Assessing the Economic Impact of Forced Shipping Market Fragmentation: A Two-Market Equilibrium Analysis of Panamax Bulk Carriers

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Abstract
Proposals in the United States to intervene in shipping—especially to reduce reliance on Chinese maritime capabilities—have drawn attention to the possibility of forcibly splitting the global shipping market into distinct blocs. This study evaluates the potential economic ramifications of such fragmentation by applying a two-market partial equilibrium model to Panamax bulk carriers. Under the proposed scenario, vessels operating in a "China Block" (China, Russia, Iran) are barred from serving a "Western Block" (United States, Canada, Australia, Japan, EU), and vice versa. Using monthly ton-days data from January 2023 to December 2024, the model calculates separate charter rates for each block while allowing a portion of "ROW" cargo to flow between them. Although the results show that the average charter rate under forced market splitting remains close to a single global-market benchmark (-0.2%), monthly volatility increases significantly—particularly in the China Block (2,681 USD/day vs. 2,150 USD/day in the unified market). This elevated short-term risk poses challenges for shipping operators and may lead to higher financing costs. Moreover, external factors such as weather conditions and port congestion could amplify this volatility beyond our estimates. Policymakers should consider these quantified disadvantages when determining the extent of maritime decoupling measures.

Keywords
Economic Security, Maritime Policy, Supply Chain, Geopolitics, Market Fragmentation

Introduction

Debates on maritime policy have intensified in the United States, propelled by growing concerns over economic security vis-à-vis China. Advocates for greater intervention in shipping, which once seemed peripheral, have gained momentum over the past few years. This shift stems partially from long-standing propositions, such as O'Dea (2019), who argued that American strategic interests require reinforcing domestic shipbuilding and merchant marine sectors. More recently, these ideas have begun to shape actual legislative initiatives. One example is the draft "Shipbuilding and Harbor Infrastructure for Prosperity and Security (SHIPS) for America Act" (December 2024), which proposes increased investment in U.S. shipping and shipbuilding while mandating that:

- Government-sponsored cargoes be carried by U.S.-flagged vessels,
- A portion of certain commercial goods imported from China be carried on U.S.-flagged vessels starting from 2029.

Such proposals reflect concerns over China's dominance in maritime manufacturing (particularly shipbuilding) and the appeal of creating high-quality shipyard jobs in the United States. National subsidies to maintain a "minimum" maritime capability are not new; various countries have used them to sustain strategic or otherwise essential fleets. Yet the recent U.S. proposals point to a more extreme approach—potentially segmenting or "decoupling" from global shipping. Because modern international shipping functions largely as a single, integrated market, forcibly carving out a separate U.S.-centric or "China-free" segment could produce adverse economic effects.

Splitting a unified market can reduce economies of scale, hamper fleet allocation, and raise charter rates. Such fragmentation extends beyond price differentials and could undermine multinational cooperation on critical maritime issues, including safety, crew standards, and climate change mitigation.

Our study focuses on charter rates and aims to quantify the extent to which forced market fragmentation may undermine economic efficiency, using a two-market equilibrium framework. By illustrating a clear, data-driven method for analyzing fragmentation's effects on charter rates (and their volatility), we provide policymakers and industry stakeholders with insights into the potential trade-offs. Specifically, we propose a simplified but robust approach to:

1. Model two separate shipping blocks without inter-block vessel mobility,
2. Incorporate a portion of "arbitrage cargo" that can be carried by either block,
3. Estimate equilibrium charter rates under such a regulatory split, and
4. Compare these rates to a unified (pre-split) scenario to gauge the magnitude of additional costs and volatility.

This study focuses on Panamax bulk carriers due to relatively simple business structure, straightforward data availability and the significant involvement of both U.S. and Chinese shipping interests in this sector. However, the underlying framework can, in principle, be extended to more complex segments (e.g., container shipping).

Methodology

Our theoretical setup envisions two separate fleet segments:

- China Block Fleet – Serving countries grouped under "China, Russia, Iran," collectively referred to here as the "China Block."
- Western Block Fleet – Serving "United States, Canada, Australia, Japan, EU," collectively the "Western Block."

It should be noted that our classification of the China Block and Western Block represents an intentionally extreme scenario designed to minimize arbitrage opportunities and yield clear analytical results, rather than being based on any specific literature or regulatory proposals.

A proposed regulation states that "vessels calling at the China Block may not call at the Western Block, and vice versa." If enacted, this rule would effectively split the global shipping capacity into two disjoint fleets. Cargo flows would similarly divide into three blocks: China Block, Western Block, and the remainder of the world (ROW), which can be freely traded by both fleets.

1. China-Block Cargo: Cargo shipments originating from or destined to the China Block.
2. Western-Block Cargo: Cargo shipments originating from or destined to the Western Block.
3. ROW Cargo: Cargo shipments originating from and destined to ROW (neither the China Block nor the Western Block).

