

# Capital Market Fragmentation In Ship Finance: Structural Barriers, Stakeholder Costs, And Maritime Asset Tokenization As A Market Mechanism

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## ABSTRACT

Ship finance has undergone structural contraction over the past twelve years. The aggregate lending portfolio of the top 40 global shipping banks fell from \$454.9 billion at end-2011 to \$284.3 billion by end-2023, a reduction of 37.5%, while the global fleet continued to expand.<sup>1</sup> The capital withdrawn by European banking institutions has been partially replaced by Chinese state-backed leasing companies, introducing geopolitical concentration risk into a sector that carries approximately 80% of world trade by volume. This paper examines three dimensions of the resulting fragmentation: the effect on independent shipowners' access to fleet renewal capital; the structural exclusion of operationally expert maritime professionals from vessel-level economic participation; and the constrained capacity of the industry to finance the green transition that IMO's revised 2023 decarbonization strategy demands, with cumulative investment estimated at \$1.2 to \$1.6 trillion between 2030 and 2050.<sup>11,14</sup> The paper assesses existing market responses including maritime investment funds and shipping bonds, identifies their structural limitations, and examines maritime asset tokenization — the issuance of digital instruments representing defined economic rights in vessel-owning Special Purpose Vehicles — as a structural market mechanism. The Regulatory framework in Dubai is referenced as a case study of emerging regulatory architecture for this approach.

**Keywords:** Ship Finance, Maritime Capital Markets, Maritime Asset Tokenization, SPV Structures, IMO Decarbonization, Seafarer Workforce.

## INTRODUCTION

The global shipping industry carries approximately 80% of world trade by volume. The financial infrastructure that supports it has contracted significantly since the 2008 financial crisis and the shipping downturn of 2015-2016. Banks that historically anchored ship finance have exited the sector in substantial numbers. The institutions that have partially replaced them operate under different incentive structures and national ownership frameworks, a transition that Petrofin Research has tracked across sixteen consecutive annual surveys.<sup>1,2</sup>

These shifts have measurable consequences for three stakeholder groups. Independent shipowners without tier-one credit standing find fleet renewal capital difficult to access at competitive terms. Maritime professionals, whose operational expertise underpins vessel performance, hold no standardised vessel-level economic stake in the assets they operate. And the

capital required to fund the fleet renewal demanded by IMO's revised greenhouse gas strategy exceeds what the current bank-leasing structure delivers at the necessary pace.<sup>9,11,14</sup>

This paper employs a secondary data analysis methodology, drawing on published annual surveys from Petrofin Research, workforce reports from BIMCO and the International Chamber of Shipping, investment estimates from the Global Maritime Forum and University Maritime Advisory Services, and publicly available transaction data from maritime trade publications. Practitioner perspective informs the analysis throughout, drawing on the author's decades at sea across multiple commercial vessel categories.

The paper is organised into five analytical sections followed by policy recommendations and a conclusion. Section 1 establishes the empirical case for capital market fragmentation. Section 2 identifies

**Relevant conflicts of interest/financial disclosures:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

the stakeholder populations bearing its costs. Section 3 assesses existing market responses and their limitations. Section 4 examines maritime asset tokenization, defining the concept, explaining the mechanism, and evaluating it against the documented failures. Section 5 draws policy implications.

## 1. THE SHIP FINANCE GAP: STRUCTURAL CONTRACTION AND ITS CAUSES

### 1.1 The Scale Of Bank Retreat

The Petrofin Global Index for Ship Finance, which commenced at a base of 100 in 2008, stood at approximately 63 by end-2023.<sup>1</sup> In absolute terms, the lending portfolio of the top 40 global shipping banks fell from \$454.9 billion at end-2011 to \$284.3 billion by end-2023: a contraction of \$170 billion, or 37.5%, over twelve years.<sup>1,2</sup> This occurred while the global merchant fleet expanded, producing a lower average bank finance per vessel and increasing reliance on equity, leasing, and alternative providers for new vessel financing.

