The Effect of Canal and Strait Congestion on Supramax Time-Charter Rates: A Commercial Manager's Perspective

Heisenberg Shipping

July 2026

Highlights

- Canal and strait congestion raises Supramax time-charter rates by shrinking the *effective supply* of ton-mile capacity, not by shifting cargo demand.
- Two channels transmit the shock: voyage lengthening through re-routing, and tonnage immobilisation through queuing and slow transit.
- The Supramax segment is distinctively exposed: geared, regional, minor-bulk trades, and substitutable with Panamax and Handysize.
- The *duration* of a congestion event, not only its severity, governs how far the spot spike propagates into the period charter and FFA markets.
- Each transmission channel maps onto a commercial-manager lever: speed, routing, contract type, period cover, and freight-derivative hedging.

Abstract. Maritime chokepoints (the Suez and Panama Canals, the Turkish Straits, the Strait of Malacca, and the approach channels to congested load and discharge ports) concentrate global seaborne trade into a handful of passages whose disruption reverberates through the freight market within days. This paper synthesises the recent literature to trace how congestion at these points transmits into the time-charter (TC) rate for the Supramax dry bulk segment, and reframes that transmission from the standpoint of the commercial manager who must price period cover, choose between voyage and time-charter employment, and manage vessel positioning against it. We argue that congestion acts on rates almost entirely through the *effective supply of ton-mile capacity* rather than through cargo demand: re-routing lengthens voyages and queuing immobilises tonnage, and both withdraw carrying capacity from a market whose freight rate is set by the balance of supply against ton-mile demand. The Supramax segment is distinctively exposed because its geared, mid-sized, regionally-traded vessels serve exactly the secondary ports and minor-bulk trades where congestion accumulates, and because it sits between the Panamax and Handysize segments across which cargo and tonnage substitute. We organise the evidence around five themes: chokepoint criticality, disruption episodes, congestion-to-rate transmission, freight-rate formation in the dry bulk segment, and volatility and risk transfer, and close with a decision-oriented framework linking each transmission channel to the commercial levers a manager controls: speed and routing, contract-type selection, period-cover timing, and freight-derivative hedging.

Keywords: dry bulk shipping; Supramax; time-charter rates; maritime chokepoints; port congestion; ton-mile demand; forward freight agreements; commercial ship management

JEL classification: R41 (Transportation Economics: Demand, Supply, Congestion); L91 (Transportation: General); Q54 (Climate; Natural Disasters); G13 (Contingent Pricing; Futures Pricing); F14 (Empirical Studies of Trade)

1. Introduction

A dry bulk commercial manager does not experience canal congestion as a geopolitical headline; they experience it as a repricing of every open position on the fleet. When the *Ever Given* grounded across the Suez Canal in March 2021, when drought forced the Panama Canal Authority to cut draft and transit slots through 2023–2024, and when attacks on shipping in the Red Sea from late 2023 pushed vessels around the Cape of Good Hope, the immediate commercial question was never only "is the passage open?" but "what does this do to the rate at which I can fix my ships, and for how long?" This paper is written to that question.

The economic starting point is that a chokepoint is defined by the absence of good alternatives. Global trade relies on a small number of strategic passages that connect ocean basins with few substitute routes, and their exposure to disruption has, until recently, been poorly quantified (Verschuur 2025). Combining shipping-lane geometry with bilateral trade data shows that the closure of a single chokepoint propagates through the trade network far beyond the countries that border it (Pratson 2023), and the systemic value of trade exposed to chokepoint disruption has been estimated in the range of USD 192 billion annually, concentrated in a few passages (Verschuur 2025). For the freight market, the relevant consequence of a closure or slowdown is not lost cargo (most cargo still needs to move), but a longer or slower path for the ships that carry it.

The dry bulk market prices that path. Freight and hire rates in bulk shipping are set by the interaction of vessel supply with the demand for transport measured in ton-miles, and this supply–demand formation is the organising principle of maritime freight economics (Efes 2019; Hayashi 2020). Congestion enters this balance on the supply side. It does so through two channels that this paper keeps distinct throughout: *ton-mile lengthening*, where re-routing raises the sea-days required to move a given tonne, and *effective supply withdrawal*, where queuing, slow steaming through restricted channels, and extended laytime tie up tonnage that cannot re-enter the spot market. Both shrink the carrying capacity available to satisfy demand, and a tighter effective balance lifts rates.

Our focus is the Supramax: the geared, roughly 50,000–60,000 dwt segment (extended in practice to the Ultramax at around 60,000–65,000 dwt) that carries grains, coal, minor bulks, steels, and fertilisers on flexible, often regional itineraries. This segment deserves separate treatment rather than being folded into a generic "dry bulk" analysis. Its onboard cranes let it work ports without shore-side gear, precisely the secondary and minor-bulk ports where congestion tends to build, and it sits between the Panamax and Handysize segments, so that cargo parcels and tonnage substitute across the size boundaries in ways that shape how a congestion shock is distributed (Kanamoto 2020; Bernacki 2021). Vessel size interacts materially with the cost consequences of any voyage deviation (Vyshnevska 2017), which is exactly what congestion imposes.

