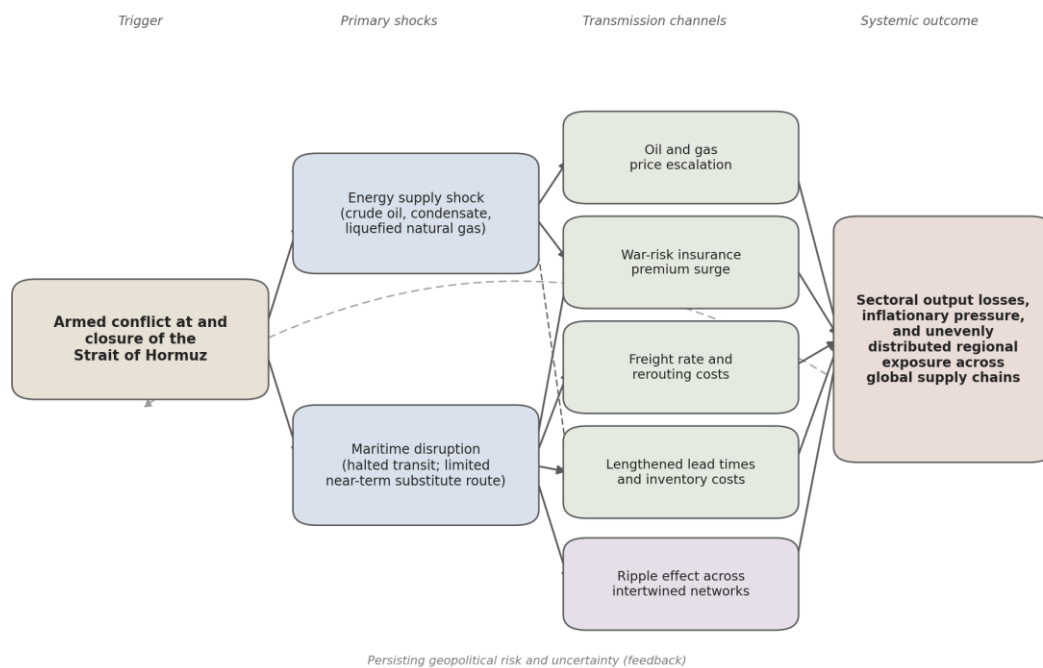


Figure 1. Conceptual framework for the transmission of a Strait of Hormuz closure to global supply chains.

The framework yields six propositions. The first concerns the compound nature of the shock. Unlike a canal grounding, which is principally a logistics event, or a producer embargo, which is principally an energy event, a closure of the Strait simultaneously curtails energy

supply and halts maritime transit, so that the price, logistics, and propagation channels are activated together rather than in sequence (Dolgui et al., 2018; Kilian, 2009; Pratson, 2023).

P1. *A closure of the Strait of Hormuz transmits to global supply chains as a compound shock that activates energy-price, maritime-cost, and propagation channels simultaneously, rather than as a single-channel disruption.*

The second proposition is the study's central theoretical claim. The severity of a chokepoint disruption depends not only on the volume of trade it carries but on whether that trade can be re-routed. Where a substitute route exists, as around the Cape of Good Hope for the Suez and Bab el-Mandeb passages, disruption raises cost and time but preserves access and can be buffered with inventory and contingency routing; where no substitute exists, disruption severs access and exceeds the buffering capacity of exposed networks (Christopher & Peck, 2004; Craighead et al., 2007; Pratson, 2023; Verschuur et al., 2025). Route substitutability therefore moderates the relationship between a chokepoint's trade volume and the severity of its disruption.

P2. *The severity of a chokepoint disruption for global supply chains increases as route substitutability decreases; because the Strait of Hormuz has no near-term maritime substitute, its closure produces more severe and less bufferable disruption than closures of substitutable chokepoints carrying comparable volumes.*

The third proposition follows from the energy economics. Because the shock curtails supply rather than reflecting strong demand, it follows the more adverse macroeconomic template and transmits to output and inflation through reinforcing channels (Kilian, 2008, 2009, 2014).

P3. *Because a closure is a supply-driven energy shock, its macroeconomic and supply chain transmission is more adverse than that of a demand-driven price increase of comparable magnitude.*

The fourth proposition concerns amplification. The repricing and withdrawal of war-risk insurance can suppress flows before, and well beyond, any direct interdiction of vessels, and the anticipation of risk acts on investment and activity independently of physical flows (Caldara & Iacoviello, 2022; CRS, 2026; Gross & Beane, 2026; Notteboom et al., 2024).

