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Lease-Insurance Synergy: An Empirical Study on Solving the Financing Dilemma of Distant Water Fisheries

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Abstract

The global distant water fishery industry has long been trapped in a tripartite financing predicament characterized by "difficult valuation, high operational risk, and mismatched cash flow cycles," with the penetration rate of traditional credit facilities remaining below 40%. To address this systemic challenge, this study constructs a three-dimensional coupling model of "leasing—insurance—industry," integrating insurance institutions into the entire chain of vessel valuation, risk hedging, and cash flow alignment. Leveraging panel data from 147 Chinese fishing vessels and 2.795 billion yuan in financing projects spanning 2019–2024, this research conducts the first empirical examination of the causal effects of the lease-insurance linkage mechanism on financing costs and operational performance. The findings demonstrate that this integrated mechanism reduces the comprehensive financing interest rate by 3.2 percentage points, elevates the rent fulfillment rate by 14.3 percentage points, and suppresses the project non-performing rate to below 0.5% (Sun, Y., & Ortiz, J., 2024), with insurance coverage emerging as the most critical driver of risk mitigation. Robustness is confirmed through difference-in-differences (DID) analysis and multiple complementary tests. Further simulation results indicate that applying this framework to the Alaskan fishing fleet in the United States could lower the average financing interest rate from 8.5% to 5.3% and boost the rent fulfillment rate to over 90%. This study proposes that Chinese and American regulatory authorities streamline cross-border filing procedures, establish interoperable data-sharing interfaces, and incorporate fishery leasing into green finance subsidy schemes to facilitate the internationalization of the model. By filling the micro-evidence gap in the coupling of financial instruments for high-risk industries, this paper provides a replicable and scalable financing paradigm for the global distant water fishery sector.

Keywords: lease-insurance linkage, distant water fisheries, financing costs, risk mitigation, international adaptation, three-dimensional coupling model, seasonal cash flow, vessel valuation, green finance, cross-border data sharing

1. Introduction

1.1 Research Background: The Financing Dilemma of Global Distant Water Fisheries

The FAO's "2024 World Fisheries Report" highlights that the annual financing demand of the global distant water fishery industry has

exceeded 80 billion U.S. dollars, yet the sector continues to grapple with a severe "funding valley"—the penetration rate of formal financial services from banks and leasing companies stands at a mere 38.2%, forcing over 60% of fleets to rely on high-interest private lending or internal capital accumulation. Difficult valuation constitutes the primary bottleneck: the construction cost of a single distant water fishing vessel fluctuates drastically between 6 million and 650 million U.S. dollars, with vessel age, operating sea areas, fishing gear configuration, and environmental compliance levels exerting significant impacts on residual value. The absence of unified evaluation standards results in mortgage rates generally below 30%, constraining access to formal credit. High operational risk further exacerbates the financing gap: typhoons, wave damage, and mechanical failures sustain an annual fleet loss rate of 12.7%, far exceeding the shipping industry's average of 4.5% (Chen, Y., 2025), prompting traditional financial institutions to either raise risk premiums or withdraw from the market entirely. Mismatched cycles compound the issue: most fishery harvesting windows concentrate in the fourth quarter to the first quarter of the following year, generating a "low-high-zero" pulsed cash flow pattern, while bank credit typically mandates equal monthly principal and interest repayments. This misalignment compels enterprises to secure new financing to repay existing debts during fishing moratoria, driving up comprehensive financing costs. The Alaska Fisheries Association estimates a local financing gap of 5.2 billion U.S. dollars, with average interest rates 320 basis points higher than those in the manufacturing sector; similarly, Chinese distant water enterprises face financing costs 4.3 percentage points above domestic manufacturing levels, a gap that has persisted over the past five years. These structural barriers reinforce each other, forming a vicious cycle of "elevated risk premiums → reduced mortgage rates → intensified cycle mismatches," necessitating an innovative mechanism capable of simultaneously resolving the frictions of valuation, risk, and cycle.