The contribution of this paper is threefold. First, it assembles the recent, verifiable literature (spanning chokepoint geography, disruption case studies, congestion economics, dry bulk freight-rate formation, and freight risk) into a single account of the congestion-to-rate transmission mechanism. Second, it specialises that account to the Supramax segment, whose exposure differs in kind, not just degree, from the Capesize and Panamax segments that dominate the empirical literature. Third, it translates the mechanism into a commercial-management decision frame, mapping each transmission channel onto the levers a manager actually controls. The remainder of the paper proceeds as follows. Section 2 establishes chokepoint criticality; Section 3 reviews the recent disruption episodes as natural experiments; Section 4 sets out freight-rate formation in the dry bulk segment; Section 5 develops the transmission mechanism and the Supramax-specific amplifiers; Section 6 turns to volatility and risk transfer; Section 7 presents the commercial-manager framework; Section 8 identifies research gaps; Section 9 concludes.

2. Maritime chokepoints and freight

The premise underlying every congestion effect is concentration: a large share of seaborne trade funnels through a handful of narrow passages that have no close substitutes, so a constraint at any one of them cannot be routed around cheaply. Tracking global marine traffic confirms that a small set of chokepoints carries a disproportionate share of transits and that their relative importance can be measured directly from vessel movements rather than inferred from trade statistics (Wang 2023). The strategic literature on the Suez Canal in particular frames it as a passage whose control and vulnerability carry consequences well beyond the transit fees, shaping the routing of entire fleets (Chorev 2023; Tadini 2020).

What matters for the freight market is that these passages are supply-side bottlenecks. When a chokepoint closes, the modelling consistently shows the shock propagating through the trade network to countries and commodities far from the passage itself (Pratson 2023; Verschuur 2025). Agent-based modelling of the global LNG trade under a Suez closure demonstrates the same logic for energy cargoes: with few alternative routes, a passage constraint forces longer hauls and reallocates flows rather than eliminating them (Meza 2022). The sensitivity of energy-cargo routing to the geopolitical status of a chokepoint has been documented for LNG transits through the Suez Canal specifically (Polemis 2025), and geopolitical risk has been shown to reshape the LNG–LPG trade more broadly (Michail 2022), the same routing logic that governs the dry bulk fleet's response. The general-equilibrium framing is that a chokepoint disruption is a negative shock to the effective transport capacity of the world fleet, and climate-induced constraints (the Panama drought being the archetype) are increasingly recognised as a structural rather than one-off source of such shocks (Key 2024).

The chokepoints most relevant to Supramax trades are not identical to those that dominate the container or crude tanker discussion. The Turkish Straits (Bosphorus and Dardanelles) sit astride the grain and steel trades of the Black Sea, a core Supramax employment area, and traffic-flow simulation of the straits (including the prospective effect of the planned Canal Istanbul) shows how sensitive transit times in these narrow waters are to vessel-traffic management and one-way scheduling (Ormeci 2026; Yang 2025). The Strait of Malacca and the broader Southeast Asian passages govern the coal and minor-bulk trades between the Indian Ocean and the Far East, and the connectivity literature has long examined how alternative routings (the Kra Canal proposal, the Northern Sea Route) would redistribute these flows (Rahman 2016; Idris 2018). The commercial implication is that a Supramax fleet's exposure to chokepoint risk is spread across several passages simultaneously, each governing a different trade lane, so that congestion risk for the segment is better understood as a portfolio of passage exposures than as a single Suez-or-Panama bet. The systematic literature on maritime-network resilience frames exactly this: the vulnerability of the system is a property of its network of nodes and passages, not of any single link (Zhang 2024).

3. Disruption episodes as experiments

The 2021–2026 period supplied an unusually dense sequence of chokepoint disruptions, and the literature treating them functions as a set of natural experiments on how congestion transmits into shipping markets.

The *Ever Given* grounding in March 2021 is the cleanest case of an abrupt, total closure. Its analysis has concentrated on the legal and contractual fallout: the allocation of risk and liability across the supply chain, and specifically the disputes arising under time-charter contracts when a vessel is stranded and off-hire questions, laytime, and general-average claims come into play (Lee 2021; Cha 2021). This contractual dimension matters commercially because it determines who bears the cost of the delay, a question the time-charter party allocates explicitly. Traffic analysis using AIS data quantified the backlog of containerships and the recovery dynamics after the six-day closure, giving an empirical picture of how quickly a queue builds and clears (Cremaschini 2022).

The Red Sea crisis from late 2023 is the more consequential episode for the freight market because it is a *sustained* disruption acting through re-routing rather than a brief closure. Attacks on commercial shipping pushed a large share of Suez-routed traffic around the Cape of Good Hope, and the maritime-security literature documents both the scale of the traffic diversion and its persistence (Rodriguez-Diaz 2024; Oral 2025). Route-choice modelling of the Red Sea diversion captures the trade-off vessels face between the security risk of the direct route and the added sea-days of the Cape route (Bolat 2025). Crucially for freight economics, the rerouting is a ton-mile event: recent quantification of the environmental and economic costs of the diversion frames it precisely as an increase in voyage distance and duration applied across a large fleet (Sun 2026), which is the mechanism by which effective capacity is withdrawn. The episode also revived old contract-law questions (whether prolonged rerouting frustrates affreightment contracts) that bear directly on charter obligations (Alsharqawi 2026). A parallel strand situates the crisis in its geopolitical and macroeconomic context, linking maritime disruption to inflationary pressure through higher transport costs (Župac 2024; Nadkarni 2024; Sultana 2025; Sainz Caparroso 2026). The link from maritime transport costs to general price levels has been made explicitly (Alekseievska 2025).