The bank exits that drove this contraction were not gradual. DVB Bank, which had been among the most

prominent specialist transport finance lenders before a sustained period of shipping losses, was ranked 11th globally by Petrofin's 2018 league table with a portfolio of approximately \$7.5 billion when its parent, DZ Bank, announced wind-down. DVB had ceased all new lending to shipowners by December 2019, with its shipping locations closing through 2020.<sup>2,3</sup> DZ Bank had sought a buyer for DVB since mid-2017 without success. Nord/LB, the German state bank whose shipping book reached EUR 19 billion at its peak, exited the sector after reporting a net loss of EUR 2.35 billion in 2018 attributable primarily to non-performing shipping loans, reducing its exposure to EUR 7.5 billion by end-2018 before full withdrawal.<sup>4</sup> HSH Nordbank had already been restructured and sold. Commerzbank reduced its shipping exposure to near zero. HSBC withdrew from its Greek ship finance presence by end-2022.<sup>5</sup>

By end-2022, European banks' share of global ship finance fell below 50% for the first time since Petrofin began tracking the sector.<sup>5</sup> Scandinavian bank portfolios fell to \$27.8 billion by 2022. German bank contraction has been near-total among the historically dominant players.<sup>5</sup>

Year	Top-40 Portfolio (\$bn)	Petrofin Index (Base: 100, 2008)	European Share (%)
2011	454.9	~100	~70
2016	355.3	~78	~65
2019	294.4	64	~60
2020	286.9	62	58.3
2022	282.9	63	49.5
2023	284.3	~63	~48

**Table 1: Petrofin Global Ship Finance Index And Top-40 Portfolio, 2011-2023**

[Source: Petrofin Research Global Ship Finance Surveys, 2016-2024']

### 1.2 The Chinese Leasing Substitution

Chinese state-backed leasing companies provided capital liquidity during a period of acute European bank withdrawal, filling a gap that would otherwise have left independent shipowners with severely constrained refinancing options. Chinese leasing

exposure to shipping grew from \$59.2 billion in 2019 to \$66.5 billion in 2020, a 12.3% increase in the same year that European portfolios contracted.<sup>6</sup> By mid-2025, Chinese lessors operated a fleet accounting for 9.3% of the global merchant fleet by deadweight tonnage, with an order book representing a further 9.42% expansion.<sup>7</sup>

However, the structural consequence of this substitution warrants scrutiny. The principal institutions (ICBC Financial Leasing, CMB Financial Leasing, and CSSC (Hong Kong) Shipping) operate with different incentive structures from traditional shipping banks. Financing is typically structured as financial lease under sale-and-leaseback arrangements. Chinese lessors have extended leverage ratios as high as 90% loan-to-value, though published transaction data indicates these terms have

been reserved for tier-one counterparties such as major international liner operators.<sup>8</sup> Vessels are constructed predominantly at Chinese shipyards, creating an integrated supply chain linking shipbuilding orders, state-directed financing, and leasing activity. The effect is capital market concentration in a single national ownership and financing ecosystem for an industry that serves global trade.

Year	Chinese Leasing Shipping Exposure (\$bn)	Year-on-Year Change
2019	59.2	N/A
2020	66.5	+12.3%
Mid-2025	Fleet = 9.3% of global fleet (DWT)	Expanding

**Table 2: Chinese Leasing Exposure To Shipping, 2019-2025**

[Source: Petrofin Research, 2021<sup>6</sup>; Guolian Minsheng Securities, 2025<sup>7</sup>]

### 1.3 The Independent Shipowner Capital Squeeze

The structural consequence of this transition is most acute for independent shipowners who do not qualify as tier-one clients for Chinese leasing institutions. The equity participation threshold in traditional ship finance structures, typically \$5 million to \$25 million for a meaningful stake in a single vessel Special Purpose Vehicle, remains the primary barrier to fleet expansion and renewal for mid-size and smaller operators. Alternative capital structures such as shipping bonds and closed-end maritime funds are, as examined in Section 3, largely inaccessible below institutional size. The result is a bifurcated capital market: institutional-grade borrowers with structured access to Chinese leasing, and the broader population of independent owners managing aging fleets without adequate refinancing options.