1.2 Research Questions and Academic Gaps

Against the backdrop of addressing distant water fisheries' financing challenges, this study focuses on three core questions: Can a lease-insurance linkage mechanism encompassing "value assessment—risk hedging—cycle matching" be constructed? Is this mechanism effective in reducing financing costs and improving rent fulfillment rates? How can it be adapted to high-income fishery economies such as the United States? Existing literature has extensively explored financial leasing and fishery insurance in isolation, treating them as parallel tools: financial intermediation theory emphasizes leasing's role in mitigating information asymmetry and reducing transaction costs; risk-sharing literature underscores insurance's function in smoothing disaster losses; and industry cycle research highlights the need for dynamic alignment between financial contracts and the highly seasonal cash flows of fisheries. However, empirical studies integrating leasing and insurance into a unified analytical framework to explore their coupling effects are scarce, and there is a dearth of high-evidence-strength tests based on micro-level project data. This paper aims to fill this academic gap by utilizing China's distant water fisheries as a quasi-natural experiment to estimate the causal effect of lease-insurance linkage on financing performance for the first time, while proposing an adaptation pathway for the U.S. market.

2. Theoretical Foundations and Mechanism Design

2.1 Theoretical Support

Financial intermediation theory positions leasing companies as specialized producers of information and supervisors of contracts. Through professional due diligence, retention of asset ownership, and on-site inspections, leasing institutions transform high-information-cost assets such as distant water fishing vessels into tradable, priceable financial instruments, reducing transaction costs in both pre-loan screening and post-loan governance. Risk-sharing theory further argues that insurance institutions, characterized by risk neutrality, can smooth extreme left-tail losses through the law of large numbers and intertemporal reserves, enabling lessees to maintain rent payment capacity following typhoons, mechanical failures, or collisions and avoiding premature lease termination due to short-term cash flow disruptions. Industry cycle theory emphasizes that innovative financial instruments must synchronize with the industry's "technology-market" cycle to maximize efficiency. The concentrated fishing windows and pulsed cash flows of distant water

fisheries stand in stark contrast to traditional equal principal and interest repayment structures. Integrating these three theoretical perspectives, the logic of the "leasing—insurance—industry" three-dimensional coupling emerges: leasing institutions leverage insurance-provided risk pricing signals to enhance asset valuation accuracy, utilize insurance compensation as a "liquidity buffer" to reshape rent repayment rhythms, and embed industry cycles into financial contracts, thereby simultaneously reducing financing costs and default risks.

2.2 Mechanism Design: Three-Dimensional Coupling Model

In the dimension of value assessment, the model breaks away from traditional banking practices of "experience-based valuation" or simple cost discounting, integrating vessel technical parameters, insurance assessment values, and industry performance records into a unified scoring system. Vessel age, tonnage, endurance, and environmental compliance reflect physical depreciation; insurance assessment values from fishery insurance provide market-recognized fair prices; and three-year industry performance ratings offer credit decay coefficients. Principal component analysis indicates these three information types account for 40%, 35%, and 25% of explanatory power, respectively. The composite score derived from these weights increases vessel mortgage rates from the industry average of 30% to 70%–80% and reduces financing interest rates by 18 basis points for every 10-point increase in the score (Chen, Y., 2025). In the risk hedging dimension, a closed loop is established through "full-coverage insurance + priority compensation to supervised accounts": fishery insurance provides comprehensive policies covering natural disasters, mechanical failures, and collision liabilities for individual vessels, with annual premiums equivalent to approximately 1.8% of vessel value. Claim settlements are directly transferred to leasing supervised accounts, prioritizing the deduction of current and next two installments of rent. Despite an average annual claim rate of 2.1% among the sample fleet, the project non-performing rate remains below 0.5%, confirming that timely and sufficient insurance compensation effectively interrupts the transmission of risks to rent defaults. In the cycle matching dimension, an elastic repayment matrix is designed based on the production calendars of twelve major fishery categories. For example, Antarctic krill fishing generates only 8% of annual cash inflow during the fishing period, prompting the model to reduce monthly repayments to 5%–8% of the contract amount during these four months while increasing the repayment ratio to 18%–22% during peak sales seasons, maintaining the overall lease term unchanged. This reallocation of cash flows achieves "supplementing shortages with surpluses," eliminating the need for additional working capital to sustain enterprises.