The Panama Canal drought of 2023–2024 differs again: neither a closure nor a security diversion, but a *capacity rationing* through reduced draft and fewer daily transit slots. Its structural, climate-driven character makes it a recurring rather than transient risk (Key 2024), and it illustrates congestion as a partial, graduated constraint: vessels are not blocked but must wait, book slots at auction, or divert, each of which withdraws effective capacity in a measurable way. Together these episodes exhibit the full spectrum of chokepoint disruption (abrupt closure, sustained rerouting, and graduated capacity rationing), and each maps onto the transmission channels developed in Section 5.

---

4. Dry bulk freight-rate formation

To see how congestion moves the Supramax TC rate, one must first be explicit about how that rate is formed. The dry bulk freight rate is the price that clears a market in which the supply of vessel capacity meets the demand for transport, the latter measured not in tonnes but in ton-miles — tonnes multiplied by distance. The supply–demand interaction is the accepted core of freight-rate formation (Efes 2019), and the short-run supply curve is highly inelastic near full fleet utilisation: when almost all ships are working, additional demand cannot be met by more sailings and must be rationed by price, so rates rise sharply. The stationarity properties of spot freight rates are themselves shaped by this supply/demand structure, with rates tending to mean-revert toward a level anchored by the marginal cost of the least efficient tonnage while spiking when utilisation approaches its ceiling (Hayashi 2020). Sentiment and expectations augment these fundamentals, so that demand and supply equations for dry bulk are better specified when a sentiment term is included alongside the physical variables (Michail 2021).

The distinction between the time-charter rate and the voyage (spot) rate is central to the commercial reading. The spot or voyage rate prices a single laden movement and is quoted per tonne or as a lump sum; the time-charter rate prices the vessel's time, quoted per day, with the charterer directing employment and bearing voyage costs. The TC rate is therefore a forward-looking average of expected voyage earnings (the time-charter equivalent, or TCE) over the charter period, plus a risk premium. Market-efficiency analysis of the choice between time charter and trip charter shows that the relationship between the two is an equilibrium condition that a commercial party can, in principle, arbitrage — the decision is not merely operational but a view on where the market is heading (Pourkermani 2023). The dynamic interaction runs both ways between the physical spot market and the paper (derivatives) market: spot and forward freight rates are co-determined, with information flowing between them (Yin 2016), and structural vector-autoregression evidence linking FFA, spot, and time-charter rates supports a "physical–paper" hypothesis in which the segments of the freight complex move together but with a discernible lead–lag structure (Ko 2024).

Two features of the dry bulk market make the ton-mile channel especially potent. First, vessel size and voyage distance jointly determine voyage efficiency: for a given cargo, a longer haul changes the economics differently across size classes, so a distance shock does not fall evenly on the fleet (Vyshnevska 2017). Second, big-data analysis of dry bulk carriers by commodity and vessel size confirms that the segment is not homogeneous (different sizes are tied to different commodities and trade lanes, so a congestion event concentrated on a particular lane transmits most strongly to the size class that serves it) (Kanamoto 2020; Bernacki 2021). Correlation and regression analysis of the dry bulk freight market confirms that its rate movements are driven by a tractable set of underlying demand and supply variables rather than being idiosyncratic (Onyshchenko 2022). The Baltic Dry Index, the headline barometer of the market, aggregates across these size classes and is itself driven by a set of global macro factors, commodity demand, fuel prices, and the broader economic cycle (Pepur 2022), with enough information content that it has been examined as a leading indicator of real economic activity (Sartorius 2018). For congestion analysis, the index is useful as context but too aggregated to isolate the Supramax response, which is why the segment-level and contract-type literature matters.

5. The transmission mechanism

We now assemble the mechanism. Congestion at a canal, strait, or port does not change the tonnage of cargo that needs to move; it changes the amount of vessel capacity required to move it, and the amount available to do so. The effect reaches the TC rate through two supply-side channels, illustrated in Figure 1.

Channel A — ton-mile lengthening through re-routing. When a passage is closed or made uneconomic, vessels take a longer route: the Red Sea diversion around the Cape of Good

Hope is the defining recent example, adding thousands of nautical miles and one to two weeks of steaming to affected voyages (Rodriguez-Diaz 2024; Sun 2026). Because demand is measured in ton-miles, a longer average haul is an increase in demand for vessel capacity even when the tonnage of cargo is unchanged (Efes 2019). A fleet that could carry a given annual cargo programme over the short route cannot carry it over the long route without more ship-days; the same physical fleet delivers less effective supply. The LNG agent-based results make the general point that re-routing around a chokepoint reallocates and lengthens flows rather than cancelling them (Meza 2022).

Channel B: effective supply withdrawal through queuing and slow transit. Congestion at ports and in restricted channels immobilises tonnage without moving it anywhere. Port-congestion determinants and their impact on the logistics network have been documented directly, with waiting and turnaround times identified as the operative variables (Nze 2018). For dry bulk specifically, preoperational waiting times are pervasive, and the just-in-time-arrival literature quantifies how much vessel time is lost to anchorage queues at load and discharge ports (Senss 2023; Pahl 2024). The empirical bridge from congestion to price has been made most directly for the container market: measuring the impact of port congestion on container-ship freight rates shows a positive, quantifiable pass-through from congestion to rates (Michail 2025; Michail 2023). The dry bulk mechanism is identical in structure (every day a Supramax spends waiting at anchorage or transiting a restricted channel slowly is a day it is not available to the spot market), even though the segment-specific quantification is thinner, a gap we return to in Section 8. Queue-management policy at the passage itself modulates the size of this effect, since the scheduling regime determines how much aggregate waiting a given arrival rate produces (Çağlayan 2024; Ormeci 2026).