## 2. WHO BEARS THE COST: A STAKEHOLDER ANALYSIS

### 2.1 The Seafarer Principal-Agent Problem

At any given time, 1.89 million seafarers serve the world merchant fleet across more than 74,000 vessels.<sup>9</sup> They hold statutory command authority under international maritime conventions, bear direct operational risk, and possess domain expertise in asset

condition, maintenance scheduling, and charter performance management that shore-based financiers do not replicate.

They hold no standardised vessel-level economic stake in the assets they operate. Where profit-sharing or employer equity schemes exist at some shipping companies, they are not standard across the industry and are not directly linked to the performance of the specific vessels under a seafarer's command.

A Master Mariner commanding a standard Capesize bulk carrier is responsible for an asset with secondhand values that broker data shows moved from approximately \$19-20 million for a 10-year-old unit at the 2016 market trough to approximately \$27 million by mid-2021 and higher still at the freight rate peak later that year.<sup>13</sup> Charter income, net of vessel operating expenses, maintenance reserves, and management fees, flows to the owning SPV structure. The officer receives a fixed salary. Vessel appreciation does not translate to any form of economic participation for the professional most directly responsible for maintaining that asset's operational, safety, and class status.

In corporate finance terms, this is a principal-agent structure operating at scale across an entire industry:

the agent manages the asset and bears operational risk, while the principal captures the economic value.

BIMCO and ICS documented a shortfall of 26,240 STCW-certified officers in 2021, with an additional 89,510 officers projected to be needed by 2026 to operate the world merchant fleet.<sup>9,10</sup> While this workforce shortfall has multiple causes including training capacity constraints and pandemic-related disruption, one contributing factor that has received limited analytical attention is the structural absence of any standardised vessel-level wealth creation mechanism for maritime professionals. In comparable asset-intensive sectors, operators hold economic exposure to the assets they manage: airline professionals may hold employer equity, oil and gas workers participate in production-linked structures, and financial professionals benefit from carried interest arrangements. No equivalent mechanism exists in maritime as a standard career feature. Whether this absence contributes to declining career attractiveness is a question that workforce analytics have not specifically isolated, but the structural gap is observable.

## 2.2 The Green Transition Financing Gap

IMO's revised GHG strategy, adopted in 2023, targets net-zero emissions from international shipping by or around 2050.<sup>14</sup> The Global Maritime Forum, working with the University Maritime Advisory Services and the Energy Transitions Commission, estimated the cumulative capital investment required at \$1.2 to \$1.6 trillion between 2030 and 2050, translating to \$40-60 billion per year for twenty years.<sup>11</sup>

Current global bank lending to shipping stands at approximately \$284 billion across the top 40 institutions and has been contracting in real terms relative to the fleet it supports.<sup>1</sup> Chinese leasing companies are expanding their fleet exposure, but their financing is structurally oriented toward Chinese-built vessels rather than toward the mobilisation of diversified global capital for independent fleet renewal across vessel types and geographies. The gap between what ship finance currently delivers and what decarbonisation requires is a capital allocation problem that a single instrument class or a single national financing ecosystem cannot close.