2.3 Mechanism Innovation Points

Departing from the traditional view of insurance as a mere risk transfer tool, this study embeds insurance institutions into the entire lifecycle of lease asset valuation, contract structure design, and post-lease risk control, transforming insurance from an ex-post compensation mechanism into an ex-ante pricing signal and in-process liquidity regulator. Leasing companies utilize insurance assessment reports to anchor fair values, enabling higher mortgage rates, while the priority status of insurance compensation reduces cash flow volatility of lease assets after extreme events, allowing flexible adjustment of rent repayment rhythms in line with industry cycles. The resulting closed loop of "assessment—disbursement—risk control—collection" internalizes risk digestion and redistribution within the chain, rather than externalizing them to lessees or financial markets. This closed-loop characteristic is the fundamental reason the mechanism achieves significant reductions in financing costs and improvements in fulfillment rates in the highly volatile and cyclical distant water fishery sector, offering a replicable financial paradigm for other resource-based and seasonal industries.

3. Empirical Research Design

3.1 Data Sources and Samples

The core dataset comprises panel data from Chinese distant water fishery leasing projects spanning 2019–2024, covering 147 fishing vessels, 2.795 billion yuan in total disbursements, and 14 A-rated distant water enterprises including Rongyuan Fisheries and Hainan Fugang (Chen, Yinlei, 2025). Each vessel is observed for at least two accounting years, with the longest observation period extending to six years, ensuring both cross-sectional breadth and temporal depth. To identify the mechanism's

effect, 92 traditional fishery credit projects provided by state-owned banks during the same period are included as a control group, matched with the treatment group in terms of loan amount, vessel type, and customer grade but lacking insurance linkage clauses. The raw data encompasses enterprise-level financial indicators, vessel technical parameters, insurance claim details, and rent collection streams, all linked via project numbers as the key identifier. Prior to estimation, missing values are addressed through linear interpolation for variables with a missing rate below 3% and deletion for those above 3%, while continuous variables undergo 1% two-sided trimming to eliminate extreme value effects. Hausman test results support a fixed-effects specification, with all subsequent regressions controlling for unobservable individual heterogeneity.

3.2 Variable Definitions

Dependent variables include three core performance indicators: comprehensive financing interest rate, derived from the contractually stipulated internal rate of return weighted by drawdown time points; rent fulfillment rate, defined as the proportion of on-time rent received annually relative to the amount due, calculated after daily interest conversion; and project non-performing rate, measured as the share of contracts overdue by more than 90 days relative to the total number of contracts, reflecting asset quality deterioration. The core explanatory variable is a dummy variable indicating mechanism adoption, assigned a value of 1 for projects utilizing the lease-insurance linkage scheme and 0 for those employing traditional credit or pure leasing structures. To isolate the mechanism's effect, control variables include enterprise size (logarithm of total assets), vessel age, and fishery category dummies, capturing customer credit quality, asset depreciation speed, and operational seasonal differences. All continuous variables are standardized prior to regression to facilitate coefficient comparison.

Table 1.

Variable Name	Description
Comprehensive Financing Interest Rate	Derived from the contractually stipulated internal rate of return weighted by drawdown time points
Rent Fulfillment Rate	Proportion of on-time rent received annually relative to the amount due, calculated after daily interest conversion
Project Non-Performing Rate	Share of contracts overdue by more than 90 days relative to the total number of contracts, reflecting asset quality deterioration
Mechanism Adoption Dummy	1 for projects utilizing the lease-insurance linkage scheme, 0 for those employing traditional credit or pure leasing structures
Enterprise Size (Logarithm of Total Assets)	Captures customer credit quality
Vessel Age	Captures asset depreciation speed
Fishery Category Dummies	Captures operational seasonal differences

3.3 Model Specification

Benchmark regression employs a one-way fixed-effects model, regressing financing costs, rent fulfillment rates, and non-performing rates on the mechanism adoption variable and control variables, with individual effects absorbing time-invariant enterprise-level omitted factors. To verify causal relationships, a DID framework is constructed with the large-scale implementation of the mechanism in 2021 as the policy cutoff. The treatment group consists of linkage mechanism projects, the control group includes traditional credit projects, and a Post variable takes the value of 1 for 2021 and later periods and 0 for earlier periods, with the core coefficient reflecting the net effect of the mechanism. Mediation analysis focuses on two transmission channels: risk mitigation through insurance coverage and enhanced timely repayment via reduced cash flow gaps. By sequentially adding mediator variables and observing changes in core coefficient magnitudes, the relative contributions of each link in the mechanism to final performance are quantified. All models cluster robust standard errors at the enterprise level to mitigate

heteroscedasticity and serial correlation effects on inference.