From effective supply to the rate. Both channels reduce the effective supply of ton-mile capacity while demand is unchanged, moving the market up the steep part of the supply curve. Because the short-run supply of shipping is inelastic near full utilisation, a modest withdrawal of effective capacity can produce a disproportionate rate response (Hayashi 2020; Efes 2019). The response appears first in the spot/TCE market, then propagates to the period time-charter rate and the FFA curve, consistent with the co-movement and lead–lag structure documented across the freight complex (Yin 2016; Ko 2024). The period TC rate, being a forward average of expected TCE, rises by less than the spot spike for a disruption expected to be temporary, and by more when the market judges the constraint to be persistent — which is why the *duration* of a congestion event, not just its severity, is the commercially decisive variable.

Supramax-specific amplifiers. Three features make the Supramax response distinct from that of the larger, single-commodity segments. First, the segment's geared flexibility ties it to minor-bulk and secondary-port trades, exactly where congestion accumulates and where shore infrastructure is least able to clear queues quickly (Kanamoto 2020). Second, Supramax employment is heavily regional and round-voyage in character, so added sea-days from a diversion or a slow transit consume a proportionally larger share of a short itinerary than they would on a long-haul Capesize voyage, and the size-distance interaction means the cost consequence is not uniform across the fleet (Vyshnevska 2017; Bernacki 2021). Third, the segment substitutes with its neighbours: when Panamax tonnage is drawn into congested lanes, cargo can shift down into Supramax and Handysize, and vice versa, so a congestion shock redistributes across the size boundary rather than staying contained — the segment structure identified in the big-data and size-class literature is what makes this substitution operative (Kanamoto 2020). The net effect is that the Supramax TC rate can respond to a congestion event with an intensity that a Capesize-centred or index-level analysis would understate.

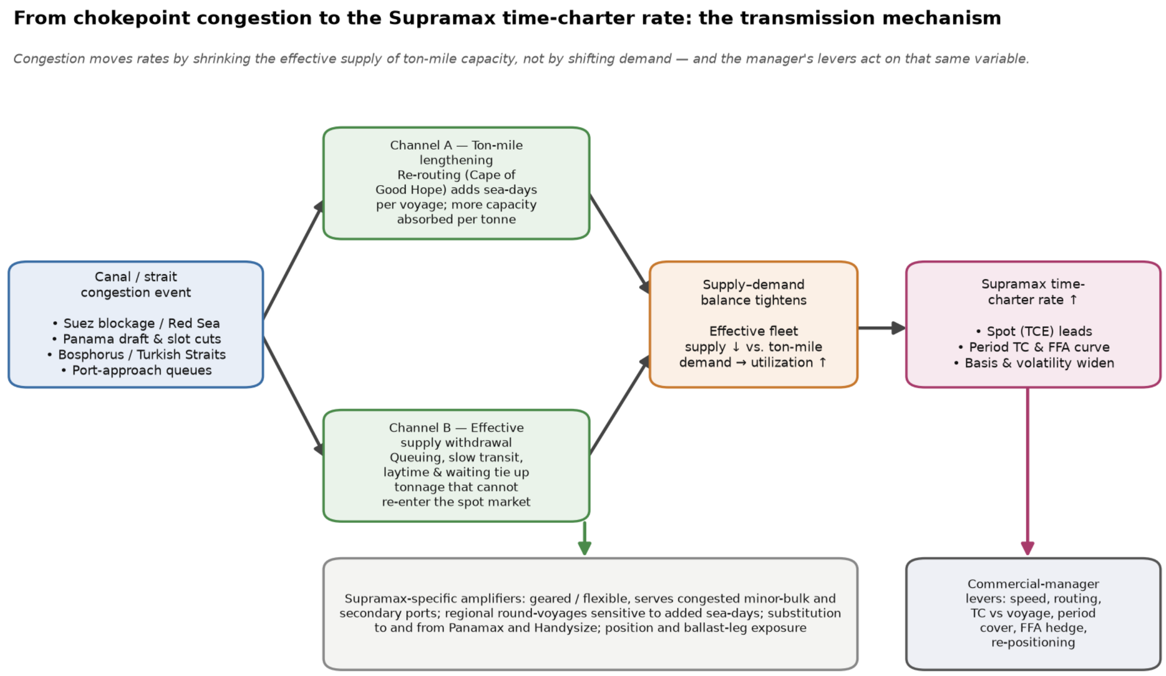

Figure 1. From chokepoint congestion to the Supramax time-charter rate: the transmission mechanism. Congestion enters through two supply-side channels (ton-mile lengthening, Channel A, and effective supply withdrawal, Channel B), which tighten the supply–demand balance and lift the rate, with Supramax-specific amplifiers and the commercial-manager levers that act on the same variables.

---

6. Volatility and risk transfer

Congestion does not only move the level of the freight rate; it moves its variance and its correlation structure, which is where the commercial manager's risk exposure lives. Dry bulk freight rates are among the most volatile prices in any transport market, and that volatility is amplified by geopolitical risk and economic-policy uncertainty — both elevated precisely during the chokepoint episodes of recent years (Drobetz 2020). More recent work extends this to trade-policy uncertainty specifically, showing that policy-driven uncertainty feeds into dry bulk rates and shipping costs (Georgoulas 2025; Melas 2025), and the geopolitical-risk channel has been traced into the resilience of the wider shipping supply chain and the security of its logistics nodes (Li 2026). The COVID-19 shock, though not a chokepoint event, provided a clean demonstration that an external supply-chain disruption transmits into freight rates with a state-dependent intensity that quantile methods reveal (Khan 2022; Shi 2023).