P4. *The war-risk insurance and risk-pricing channel amplifies a closure and can precede physical interdiction, so that observed reductions in throughput exceed the volume directly interrupted.*

The fifth proposition specifies the role of duration, illustrated in Figure 2. A short interruption resembles the Suez analogue and is largely absorbed through inventory and other engineering-resilience buffers; a sustained interruption exhausts inventories and forces substitution of supply sources or production, shifting the relevant concept from recovery to viability and from engineering to social-ecological resilience (Ivanov, 2020; Ivanov & Dolgui, 2020; Sheffi & Rice, 2005; Wieland & Durach, 2021).

P5. *Disruption severity is governed by duration: short closures are absorbed through engineering-resilience buffers, whereas sustained closures exceed those buffers and require transformation through substitution, raising survivability rather than recovery as the relevant concept.*

The sixth proposition addresses distribution. The physical supply risk is concentrated among importers dependent on the Strait, predominantly in Asia, while the price effect is transmitted globally because oil is fungible, so that exposure is asymmetric and a coordinated

response is complicated by the divergent problems different regions face (Gross & Beane, 2026; IEA, 2025; Verschuur et al., 2025; Verschuur, Koks, & Hall, 2022).

P6. *Exposure to a closure is asymmetric: physical supply risk is regionally concentrated among dependent importers while price effects are globally shared, which complicates coordinated mitigation.*

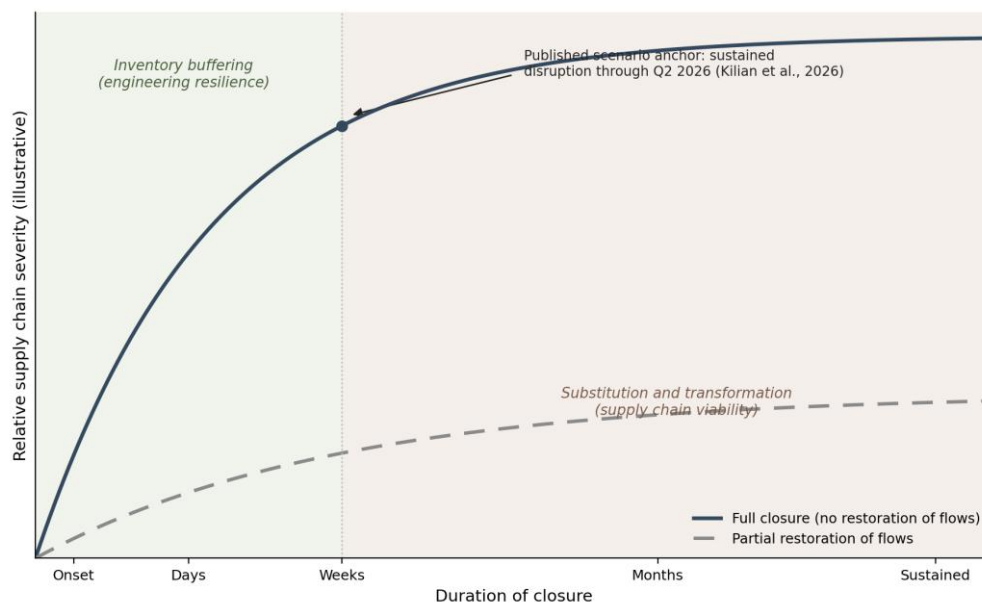


Figure 2. Stylised relationship between the duration of a closure and relative supply chain severity, distinguishing the inventory-buffering region from the substitution-and-transformation region, and contrasting full closure with partial restoration of flows. The curve is a conceptual representation synthesising the cited evidence rather than estimated data; the single annotated point is anchored to the published scenario of Kilian et al. (2026).

4. Methodology

The study adopts a theory-elaboration design appropriate to a phenomenon that cannot yet be studied as a completed empirical event. Theory elaboration combines existing conceptual material with case evidence to develop propositions, and is well suited to a setting in which established theories apply but have not been integrated for the case at hand. Three methods are combined: a structured integrative review of the relevant literatures, a

comparative analogue analysis of documented chokepoint disruptions, and a transparent scenario synthesis that applies the framework using published parameters.