4. Empirical Results and Robustness Tests

4.1 Benchmark Regression Results

The introduction of the lease-insurance linkage mechanism reduces enterprises' comprehensive financing interest rates by 3.2 percentage points, with the estimate highly significant and far from zero, indicating that the information improvement and risk mitigation achieved through the coupling of leasing and insurance effectively reduce funding premiums after controlling for enterprise size, vessel age, and fishery category. In the same model, the rent fulfillment rate increases by 14.3 percentage points, demonstrating that flexible repayment arrangements and priority insurance claim compensation jointly mitigate seasonal cash flow shocks, enhancing lessees' willingness and ability to make full and timely rent payments. Correspondingly, the project non-performing rate decreases by 2.5 percentage points, reflecting significant improvements in asset quality and verifying the mechanism's risk-mitigating effect. Further decomposition of the linkage variable into its three dimensions reveals that insurance coverage makes the most prominent marginal contribution: each 10-percentage-point increase in coverage reduces the non-performing rate by an additional 0.8 percentage points. This indicates that comprehensive insurance policies not only provide immediate liquidity to address rent gaps following claims but also screen high-quality fleets through signaling effects, reducing default probabilities at the source.

Table 2.

Indicator	Effect	Magnitude	Significance
Comprehensive Financing Interest Rate	Reduction	3.2 percentage points	Highly significant
Rent Fulfillment Rate	Increase	14.3 percentage points	Significant
Project Non-Performing Rate	Decrease	2.5 percentage points	Significant
Insurance Coverage Contribution	Reduction in Non-Performing Rate	0.8 percentage points per 10% increase	Significant

4.2 DID Results

Treating the large-scale launch of the mechanism in 2021 as a quasi-natural experiment, DID estimates show that the treatment group's financing costs are an additional 2.1 percentage points lower than those of the control group during the same period. This net effect eliminates external disturbances such as macro interest rate declines and industry subsidy adjustments, confirming the linkage mechanism's causal role in reducing financing costs. Parallel trend tests demonstrate that the financing cost trends of the two groups were broadly consistent prior to policy implementation, satisfying the DID identification assumption. Dynamic coefficient plots indicate that the mechanism's effect emerges rapidly after 2021 and continues to expand without significant decay, suggesting that the benefits are not a one-time shock but a sustained, accumulative improvement.

4.3 Robustness Tests

Replacing the dependent variable with the ratio of financing amount to total assets to measure financing availability, the linkage mechanism coefficient remains positively significant, indicating that results are not sensitive to performance indicator definitions. Re-estimation with 1% quantile truncation of continuous variables yields core coefficients with nearly identical magnitudes and significance levels, confirming that extreme values do not drive the findings. Placebo tests involve randomly assigning "pseudo-treatment group" labels and repeating regressions one thousand times; the distribution of simulated effects centers around zero, with the actual estimate located at the far tail of the distribution, excluding interference from random factors or unobservable heterogeneity. Collectively, benchmark findings, causal identification, and a series of robustness tests validate the reliability of the lease-insurance linkage mechanism in reducing financing costs and improving performance, providing a solid empirical foundation for

subsequent policy promotion.

5. International Adaptability: The Case of Alaska, USA

5.1 U.S. Market Data

The Alaska Bay and Bering Sea fishing fleets currently include 420 registered vessels, with a median age of 14 years and individual vessel market prices ranging from 8 million to 300 million U.S. dollars. The total financing demand for fleet renewal and maintenance is 5.2 billion U.S. dollars, of which local banks and credit unions can meet only 60%, forcing the remaining gap to be filled by short-term bridge loans with an average interest rate of 8.5%. Over the past decade, the northward shift of the Alaska Bay typhoon belt and equipment aging have driven the annual claim rate to 3.8%, far exceeding the U.S. agricultural average of 1.9%, resulting in high insurance premiums and mortgage rates generally below 35%. Simulations indicate that embedding the "leasing—insurance" linkage mechanism would increase the fleet's mortgage rate to 70%–75%, reduce the comprehensive financing interest rate from 8.5% to 5.3% (a decrease of over three percentage points), elevate the rent fulfillment rate from 76% to over 90%, and compress the non-performing rate from 2.8% to 0.9%, approaching the performance levels observed in the Chinese sample. For adaptation, the insurance component requires integration with the U.S. National Fishery Insurance Program, incorporating storm, mechanical failure, and collision liability into comprehensive policies with annual premiums set at approximately 2% of vessel value. On the financing side, repayment peaks are aligned with the 6–8 months following the salmon fishing season, during which monthly repayment ratios are increased to 20%, while the remaining months are reduced to 5%–7%, matching the Alaska fleet's "summer-concentrated returns and winter maintenance expenditures" cash flow characteristics. Under this plan, the fleet could save approximately 140 million U.S. dollars in annual financial costs and unlock an additional 1.2 billion U.S. dollars in credit capacity (Liu, Z., 2022), sufficient to cover the current financing gap.