The risk-transfer structure matters because it determines how a manager can lay off congestion exposure. Volatility and risk spillovers run between the freight markets of different size segments: the Capesize (BCI) and Panamax (BPI) indices exhibit measurable correlation and spillover, so a shock originating in one segment's trade lanes transmits to the others (Zou 2025). Within the Capesize complex, volatility transmission has been traced from energy and commodity markets into freight contracts, linking the physical drivers of congestion (commodity flows, fuel prices) to freight-rate variance (Mi 2025). The forward freight agreement (FFA) is the instrument that prices and transfers this risk: FFAs and physical rates are dynamically interlinked (Yin 2016), and freight derivatives can be used to hedge not only freight-rate risk but ship-price risk in the dry bulk market (Adland 2019). The financialisation of the market has deepened, as the entry of exchange-traded funds has itself been examined as a factor in freight-market volatility (Gerakoudi 2026), and switching behaviour between freight-market segments in response to relative rates and risk has been formalised in the tanker literature in a way that carries directly to dry bulk chartering decisions (Kavussanos 2026). For the commercial manager, the practical consequence is that a congestion event raises both the expected rate and its uncertainty, and the paper market offers a route to convert that uncertainty into a fixed cost.

7. A commercial-manager decision framework

The value of the transmission mechanism to a commercial manager is that each channel points to a lever. We organise the response around the decisions a Supramax operator actually makes, tying each to the literature that informs it.

1. **Read the duration, not just the headline.** Because the period TC rate is a forward average, the decisive judgement is whether a congestion event is transient (an *Ever Given*-type closure that clears in days) or persistent (a Red Sea rerouting or a structural Panama drought). The distinction governs whether the spot spike will propagate into the period market, and the co-movement and lead–lag evidence across spot, TC, and FFA rates is the basis for that read (Ko 2024; Yin 2016). Structural, climate-driven constraints should be treated as recurring, not one-off (Key 2024).
2. **Choose contract type as a market view.** The decision to fix a ship on period time charter versus keeping it trading on voyage/trip employment is an implicit position on the direction of rates; market-efficiency analysis frames time-charter-versus-trip-charter as an arbitrageable equilibrium rather than a purely operational choice (Pourkermani 2023). Ahead of an expected persistent tightening, extending period cover on owned or controlled tonnage locks in the rate before the period market reprices; a charterer expecting the constraint to ease does the opposite.
3. **Optimise speed and routing against the added sea-days.** When re-routing lengthens the voyage, the TCE-optimising speed changes, and bunker cost, environmental regulation, and the freight rate jointly determine the economic speed — a trade-off formalised for the Capesize segment but general to dry bulk (Apostolou 2023). The route-choice trade-off between a risky direct passage and a longer safe one is itself a modellable decision (Bolat 2025). The economics are increasingly conditioned by carbon regulation: the EU Emission Trading System adds a per-tonne-CO_2 cost that longer, congestion-driven routings inflate, and its uneven geographic application can itself distort routing incentives (Faria 2024). Energy-efficiency investment on the vessel — which lowers the fuel and carbon cost of the added sea-days — is itself shaped by a principal–agent problem between owner and charterer over who captures the savings, a friction the commercial manager must price into period terms (Longarela-Ares 2020).
4. **Manage positioning and the ballast leg.** Because congestion redistributes tonnage across regions and size segments, the value of a vessel's position changes with the event; the substitution structure across Panamax–Supramax–Handysize means repositioning ahead of a congestion-driven regional tightening can capture the rate differential (Kanamoto 2020).

Tramp and contract-of-affreightment operators face this as a fleet-deployment optimisation (Koskina 2023; Onyshchenko 2016). The tactical-planning methods developed for liner shipping — exact optimisation of deployment and cargo allocation under network constraints (Pasha 2020; Bilican 2024) — offer transferable structure for the tramp operator repositioning a Supramax fleet around a congested passage, even though bulk employment is less scheduled than liner.

5. **Hedge the residual with freight derivatives.** Exposure that cannot be managed physically can be laid off on the FFA market, which prices and transfers freight-rate risk and is dynamically linked to physical rates (Adland 2019; Yin 2016). Because volatility and spillovers rise during congestion episodes, the hedging decision is also a decision about which segment's paper to use, given cross-segment spillover (Zou 2025; Kavussanos 2026).
6. **Price the contractual risk explicitly.** The *Ever Given* and Red Sea disputes show that delay, off-hire, laytime, and frustration questions are allocated by the charter contract, so the commercial terms — not only the rate — carry congestion risk (Cha 2021; Lee 2021; Alsharqawi 2026). Operational-risk assessment for ship operators provides a structured way to fold these into commercial decisions (Ding 2024).

Taken together, these levers act on the same variable the congestion shock does: the effective supply of the manager's own tonnage and its exposure to the market rate, which is why the mechanism in Figure 1 doubles as a decision map.