4.1 Structured review protocol

The review followed a structured protocol to support transparency and reproducibility. Sources were sought across two tiers. Tier one comprised peer-reviewed articles retrieved from major bibliographic and publisher databases using combinations of the terms maritime chokepoint, Strait of Hormuz, supply chain resilience, ripple effect, disruption propagation, oil price shock, and geopolitical risk. Tier two comprised authoritative institutional sources used for current data and event documentation, including the energy and maritime agencies and established research institutions. Inclusion required direct relevance to one of the framework's elements, namely chokepoint exposure, resilience and propagation, energy-price transmission, or geopolitical risk, and, for empirical claims, traceability to a primary source. Preference was given to recent contributions in established journals and to the original source of each datum. Sources promoting a partisan or non-scholarly agenda were excluded, as were predatory or non-peer-reviewed outlets for theoretical claims. The resulting corpus integrates a focused set of peer-reviewed studies with institutional data; it is not presented as an exhaustive systematic review, and the synthesis is interpretive.

4.2 Comparative analogue analysis

Because a sustained, war-driven closure of the Strait has not produced a complete record of supply chain outcomes, documented disruptions at other chokepoints were used as analogues to reason about plausible magnitude and persistence. Two were selected for their contrast in substitutability. The 2021 grounding of the Ever Given in the Suez Canal is an

analogue for a short, total blockage with an available substitute route; Tran et al. (2025) used vessel voyage data to estimate that the six-day blockage imposed losses of approximately eighty-nine million United States dollars on a single carrier whose fleet accounted for about one third of the affected ships, with sixty-nine of its vessels rerouted around the Cape of Good Hope or delayed. The 2023 to 2025 Red Sea crisis is an analogue for a prolonged disruption managed through rerouting; Notteboom et al. (2024) analysed how attacks in the Bab el-Mandeb Strait drove a large-scale diversion around the Cape of Good Hope, lengthening transit, raising fuel and surcharge costs, and pushing war-risk insurance premiums toward roughly three quarters of one percent to one percent of vessel value. The COVID-19 disruption supplies a third, more distant analogue for a long-duration, widely propagating shock (Ivanov, 2020). The decisive difference between these analogues and the Strait of Hormuz is that each permitted a routing response, so the analogues are read as lower bounds on the consequences of a comparable interruption at the Strait.

4.3 Scenario synthesis and its limits

The framework is applied through a qualitative scenario synthesis that organises the channels of Figure 1 and assigns to each the best available evidence on magnitude. The synthesis is order-of-magnitude and assumption-explicit. It does not estimate new quantitative effects; numerical figures are drawn from cited institutional data and from published model-based scenarios, not from original computation, and where a figure represents a modelled scenario rather than an observed outcome this is stated. The duration dimension is represented in Figure 2 as a stylised relationship, with full-closure and partial-restoration cases distinguished and a single point anchored to a published scenario; the figure is conceptual and its vertical scale is illustrative rather than estimated. Two design limitations follow. First, the

analogues are imperfect because they permitted rerouting that the Strait does not, which biases the synthesis toward conservatism. Second, behavioural responses such as strategic stockpiling, hoarding, and substitution toward alternative energy carriers are not modelled, although they would shape any real trajectory. These limitations mark the boundary between what can be inferred from existing knowledge and what requires the empirical record that a fully realised closure would generate.

5. Results

5.1 Strategic centrality and the substitutability gap

The first and most consequential result is structural and supports Proposition 2. The Strait of Hormuz concentrates a larger share of a critical commodity than any other maritime passage, and, unlike the chokepoints in recent disruptions, it lacks a near-term substitute route capable of absorbing more than a fraction of its flows. Institutional assessments converge: the volume transiting the Strait represents roughly one fifth of global petroleum liquids consumption and more than a quarter of seaborne oil trade, and the pipeline capacity available to bypass the Strait can carry only a limited portion of normal throughput (CRS, 2026; EIA, 2025; IEA, 2025). This differs qualitatively from the Red Sea, where vessels were diverted around the Cape of Good Hope at the cost of longer voyages but without an absolute loss of access (Notteboom et al., 2024). The systemic-risk modelling of Verschuur et al. (2025) makes the implication explicit by separating chokepoints whose disruption requires only detours, which can be buffered, from those whose disruption severs trade, among which they place the Strait; Pratson (2023) reaches a compatible conclusion from an independent method. Table 1 summarises the contrast across the principal analogues, and Table 2 reports selected indicators of dependence on the Strait.