Metric	Figure	Source
Top-40 bank shipping portfolio, end-2023	\$284.3bn	Petrofin Research, 2024
Peak top-40 bank portfolio, end-2011	\$454.9bn	Petrofin Research
Portfolio decline, 2011-2023	-37.5%	Petrofin Research
Chinese leasing fleet share of global fleet (DWT), mid-2025	9.3%	Guolian Minsheng Securities, 2025
Total seafarers serving world merchant fleet	1.89 million	BIMCO/ICS, 2021
STCW officer shortfall, 2021	26,240	BIMCO/ICS, 2021
Additional officers required by 2026	89,510	BIMCO/ICS, 2021
Cumulative green transition investment required (2030-2050)	\$1.2-1.6 trillion	Global Maritime Forum/UMAS/ETC, 2020
Annualised green transition investment needed	\$40-60 billion	Global Maritime Forum/UMAS/ETC, 2020

**Table 3: Key Reference Data: Ship Finance, Seafarer Workforce, And Green Transition**

[Source: *Petrofin Research 2024*<sup>1</sup>; *BIMCO/ICS 2021*<sup>9</sup>; *Global Maritime Forum/UMAS/ETC 2020*<sup>11</sup>; *Guolian Minsheng Securities 2025*<sup>7</sup>]

### 3. EXISTING SOLUTIONS: AN ASSESSMENT

Three categories of existing market response have attempted to address ship finance fragmentation. Each has delivered results within specific institutional parameters. None has materially addressed capital access for independent shipowners or for maritime professionals seeking vessel-level economic exposure.

#### 3.1 Maritime Investment Funds

Closed-end maritime investment funds have demonstrated that institutional capital can be mobilised into shipping equity. Tufton Oceanic's private equity vehicle, managed by Tufton Investment Management, held approximately \$1.3 billion in assets across 76 vessels as of mid-2018, primarily serving major European pension funds and institutional clients.<sup>12</sup> Taylor Maritime Investments, which listed on the London Stock Exchange in 2021 and completed the acquisition of Grindrod Shipping in 2024, represents a comparable model.

These vehicles carry structural limitations that constrain their relevance to the access problem documented in this paper. They are closed-end instruments whose secondary liquidity depends on exchange trading volumes that are thin relative to underlying asset values. The private equity vehicle model operates at minimum commitment sizes that reflect a pension fund and institutional investor client base. A fund management layer sits between capital and vessel economics, introducing fee drag, fund-level leverage risk, and reporting opacity above the underlying asset. The fund structure provides no mechanism for maritime professionals to participate on the basis of operational knowledge of specific vessels.

#### 3.2 Shipping Bonds

High-yield bond instruments issued by listed shipping companies address corporate borrowing at the balance sheet level. These instruments are debt, not equity, and they provide no revenue participation exposure to individual vessel performance. Capital market activity in shipping bonds grew substantially in 2020,

with new issues rising from \$6.87 billion in 2019 to \$24.79 billion, reflecting broad corporate refinancing conditions rather than any structural broadening of access to vessel-level economics.<sup>6</sup>

#### 3.3 Prior Digital Asset Experiments

Between 2017 and 2022, multiple platforms across Singapore, Malta, and several offshore jurisdictions attempted to enable participation in maritime vessel economics through digital token structures. The common failure modes were consistent: operation without a recognised regulatory licence, inadequate secondary liquidity mechanisms, token rights that did not correspond clearly to vessel-level economics, and in some cases structures that constituted unregistered securities offerings under applicable national law.

These were structural and regulatory failures, not definitional ones. The principle of using digital instruments to represent economic exposure to vessel SPVs is technically sound. Early failures reflected the absence of appropriate licensing frameworks rather than any fundamental deficiency in the underlying architecture. The development of recognised digital asset licensing regimes, including VARA in Dubai and MiCA in the European Union, provides the regulatory foundation that prior experiments lacked.

### 4. MARITIME ASSET TOKENIZATION AS A MARKET MECHANISM

#### 4.1 Defining Maritime Asset Tokenization

Maritime asset tokenization is the process of issuing digital instruments that represent defined economic rights in a vessel-owning Special Purpose Vehicle. The term requires precise definition because it is used inconsistently in industry discourse, often conflated with broader digital asset concepts that carry different legal and regulatory characteristics.