8. Research gaps

Three gaps stand out from this synthesis. First, the most direct empirical evidence on congestion-to-rate pass-through is for the **container market** (Michail 2025; Michail 2023); the analogous dry bulk quantification, and specifically a Supramax-segment estimate of the elasticity of the TC rate to anchorage-waiting and re-routing sea-days, is largely absent. The just-in-time-arrival literature measures the waiting times (Senss 2023) but does not connect them to a segment-level rate response. Second, the empirical freight-rate and volatility literature is **skewed toward the Capesize and Panamax segments** (Mi 2025; Zou 2025), leaving the Supramax/Ultramax segment (despite its distinctive geared, minor-bulk, multi-chokepoint exposure) comparatively under-studied. Third, the disruption case studies are strong on **legal, security, and macro dimensions** (Cha 2021; Rodriguez-Diaz 2024; Sun 2026), but they rarely close the loop to a segment-level freight-rate impact with an identified causal design. A natural agenda follows: AIS-derived measures of Supramax anchorage time and voyage-distance changes, matched to Baltic Supramax TC assessments, would let the transmission channels of Section 5 be estimated directly rather than inferred by analogy.

9. Conclusion

For the commercial manager, canal and strait congestion is not primarily a geopolitical or logistical phenomenon but a repricing of vessel time. The mechanism is supply-side: congestion lengthens voyages and immobilises tonnage, both of which withdraw effective ton-mile capacity from a market whose rate is set by the balance of that capacity against demand, and where the short-run supply curve is steep enough that a modest withdrawal produces a large rate move. The Supramax segment is distinctively exposed: geared and regional, tied to the minor-bulk and secondary-port trades where congestion accumulates, and substitutable with its Panamax and Handysize neighbours across which shocks redistribute. The response appears first in spot/TCE earnings and then in the period TC rate and FFA curve, with the *duration* of the constraint determining how far up that chain it travels. Each transmission channel maps onto a lever the manager controls (duration read, contract-type choice, speed and routing, positioning, derivative hedging, and contractual risk pricing), so the same diagram that explains the shock also organises the response. The main gap the literature leaves open is a direct, segment-level estimate of the Supramax TC rate's sensitivity to measured congestion, which the growing availability of AIS-based waiting-time and voyage-distance data now makes feasible.

Funding

This research received no external funding.

Data availability

This is a review of published literature; no new datasets were generated. The bibliographic records underlying the synthesis were retrieved from the OpenAlex scholarly database and verified against Crossref. Every reference carries a resolvable DOI, listed in full below.

Conflicts of interest

The author declares no conflict of interest.

References

Every DOI listed below was confirmed to resolve, and none is recorded as retracted. References are listed alphabetically by first author.

- Adland, Ameln, Børnes (2019). *Hedging ship price risk using freight derivatives in the drybulk market*. Journal of Shipping and Trade. https://doi.org/10.1186/s41072-019-0056-3
- Alekseievska, Yakubovskiy, Pichuhina (2025). *The rising cost of maritime transport as a driver of global inflationary processes*. Galician economic journal. https://doi.org/10.33108/galicianvisnyk_tntu2025.03.016
- Alsharqawi, Althabhawi, Ahamat et al. (2026). *Red Sea Crisis And The Problem OF Frustrated Contracts*. Malaysian Journal of Syariah and Law. https://doi.org/10.33102/mjsl.vol14no1.1008
- Apostolou, Lagoudis, Theotokas (2023). *Capesize time charter equivalent optimization based on speed and environmental regulations*. Maritime Business Review. https://doi.org/10.1108/mabr-05-2023-0037
- Bernacki (2021). *Assessing the Link between Vessel Size and Maritime Supply Chain Sustainable Performance*. Energies. https://doi.org/10.3390/en14112979
- Bilican, Iris, Karatas (2024). *A collaborative decision support framework for sustainable cargo composition in container shipping services*. Annals of Operations Research. https://doi.org/10.1007/s10479-024-05827-7

- Bolat (2025). *Modeling the Impact of Houthi Attacks on Red Sea Trade Routes with the GEO-SHIP Framework*. Transactions on Maritime Science. https://doi.org/10.7225/toms.v14.n03.004
- Cha, Lee, Lee et al. (2021). *Legal Disputes under Time Charter in Connection with the Stranding of the MV Ever Given*. Sustainability. https://doi.org/10.3390/su131910559
- Chorev (2023). *The Suez Canal: Forthcoming Strategic and Geopolitical Challenges*. Palgrave Studies in Maritime Politics and Security. https://doi.org/10.1007/978-3-031-15670-0_1
- Cremaschini, Monaco, Ilardi (2022). *Analysis of the effects of the Suez blockade on global containership traffic using AIS data and spatio-temporal data cube*. Abstracts of the ICA. https://doi.org/10.5194/ica-abs-5-46-2022
- Ding, J.-F., Chou, C.-C., et al. (2024). *An evaluation of operational risks for general cargo ship operators*. Brodogradnja. https://doi.org/10.21278/brod75101
- Drobetz, Gavriilidis, Krokida et al. (2020). *The effects of geopolitical risk and economic policy uncertainty on dry bulk shipping freight rates*. Applied Economics. https://doi.org/10.1080/00036846.2020.1857329
- Efes, Başer, Açık (2019). *Supply-Demand Interaction in the Formation of Freight Rates*. Pomorstvo. https://doi.org/10.31217/p.33.1.5
- Lynce de Faria, D. (2024). *The EU Emission Trading System Tax Regime and the Issue of Unfair Maritime Competition*. Sustainability. https://doi.org/10.3390/su16219474
- Georgoulas, Papadimitriou (2025). *Assessing the impact of China's trade policy uncertainty on the dry bulk shipping freight rates*. Pomorstvo. https://doi.org/10.31217/p.39.2.3
- Gerakoudi, Georgoulas, Stavroulakis (2026). *The impact of exchange traded funds in freight market volatility*. Journal of Shipping and Trade. https://doi.org/10.1186/s41072-026-00228-4
- Hayashi (2020). *Stationarity of spot freight rates considering supply/demand effect*. Journal of Shipping and Trade. https://doi.org/10.1186/s41072-020-00078-8
- Idris, Ramli (2018). *Southeast Asian Region Maritime Connectivity And The Potential Development Of The Northern Sea Route For Commercial Shipping*. Journal of Southeast Asian Studies. https://doi.org/10.22452/jati.vol23no2.2
- Kanamoto, Murong, Nakashima et al. (2020). *Can maritime big data be applied to shipping industry analysis? Focussing on commodities and vessel sizes of dry bulk carriers*. Maritime Economics & Logistics. https://doi.org/10.1057/s41278-020-00171-6
- Kavussanos, Moysiadou, Tsouknidis (2026). *Time segmentation in tanker freight markets: The role of risk and relative freight rates in switching decisions*. Energy Economics. https://doi.org/10.1016/j.eneco.2025.109110
- Key, Parrado, Delpiazzo et al. (2024). *Potential climate-induced impacts on trade: the case of agricultural commodities and maritime chokepoints*. Journal of Shipping and Trade. https://doi.org/10.1186/s41072-024-00170-3
- Khan, Su, Khurshid et al. (2022). *The dynamic interaction between COVID-19 and shipping freight rates: a quantile on quantile analysis*. European Transport Research Review. https://doi.org/10.1186/s12544-022-00566-x
- Ko, Chang (2024). *Analysis and forecasting of the dry bulk shipping market: structural VAR models using FFA-spot-time charter rates*. Maritime Policy & Management. https://doi.org/10.1080/03088839.2024.2348692