Table 1. Comparative features of major maritime chokepoint disruptions.

Event / chokepoint	Year	Nature of disruption	Substitute route	Documented supply chain effect
Suez Canal (Ever Given)	2021	Six-day total blockage, then cleared	Cape of Good Hope available	Carrier losses of about USD 89 million for one fleet; rerouting and delay of 69 vessels (Tran et al., 2025)
Bab el-Mandeb / Red Sea	2023– 2025	Prolonged security threat; partial avoidance	Cape of Good Hope used at scale	Longer transit, higher fuel and surcharges, war-risk premiums near 0.75–1% of vessel value (Notteboom et al., 2024)
Strait of Hormuz	2025– 2026	Conflict-driven closure and attacks on shipping	No comparable near-term maritime substitute	Trade effectively severed for dependent economies; scenario estimates of large price and output effects (Verschuur et al., 2025; Kilian et al., 2026)

Note. Entries are drawn from the cited sources; figures for the Strait of Hormuz combine reported events with model-based scenario estimates.

5.2 The energy price channel

The most immediate channel is the price of oil and gas, supporting Proposition 3. A war-induced closure is a supply-driven energy shock, the category Kilian (2009, 2014) associates with the most adverse dynamics, and Kilian (2008) cautions that such shocks transmit through several reinforcing mechanisms. The potential scale is indicated by model-based scenario work: economists at the Federal Reserve Bank of Dallas estimated that a

disruption persisting through the second quarter of 2026 would raise the average West Texas Intermediate price toward ninety-eight United States dollars per barrel and lower global real gross domestic product growth by roughly two and nine tenths percentage points on an annualised basis, while emphasising that reducing the shortfall of oil even partially would substantially dampen the impact (Kilian et al., 2026). These are scenario outputs of a structural model rather than observed outcomes. Two qualifications apply. Because oil is globally fungible, the price effect is not confined to importers of Gulf crude; even the United States, the largest producer, remains exposed because the disruption raises the global price faced by all buyers (Gross & Beane, 2026). And the gas dimension is distinct, because the concentration of Qatari liquefied natural gas passing through the Strait removes a large share of seaborne gas from the market for users that cannot readily switch fuels (CRS, 2026).

5.3 Maritime cost channels and insurance amplification

Beyond the price of the cargo, a closure raises the cost and lengthens the time of moving goods, supporting Proposition 4. The analogues are informative. In the Suez case a six-day total blockage generated quantifiable carrier losses through extended voyages, waiting time, and the inventory cost of delayed cargo, even though the canal was cleared within days (Tran et al., 2025). In the Red Sea case a prolonged threat was managed by diversion around the Cape of Good Hope, which lengthened Asia to Europe voyages, raised fuel consumption and surcharges, and drove war-risk premiums sharply higher (Notteboom et al., 2024). Both illustrate the cost channels of Figure 1. For the Strait, the same channels operate but the routing response is constrained, because there is no comparable maritime detour for the landlocked Gulf exporters. Reporting on the 2026 episode indicates that the initial contraction in transit was driven substantially by the repricing and withdrawal of tanker insurance rather

than by the physical interdiction of every vessel, a dynamic that can suppress flows well before, and well beyond, any direct attack (CRS, 2026; Gross & Beane, 2026). The insurance channel therefore functions as an amplifier, converting a localised security threat into a broad reduction in throughput.

Table 2. Selected indicators of dependence on the Strait of Hormuz.

Indicator	Approximate magnitude	Source
Oil and petroleum products transiting daily (2024–2025)	About 20 million barrels per day	EIA (2025); CRS (2026)
Share of global petroleum liquids consumption	About one fifth	EIA (2025)
Share of seaborne / maritime oil trade	Roughly one quarter or more	CRS (2026); IEA (2025)
Principal destination of flows	Predominantly Asia (notably China and India)	IEA (2025)
Annual value of trade exposed to chokepoint disruption (global)	About USD 192 billion	Verschuur et al. (2025)

Note. Values are approximate and are reported as stated in the cited sources.