Recent analyses of shipping cargo flows have increasingly relied on AIS (Automatic Identification System) data. AIS data enables precise vessel size classification, which is often difficult to determine from customs data alone, and captures voyage-specific factors beyond mere loading volumes. For this study, we obtained ton-days data, which is a metric that has gained prominence among industry analysts over traditional ton-miles since the adoption of slow steaming practices, from S&P Connect (S&P Global, 2024). Our analysis covers the 24-month period from January 2023, a period chosen to coincide with the availability of reliable cargo movement data integrated with AIS.

This dataset represents actual historical cargo movements. To utilize this historical data in our analysis of market fragmentation, we make the following assumption: While "China Block <=> Western Block" cargo flows exist in the historical data, we assume these volumes remain constant after market fragmentation but are redirected to trade with ROW countries. Consequently, the total volumes of China-Block Cargo and Western-Block Cargo remain unchanged from historical figures,

while the volume of ROW Cargo is calculated by subtracting the China Block <=> Western Block trade volumes from the historical ROW cargo volumes.

We obtain Panamax vessel supply data (capacity in DWT) from Clarksons Shipping Intelligence database (Clarkson Research, 2024). For simplicity:

- We fix the total Panamax capacity (denoted $\boldsymbol{S}$) at its January 2023 level.
- We divide this capacity into two fleets:$\boldsymbol{S}_1$ (China-Block Fleet) and $\boldsymbol{S_2}$ (Western-Block Fleet), with $\boldsymbol{S_1} + \boldsymbol{S_2} = \boldsymbol{S}$.
- Once assigned, no changes occur over the 24-month horizon—no newbuild deliveries, no scrapping, and no reflagging between blocks.

Our study builds on the classical understanding of short-term shipping market dynamics in maritime economics explained in a standard textbook such as Stopford (2009): demand remains relatively constant regardless of price fluctuations, while rates increase exponentially as available supply decreases. Under this assumption, and after controlling for other volatility factors, the charter rate function takes the following form:

$$\text{Charter rate(F)} = \alpha \times \ln\left(\frac{Q}{S_f}\right) + \beta$$

where:

- $\boldsymbol{F}$ = Theoretical charter rate equivalent to Baltic Panamax 5 TC Average rate (USD/Day).
- $\boldsymbol{Q}$ = cargo moved by that fleet segment (in a given month),
- $\boldsymbol{S_f}$= effective fleet capacity (either $\boldsymbol{S}$, $\boldsymbol{S_1}$ or $\boldsymbol{S_2}$),
- α ,β = parameters derived through regression analysis using cargo volumes and fleet capacity data from the pre-split global Panamax market; these parameters are applied uniformly across both China-Block and Western-Block markets.

Under the unified scenario (pre-split), the total demand $\boldsymbol{Q}_{\text{global}}$ is allocated against total capacity $\boldsymbol{S}$, yielding a baseline (theoretical) charter rate $\boldsymbol{F}_0$. In the split scenario, we have two sub-markets:

- China-Block Market: handles “China-Block Cargo” plus a portion of the “ROW Cargo”.
- Western-Block Market: handles “Western-Block Cargo” plus the remaining portion of the “ROW Cargo.”

If the “ROW Cargo” is large enough, these two markets can, in principle, converge on the same charter rate via arbitrage. However, if either block’s ratio $\frac{S_1}{S}$ or $\frac{S_2}{S}$ is less than the corresponding cargo ratio, full arbitrage fails, and one block may see elevated charter rates relative to the other.

The model opts for a "Cost Impact" measure rather than traditional deadweight loss analysis. While deadweight loss is commonly used to measure market inefficiencies in cases where quantities can adjust (Just and Hueth, 1979), such analysis becomes inappropriate when both supply and demand are fixed in the short run, as is the case in shipping markets. Instead, we employ the Cost Impact measure, which captures the weighted deviation of charter rates in segmented markets from the unified market baseline - a more intuitive metric for industry practitioners while maintaining theoretical consistency with short-run shipping market dynamics.

We define Cost Impact as:

$$\text{Cost Impact} = |F_1 - F_0| \times \left(\frac{S_1}{S}\right) + |F_2 - F_0| \times \left(\frac{S_2}{S}\right)$$

- $\boldsymbol{F}_1$ = theoretical charter rate in the China-Block market,
- $\boldsymbol{F}_2$ = theoretical charter rate in the Western-Block market,
- $\boldsymbol{F}_0$ = theoretical charter rate under a single, global Panamax market,
- $\frac{S_1}{S}$ and $\frac{S_2}{S}$ = the capacity shares allocated to each block.