- Koskina, Y., Onyshenko, S., Drozhzhyn, O., et al. (2023). *Efficiency OF Tramp Fleet Operating Under The Contracts OF Affreightment*. Scientific Journal of Silesian University of Technology. Series Transport. https://doi.org/10.20858/sjsutst.2023.120.9
- Lee, Wong (2021). *Suez Canal blockage: an analysis of legal impact, risks and liabilities to the global supply chain*. MATEC Web of Conferences. https://doi.org/10.1051/matecconf/202133901019
- Li, Xia, Wang et al. (2026). *Geopolitical Risk and Shipping Supply Chain Resilience: Systemic Characteristics, Impact Mechanisms, and the Security of Logistics Nodes*. Systems. https://doi.org/10.3390/systems14040427
- Longarela-Ares, Calvo-Silvosa, Pérez-López (2020). *The Influence of Economic Barriers and Drivers on Energy Efficiency Investments in Maritime Shipping, from the Perspective of the Principal-Agent Problem*. Sustainability. https://doi.org/10.3390/su12197943
- Melas, Michail, Louca (2025). *Trade Uncertainty, Economic Policy Uncertainty and Shipping Costs*. German Economic Review. https://doi.org/10.1515/ger-2024-0025
- Meza, Ari, Sada et al. (2022). *Disruption of maritime trade chokepoints and the global LNG trade: An agent-based modeling approach*. Maritime Transport Research. https://doi.org/10.1016/j.martra.2022.100071
- Mi, Ahmed, Chen (2025). *Exploring volatility transmission in Capesize freight contracts: Insights from energy and commodity markets*. PLOS ONE. https://doi.org/10.1371/journal.pone.0317487
- Michail, Melas (2021). *Sentiment-Augmented Supply and Demand Equations for the Dry Bulk Shipping Market*. Economies. https://doi.org/10.3390/economies9040171
- Michail, Melas (2022). *Geopolitical Risk and the LNG-LPG Trade*. Peace Economics, Peace Science and Public Policy. https://doi.org/10.1515/peps-2022-0007
- Michail, Melas (2023). *Measuring the Impact of Port Congestion on Containership Freight Rates*. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.4318470
- Michail, Melas (2025). *Measuring the impact of port congestion on containership freight rates*. Maritime Transport Research. https://doi.org/10.1016/j.martra.2025.100130
- Nadkarni, S., et al. (2024). *Assessing the Implications of the Red Sea Conflict on the Indian Supply Chain: A Comprehensive Analysis*. International Journal For Multidisciplinary Research. https://doi.org/10.36948/ijfmr.2024.v06i03.17533
- Nze, Onyemechi (2018). *Port congestion determinants and impacts on logistics and supply chain network of five African ports*. Journal of Sustainable Development of Transport and Logistics. https://doi.org/10.14254/jsdtl.2018.3-1.7
- Onyshchenko, Koskina, Savelieva (2016). *Developing a logit model for the provision of the process of managing the conclusion of voyage chartering transactions*. Eastern-European Journal of Enterprise Technologies. https://doi.org/10.15587/1729-4061.2016.85233
- Onyshchenko, S., Onyshchenko, V., et al. (2022). *Dry Bulk Freight Market Research Basedon Correlationandregressionanalysis*. Development of Management and Entrepreneurship Methods on Transport (ONMU). https://doi.org/10.31375/2226-1915-2022-2-5-17
- Oral (2025). *Environmental impacts of the Houthis' attacks against commercial shipping in the Red Sea*. Frontiers in Political Science. https://doi.org/10.3389/fpos.2025.1711643
- Ormeci, O.Y., Ozkok, M., Erol, S., et al. (2026). *Analyzing the impact of Canal Istanbul on ship traffic dynamics in the Turkish straits: a maritime traffic flow simulation model*. Brodogradnja. https://doi.org/10.21278/brod77315