5.4 Propagation, duration, and the threshold to transformation

The cost and supply shocks propagate through production networks, and their severity depends on duration, supporting Propositions 1 and 5. A disruption at the Strait raises input costs and lengthens lead times for firms far from the Gulf, and these effects travel forward to customers and backward to suppliers according to network position (Dolgui et al., 2018; Li et al., 2021). Inoue and Todo (2019) showed that such propagation can amplify an initial shock into aggregate losses much larger than the direct disturbance. Duration determines whether the disruption is absorbed or transformative, as represented in Figure 2. Ivanov (2020) demonstrated that long-duration, widely propagating disruptions destabilise production and

inventory dynamics in ways short shocks do not and that recovery carries after-shock risks. Applied to the Strait, a short closure resembles the Suez analogue and is largely absorbed through the redundancy and slack emphasised by Sheffi and Rice (2005), whereas a sustained closure exhausts inventories and forces substitution of suppliers or production. At that threshold the relevant concept shifts from recovery to viability and from engineering to social-ecological resilience, because returning to the prior configuration is no longer feasible and adaptation or transformation becomes necessary (Ivanov & Dolgui, 2020, 2021; Wieland & Durach, 2021). The breadth of affected commodities widens the set of firms that reach this threshold.

5.5 The breadth of affected commodities and sectors

A closure is not solely an energy event. The Gulf is a major source of commodities beyond crude oil and gas, and their interruption spreads the disruption across sectors that do not obviously depend on the region. Drawing on trade data, the Atlantic Council (2026) documented that, before the 2026 disruption, the Gulf supplied a substantial share of several globally traded commodities, including a meaningful fraction of seaborne jet fuel and diesel, of ammonia demand, of helium production, of seaborne sulfur, and of aluminium. Ammonia and sulfur are inputs to fertiliser production, which links a maritime closure to agricultural supply chains and to food prices; helium is critical to specific manufacturing and medical applications; and refined-product flows bear directly on transport-fuel availability. These linkages illustrate why the ripple effect reaches sectors several steps removed from the energy market and reinforce the propagation mechanism of Proposition 1.

5.6 Asymmetric regional exposure

The final result concerns distribution and supports Proposition 6. Dependence on the Strait varies sharply across economies. The IEA (2025) notes that most exports through the Strait are destined for Asia, with China and India together accounting for a large share, concentrating physical supply risk among Asian importers. Verschuur et al. (2025) likewise identify economies in the Middle East, Africa, and other import-dependent regions as the most exposed, and Verschuur, Koks, and Hall (2022) show more generally that some economies depend on specific maritime infrastructure outside their control. Gross and Beane (2026) emphasise that the price effect is nonetheless global, so that economies with little direct dependence still experience the inflationary consequences. The combined picture is one of globally shared price effects layered on regionally concentrated physical supply risk, a configuration that complicates coordinated policy responses.

6. Discussion

6.1 Theoretical implications

The principal theoretical contribution is to position route substitutability as a moderator of chokepoint disruption severity, formalised in Proposition 2. The chokepoint literature has measured the trade exposed at each passage and the rerouting that follows (Pratson, 2023; Verschuur et al., 2025; Verschuur, Koks, & Hall, 2022), and the resilience literature has identified node criticality as a driver of severity (Craighead et al., 2007), but neither has made explicit that the marginal effect of trade volume on severity is conditioned by whether the trade can be re-routed. Recognising substitutability as a moderator clarifies why disruptions of comparable headline magnitude can have qualitatively different

consequences and identifies the Strait of Hormuz as the limiting case in which the moderator approaches zero.

The analysis also reconciles competing conceptions of resilience for the case of a non-substitutable chokepoint. The engineering view, oriented to bouncing back through redundancy and slack, adequately describes the absorption of a short closure, whereas the social-ecological view, oriented to persistence, adaptation, and transformation, becomes necessary for a sustained closure that renders the prior configuration unviable (Sheffi & Rice, 2005; Wieland & Durach, 2021). The duration threshold in Figure 2 marks the transition between these regimes and connects the resilience and viability literatures (Ivanov & Dolgui, 2020), suggesting that the appropriate resilience concept is itself a function of disruption duration rather than a fixed property of the network.