A Maritime Asset Token is not a title deed. It does not confer legal ownership of a vessel. The SPV retains legal title. What a token represents is a contractual economic entitlement: specifically, participation in charter revenue distributions declared by the SPV, in proportion to the token holder's holding, net of vessel operating expenses, maintenance reserves, and

management fees. This distinction between economic exposure and legal ownership is the structural foundation of the model and the basis on which it is regulated.

The mechanism operates across three distinct layers, each serving a specific function:

**The Asset Layer.** A commercial vessel is acquired by or contributed to a Special Purpose Vehicle, a purpose-specific legal entity that isolates the vessel's economics and liabilities from the broader balance sheet of any owning group. This structure is already standard in ship finance — vessel-owning SPVs are the norm across institutional maritime lending. The SPV holds the vessel, the vessel earns charter hire, and that hire flows into the SPV as revenue.

**The Rights Layer.** The SPV issues tokens representing defined economic entitlements to net revenue distributions. These instruments are governed by a legal framework specifying the rights of token holders, the obligations of the SPV, and the conditions under which distributions are declared and paid. The token is the instrument through which these rights are issued, transferred between holders, and tracked over the life of the SPV. This layer is analogous in function to a unit in a fund structure, but without the intervening fund management entity.

**The Settlement Layer.** On-chain infrastructure records token ownership, processes transfers, and executes revenue distributions programmatically when the SPV declares a payment. The settlement record is immutable, time-stamped, and auditable by all token holders simultaneously, without requiring a central fund administrator or trustee as intermediary. This is the layer that distinguishes the tokenization model from prior maritime investment structures: settlement is programmable, transparent, and does not depend on the operational reliability of a single reporting entity.

The combination of these three layers — SPV-level asset isolation, standardised economic rights instruments, and programmable settlement — is what makes maritime asset tokenization structurally distinct from the existing solutions assessed in Section 3. The asset layer is well-established. The rights and settlement layers are the structural innovation.

## 4.2 Structural Requirements For A Viable Mechanism

The failures documented in Sections 2 and 3 define what a viable capital access mechanism in ship finance needs to do. Any credible structure must lower the effective minimum participation threshold without reducing investor protection standards. It must provide transparent, verifiable asset-level reporting that closes the information asymmetry between vessel operators and capital providers. It must operate within a recognised regulatory framework that supports institutional engagement. It must enable programmable, auditable revenue distribution tied to vessel charter performance. And it must be structured in a way that allows maritime professionals to hold economic exposure to the vessel asset classes they know and operate.

## 4.3 How Tokenization Addresses Each Documented Failure

On participation threshold: token-based access structures enable participation at fractions of a full vessel equity position. This directly extends the pool of capital available to independent shipowner SPVs beyond the minimum ticket sizes that have historically excluded non-institutional participants from vessel-level economics.

On transparency: on-chain settlement creates an auditable, immutable record of revenue receipts and distributions. Token holders can verify distribution history against charter records without relying solely on fund manager reporting. This directly addresses the information asymmetry that has disadvantaged non-institutional participants in ship finance and that the principal-agent structure identified in Section 2.1 makes acute.

On regulatory framework: operating under a recognised digital asset licence provides the jurisdictional clarity that prior digital experiments lacked. This is the precondition for institutional engagement. Without it, a platform cannot attract institutional counterparty trust regardless of the quality of its underlying structure.

On revenue distribution: charter revenue distributions to token holders, where declared by the SPV and net of operating expenses, are executed programmatically

on-chain, reducing settlement counterparty risk and administrative overhead relative to fund distribution structures.

It is important to be precise about the scope of this mechanism. Maritime asset tokenization does not by itself resolve the \$1.2-1.6 trillion green transition financing gap documented in Section 2.2.<sup>11</sup> It is one component of capital market broadening, contributing to the diversification of funding sources that the transition requires alongside bank lending, bond markets, export finance, and institutional maritime funds. No single instrument class closes a gap of that magnitude.