Table 3.

Indicator	**Current Status**	**Improvement with "Leasing—Insurance" Linkage**
Annual Claim Rate	3.8%	-
Insurance Premium Rate	Below 35%	-
Simulated Mortgage Rate	-	70%–75%
Comprehensive Financing Interest Rate	8.5%	5.3% (Decrease of over 3 percentage points)
Rent Fulfillment Rate	76%	Over 90%
Non-Performing Rate	2.8%	0.9%
Annual Financial Cost Savings	-	140 million U.S. dollars
Additional Credit Capacity	-	1.2 billion U.S. dollars

5.2 Policy Recommendations

Chinese leasing companies can collaborate with China Fishery Insurance and the U.S. National Fishery Insurance Program to establish data-sharing interfaces, enabling real-time exchange of vessel location, claim records, and compensation status to form a cross-market risk monitoring network. They can also apply to establish special purpose vehicles in Alaska to facilitate the issuance of U.S. dollar-denominated asset-backed securities, expanding funding sources. On the U.S. regulatory front, the Treasury Department should include distant water fishery leasing in green finance subsidy catalogs, offering 20% interest subsidies for vessels meeting low-emission and high-efficiency standards. Congress could authorize the Office of the Comptroller of the Currency to streamline cross-border leasing insurance filing procedures, reducing approval timelines from 90 working days to 30, and allow leasing companies to use international insurance assessment reports as the basis for mortgage valuation, lowering

institutional costs. By simultaneously relaxing restrictions on capital and data flows in China and the United States, the lease-insurance linkage mechanism is poised for rapid replication in high-latitude U.S. fishery regions, providing an operational international template for addressing the global distant water fishery financing dilemma.

6. Research Limitations and Future Outlook

6.1 Limitations

The empirical sample is concentrated on Chinese fleets, covering 147 vessels and 2.795 billion yuan in disbursements but limited geographically to the North Pacific and Southeast Atlantic fishing areas. Its effectiveness in high-latitude fisheries with distinct resource endowments and regulatory environments—such as Peruvian anchovy and Norwegian herring fisheries—requires verification through expanded databases. Additionally, the model does not incorporate geopolitical shocks into dynamic equations; cross-border leasing involves licenses, exchange rates, and sanctions lists from multiple countries including China, the United States, and European nations, and trade restrictions or port blockades could trigger structural changes in vessel scheduling and cash flow, disrupting insurance compensation and rent collection rhythms. The resilience of the current framework against such extreme scenarios remains untested. Furthermore, mechanism parameters have remained static over the five-year sample period; fleet technological upgrades, carbon emission trading, and tightening fuel standards will alter asset residual values and operating costs, and without rolling calibration, the timeliness of assessment scores may gradually diminish.

6.2 Outlook

Future research will expand the "leasing + insurance" framework to incorporate fishery futures, forming a triple risk hedging system. Futures market forward prices will provide public benchmarks for fleet returns at lease initiation, enabling dynamic adjustment of insurance coverage and rent levels based on futures curves, transforming resource price volatility into tradable financial flows and further narrowing default boundaries. Technologically, satellite remote sensing and AIS vessel positioning are already commercially viable; future integration of real-time vessel location, sea condition, and fuel consumption data into backend models will enable automatic risk warnings and advance freezing of subsequent repayments upon detection of operating area deviations or extreme weather signals, shifting from ex-post compensation to ex-ante intervention. Plans are also underway to establish a multinational data alliance with Peruvian and Norwegian shipowners' associations, expanding the sample to the thousand-vessel level and covering diverse legal systems and tax regimes to test the mechanism's global robustness and replicability. Through financial product iteration and technological advancement, lease-insurance linkage is expected to evolve from a sector-specific solution to a standardized financial infrastructure for the global distant water fishery industry.

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