6.2 Managerial implications

Three implications follow for firms. First, because the insurance and risk-pricing channel can suppress flows ahead of any physical interdiction (Caldara & Iacoviello, 2022; CRS, 2026; Gross & Beane, 2026), the monitoring of war-risk premiums and chartering behaviour provides an early indicator of disruption that precedes changes in physical throughput. Second, because severity at a non-substitutable chokepoint cannot be addressed by transport redundancy, the relevant resilience investments are redundancy in the form of strategic reserves and diversified sourcing and flexibility in the form of the capacity to substitute suppliers and production, consistent with the redundancy-versus-flexibility trade-off identified by Sheffi and Rice (2005). Third, because propagation is governed by network structure (Inoue & Todo, 2019; Li et al., 2021), firms should map their indirect exposure to Gulf-linked inputs,

including the fertiliser and refined-product chains implied by the commodity breadth documented by the Atlantic Council (2026), rather than only their direct sourcing.

6.3 Policy implications

For policymakers, the asymmetry of exposure implies differentiated responses. Import-dependent economies, concentrated in Asia, face a quantity problem that calls for strategic reserves, coordinated release, and demand-management measures, whereas distant economies face primarily a price and inflation problem (Gross & Beane, 2026; IEA, 2025). The scenario analysis offers a further implication with direct policy relevance: because even a partial restoration of flows substantially dampens the impact (Kilian et al., 2026), the operative objective need not be full reopening but the reduction of the shortfall, which reframes contingency planning around marginal restoration of supply rather than around complete avoidance of disruption. The feedback loop in Figure 1 adds a caution, since persistent geopolitical risk can deter the very investment in capacity and diversification that would build resilience (Caldara & Iacoviello, 2022).

6.4 Limitations

Several limitations bound these conclusions. The study is conceptual and theory-elaborating, and the propositions are offered for testing rather than tested here. The analysis rests on analogues that are imperfect, most importantly because the chokepoints in the analogues permitted rerouting while the Strait does not, so the analogues are best read as lower bounds. The quantitative figures are drawn from institutional data and from model-based scenarios rather than from observed outcomes of a completed event, and scenario estimates are sensitive to assumptions about duration, spare capacity, and reserve releases.

The duration-severity relationship in Figure 2 is stylised and its vertical scale is illustrative. The synthesis also does not model behavioural responses such as hoarding, stockpiling, and fuel substitution, each of which would alter a real trajectory. Finally, the structured review is focused rather than exhaustive, and a different corpus might weight the channels differently.

6.5 Future research

The propositions define an empirical agenda. Proposition 2 can be tested by comparing the supply chain consequences of disruptions across chokepoints that differ in substitutability, holding trade volume constant, using the event-study and network methods already applied to the Suez and Red Sea cases (Notteboom et al., 2024; Tran et al., 2025). Propositions 3 and 4 invite event-study analysis of price, freight, and insurance responses during the 2025 and 2026 episodes as data accumulate. Proposition 5 can be examined through network-based simulation of propagation from Gulf energy and chemical feedstocks into specific industrial supply chains, extending the simulation approach of Ivanov (2020). Proposition 6 calls for comparative assessment of the effectiveness of reserve releases, demand reduction, and sourcing diversification across regions. Such work would convert the present inferences into testable, quantified relationships.

7. Conclusion

A war that interrupts transit through the Strait of Hormuz would act on global supply chains as a compound shock that is at once an energy supply shock, a maritime logistics shock, and a trigger for cascading disruption across interconnected production networks. By integrating the maritime chokepoint, supply chain resilience, and oil price shock literatures into a single transmission framework, and by reading that framework against documented

disruptions at the Suez Canal and in the Red Sea, this study identifies the feature that makes the Strait distinctive: the near-absence of a substitute route, which deprives firms of the rerouting response that contained earlier disruptions and places the Strait among the chokepoints whose closure effectively severs trade for dependent economies. The study's central theoretical move is to formalise route substitutability as a moderator of chokepoint severity, and its central empirical inference is that duration, rather than onset, governs whether a closure is absorbed or becomes transformative.

The contribution is conceptual: an integrated framework, a set of six testable propositions, and a disciplined comparative synthesis rather than new empirical estimates. Its practical value lies in reorienting resilience planning for a non-substitutable chokepoint toward strategic reserves, diversified sourcing, the mapping of indirect network exposure, and the monitoring of insurance and chartering behaviour as early indicators, and in reframing the policy objective around the marginal restoration of supply. Its central caveat is that the analogues understate rather than overstate the likely consequences, because they permitted a routing response that the Strait does not. Testing the propositions as disruption data accumulate is the priority for subsequent research.

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