#### **4.4 Regulatory Architecture: VARA As A Case Study**

The Virtual Assets Regulatory Authority in Dubai has developed a regulatory framework that accommodates digital asset platforms operating in this category. The VARA Approval process assesses a platform's legal structure, compliance architecture, AML/KYC controls, and operational infrastructure before a formal licence is issued.

Shipfinex, a maritime asset tokenisation platform incorporated as a Free Zone Company in Dubai, operates under VARA In-Principle Approval (IPA/26/01/002) and is additionally registered as a Virtual Asset Service Provider under Polish financial regulation. This dual regulatory positioning demonstrates that the maritime SPV plus on-chain settlement model can be structured within a recognised regulatory architecture, which was the specific structural failure of prior digital experiments in this space. The token instruments issued are designated Maritime Asset Tokens (MATs). MATs represent economic exposure to commercial vessel SPVs, not legal ownership of vessels. Charter revenue distributions, where declared by the SPV and net of vessel operating expenses, are passed through to MAT holders in proportion to their holdings.

#### **5. POLICY IMPLICATIONS AND RECOMMENDATIONS**

The capital market fragmentation documented in this paper has implications beyond individual market participants. The concentration of ship finance in Chinese state-backed leasing institutions represents a

structural risk to global trade infrastructure that private market actors alone cannot address. Policy frameworks that encourage diversified, internationally regulated capital market mechanisms for ship finance reduce single-source concentration risk and serve the interests of the broader industry simultaneously.

First, regulators in maritime finance jurisdictions should develop standardised frameworks that provide clear digital asset regulatory clarity while addressing cross-jurisdictional legal questions for asset-backed digital instruments. The VARA approach in Dubai and the MiCA framework in the European Union represent starting architectures. Cross-jurisdictional harmonisation would reduce the legal compliance cost that has historically limited institutional adoption of digital maritime instruments and would support platforms seeking multi-jurisdictional operation.

Second, maritime education and training institutions should incorporate commercial maritime finance as a core curriculum element. The principal-agent problem identified in Section 2.1 cannot be corrected by market mechanisms if maritime professionals lack the financial literacy to engage with structured instruments that could address it. IMO model course frameworks and national maritime academy curricula are the natural vehicles for this.

Third, the green transition financing requirement demands a portfolio approach across instrument types.<sup>11</sup> Policy frameworks should support bank lending, bond markets, maritime investment funds, and token-based SPV structures in parallel, with particular attention to the regulatory clarity required for digital settlement infrastructure to attract institutional participation at scale.

#### **CONCLUSION**

Ship finance has contracted by 37.5% in top-40 bank exposure since 2011, concentrating in Chinese state-backed leasing institutions and leaving independent shipowners, maritime professionals, and the green transition underserved by capital markets.<sup>1</sup> This paper has documented the scale of that contraction, identified the stakeholder populations bearing its costs, assessed the structural limitations of existing market responses, and examined maritime asset tokenization — the issuance of digital instruments

representing economic rights in vessel-owning SPVs — as a mechanism that addresses each documented gap.

The seafarer who commands a vessel worth tens of millions of dollars and the independent shipowner who manages a fleet without access to institutional capital markets are not peripheral to this industry. They are its operational backbone. Capital market infrastructure that connects their expertise and assets to a broader pool of capital serves both the industry and the global trade it supports.

Regulated, transparent, and programmatically settled maritime asset token structures represent one credible response to these structural failures. The VARA regulatory framework in Dubai provides an existing architecture for this approach. Further cross-jurisdictional development, regulatory harmonisation, and institutional engagement are required to realise its potential.

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**HOW TO CITE:** Vikas Pandey\*, Capital Market Fragmentation In Ship Finance: Structural Barriers, Stakeholder Costs, And Maritime Asset Tokenization As A Market Mechanism, *Int. J. Sci. R. Tech.*, 2026, 3 (6), 612-620. <https://doi.org/10.5281/zenodo.20594236>