By summing these differences, weighted by each block’s share, we capture how far each sub-market’s charter rate deviates from the unified baseline. We then optimize ($\boldsymbol{S}_1$, $\boldsymbol{S}_2$) to minimize this

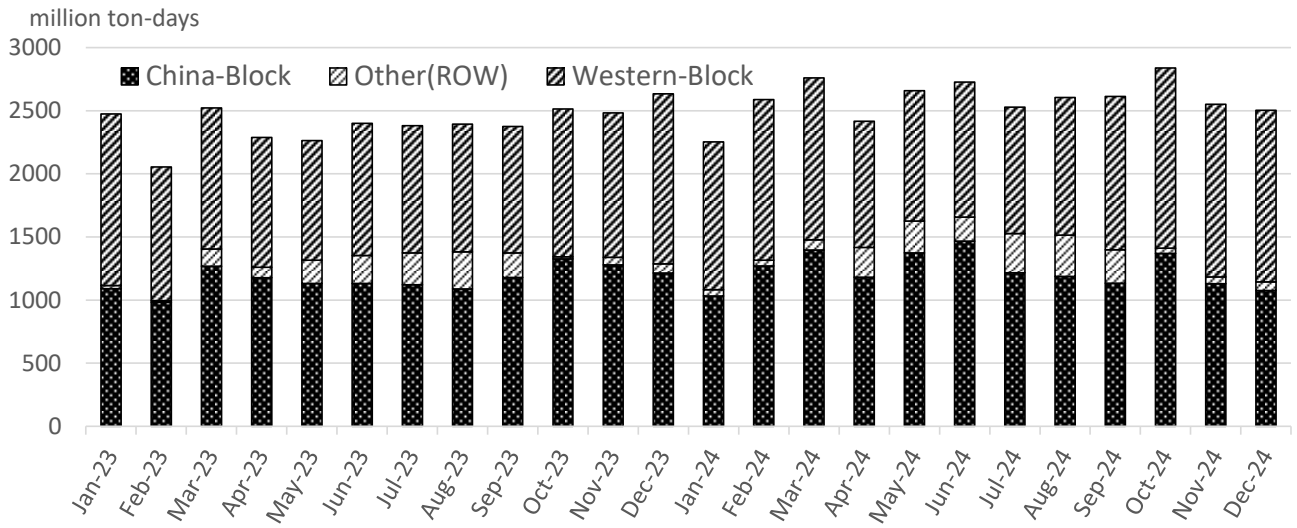
total Cost Impact, using a non-linear solver (GRG method), subject to the constraint $\boldsymbol{S}_1 + \boldsymbol{S}_2 = \boldsymbol{S}$. This optimization finds the "best possible" fleet allocation if a forced split is mandated.

Results

Based on data from S&P Connect, Panamax cargo volumes (ton-days) from January 2023 to December 2024 are as Figure 1.

Figure 1

Volume of Panamax Cargoes for each Block



- China-Block Cargo and Western-Block Cargo account for an average 48.3% and 45.6% of total Panamax demand, respectively, over the 24-month horizon.
- The remainder (6.1%) is "ROW Cargo" that can be carried by either block.

Also, the total Panamax fleet capacity $\boldsymbol{S}$ at its January 2023 was 241.28 million DWT.

Using the methodology described above, we derived the parameters α and β from these data points. The estimation yielded $\alpha = 6.447 \times 10^{-6}$ and $\beta = 6.893$.

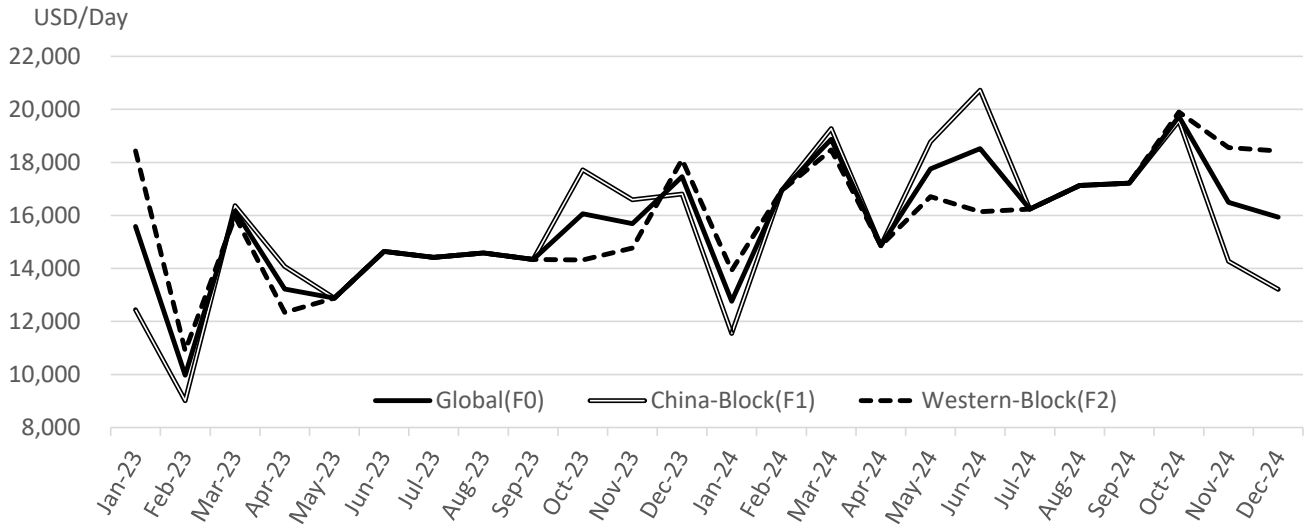
By applying a GRG-based non-linear optimization to minimize the Cost Impact measure, we find that the optimal assignment across all 24 months is approximately 50% of capacity to the China-Block fleet and 50% to the Western-Block fleet—close to the average cargo shares. Specifically:

- China-Block Fleet ($\boldsymbol{S}_1$): 50.0% of total Panamax fleet capacity,
- Western-Block Fleet ($\boldsymbol{S}_2$): 50.0%.

Based on the above capacity assignments, theoretical charter rates for each market are derived as Figure 2.

Figure 2

Theoretical Charter Rates for Each Market (F_0, F_1, F_2)



- Arbitrage: In 10 out of 24 months, the ROW cargo was sufficiently large to unify charter rates ($\boldsymbol{F}_1 = \boldsymbol{F}_2$).
- Western-Block "win" months: 7 out of 24 months had distinctly higher charter rates in the Western-Block market, meaning capacity constraints were tighter there, pushing up $\boldsymbol{F}_2$.
- China-Block "win" months: 7 out of 24 months had higher rates in the China-Block market, indicating that segment's capacity was more strained.

Despite the monthly divergences, the 24-month average charter rate in the forced-split scenario remains very close to the hypothetical unified market:

- Unified (Global) Market Average: 15,727 USD/day
- Weighted Average (Split): 15,703 USD/day (a -0.2% difference from the global baseline)

However, when viewed per sub-market:

- China-Block Average: 15,566 USD/day (a -1.0% difference from the global baseline)
- Western-Block Average: 15,842 USD/day (a +0.7% difference from the global baseline)

This indicates that while the combined (weighted) outcome is near the global baseline, each segment can deviate substantially in certain months, thereby creating episodes of "winners" and "losers." Moreover, the standard deviation in charter rates over 24 months was:

- Global (Hypothetical): 2,150 USD/day
- China-Block: 2,681 USD/day
- Western-Block: 2,198 USD/day

In particular, the China-Block charter rate displayed a higher volatility and deviation from the Global (2,681 USD/day vs. 2,150 USD/day). This pattern suggests that forced fragmentation, even if it does not profoundly alter the average charter rate across two years, increases monthly fluctuations in at least one segment.

In practice, market volatility under forced fragmentation is likely to exceed our model's predictions. Charter rates are influenced not only by the supply-demand dynamics captured in our model but also by short-term disruptions such as adverse weather conditions and port congestion. These temporary disturbances tend to affect one block disproportionately, and market fragmentation would reduce the system's ability to absorb such localized shocks, potentially amplifying rate volatility beyond our estimates.

Conclusion

Our two-market equilibrium study reveals that compulsory segmentation of the global maritime market—here modeled by restricting vessels in the "China Block" from serving the "Western Block"—can preserve average charter rates at a level roughly aligned with a hypothetical unified scenario. Nevertheless, the variance or volatility in monthly rates tends to increase, particularly for the block that occasionally faces tighter capacity relative to its cargo demands.

Generally, higher volatility necessitates higher risk premiums. While our model maintains constant fleet capacity throughout the period, in practice, forced market fragmentation would likely lead to reduced vessel investment until charter rates rise to levels that compensate for the increased risk premium. This adjustment process represents a disadvantage not only for cargo owners but for society as a whole. Thus, while national security or job-creation rationales might justify certain degrees of maritime intervention, the extent of these intervention should be determined based on the quantified disadvantages identified in this study. Additionally, mitigation measures—such as limiting the scope of fragmented cargoes to specific sectors (e.g., grains for Panamax vessels) or relaxing restrictions on inter-block vessel mobility under certain conditions—could be addressed by extending the methodology presented in this study.

As for future research, we plan to extend this framework to container shipping, which entails more elaborate cost functions, route structures, and potential for multi-leg voyages. Container lines are also the focal point of current U.S. policy concerns over supply chain resilience. Incorporating these complexities will help refine estimates of fragmentation-induced inefficiencies and guide policy debates regarding how far maritime "decoupling" efforts should go without incurring unacceptable economic downside.

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