- Pahl (2024). *Just-in-Time Port Call Optimization: Challenges and IT-Systems*. Journal of Physics: Conference Series. https://doi.org/10.1088/1742-6596/2867/1/012009
- Pasha, Dulebenets, Kavoosi et al. (2020). *Holistic tactical-level planning in liner shipping: an exact optimization approach*. Journal of Shipping and Trade. https://doi.org/10.1186/s41072-020-00060-4
- Pepur, Peronja, Laća (2022). *Global market factors that impact Baltic Dry Index*. Pomorstvo. https://doi.org/10.31217/p.36.2.8
- Polemis, Bentsos (2025). *LNG vessels transits through Suez Canal under the changing geopolitical context*. Journal of Shipping and Trade. https://doi.org/10.1186/s41072-025-00205-3
- Pourkermani (2023). *Time Charter or Trip Charter? An Assessment of Market Efficiency in Shipping Market*. Transactions on Maritime Science. https://doi.org/10.7225/toms.v12.n01.010
- Pratson (2023). *Assessing impacts to maritime shipping from marine chokepoint closures*. Communications in Transportation Research. https://doi.org/10.1016/j.commtr.2022.100083
- Abdul Rahman, Mohd Salleh, Ahmad Najib et al. (2016). *A descriptive method for analysing the Kra Canal decision on maritime business patterns in Malaysia*. Journal of Shipping and Trade. https://doi.org/10.1186/s41072-016-0016-0
- Rodriguez-Diaz, Alcaide, Garcia-Llave (2024). *Challenges and Security Risks in the Red Sea: Impact of Houthi Attacks on Maritime Traffic*. Journal of Marine Science and Engineering. https://doi.org/10.3390/jmse12111900
- Sainz Caparroso, S. (2026). *Analysis of maritime geopolitics on early 2026: The Red Sea Factor*. Zenodo (CERN European Organization for Nuclear Research). https://doi.org/10.5281/zenodo.18457391
- Sartorius, Sartorius, Zuccollo (2018). *Does the Baltic Dry Index predict economic activity in South Africa? A review from 1985 to 2016*. South African Journal of Economic and Management Sciences. https://doi.org/10.4102/sajems.v21i1.1457
- Senss, Canbulat, Uzun et al. (2023). *Just in time vessel arrival system for dry bulk carriers*. Journal of Shipping and Trade. https://doi.org/10.1186/s41072-023-00141-0
- Shi, Jiao, Chen et al. (2023). *Construction of resilience mechanisms in response to container shipping market volatility during the pandemic period: From the perspective of market supervision*. Ocean & Coastal Management. https://doi.org/10.1016/j.ocecoaman.2023.106642
- Sultana, Cohen (2025). *China's Red Sea gambit: a paradigm shift of NSAGs and the Maritime strategic dilemma in the Middle East*. Cogent Arts & Humanities. https://doi.org/10.1080/23311983.2025.2495475
- Sun, Abouarghoub, Demir et al. (2026). *Geopolitical disruptions and maritime transitions: Environmental and economic costs of rerouting*. Transportation Research Part A: Policy and Practice. https://doi.org/10.1016/j.tra.2025.104737
- Tadini (2020). *A Geographical Overview of the Suez Canal Freight Flows: an Impact on the Mediterranean Sea and the Genoa port*. Bollettino della Società Geografica Italiana. https://doi.org/10.13128/bsgi.v2i1.220
- Verschuur, Lumma, Hall (2025). *Systemic impacts of disruptions at maritime chokepoints*. Nature Communications. https://doi.org/10.1038/s41467-025-65403-w

- Vyshnevska, Vishnevsky (2017). *Investigation of the effect of ship size and marine transportation distance on the possible decrease of voyage efficiency*. Technology audit and production reserves. https://doi.org/10.15587/2312-8372.2017.92965
- Wang, Du, Peng (2023). *Assessing the Importance of the Marine Chokepoint: Evidence from Tracking the Global Marine Traffic*. Sustainability. https://doi.org/10.3390/su16010384
- Yang, Xie, Xie et al. (2025). *Navigational Risk Evaluation of One-Way Channels: Modeling and Application to the Suez Canal*. Journal of Marine Science and Engineering. https://doi.org/10.3390/jmse13101864
- Yin, Luo, Fan (2016). *Dynamics and interactions between spot and forward freights in the dry bulk shipping market*. Maritime Policy & Management. https://doi.org/10.1080/03088839.2016.1253884
- Zhang, Tao, Wan et al. (2024). *Resilience analysis of maritime transportation networks: a systematic review*. Transportation Safety and Environment. https://doi.org/10.1093/tse/tdae009
- Zou, Z., Xu, M., Chen, J. (2025). *Volatility, correlation and risk spillover effect between freight rates in BCI and BPI markets: Evidence from static and dynamic GARCH-Copula and dynamic CoVaR models*. PLOS ONE. https://doi.org/10.1371/journal.pone.0315167
- Çağlayan, Aymelek (2024). *An Integrated Multi-Criteria Decision Support Model for Sustainable Ship Queuing Policy Application via Vessel Traffic Service (VTS)*. Sustainability. https://doi.org/10.3390/su16114615
- Župac (2024). *The Red Sea crisis: Geopolitical background and impact on the global economy*. Zbornik radova – VI Kongres geografa Srbije sa medunarodnim ucešcem - zbornik radova. https://doi.org/10.5937/kongef24105z