Do Shipping Corporates Commercially Benefit from Green Initiatives: An Empirical Study

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***Abstract* —** Climate Change Risks (CCR) and greenhouse gas (GHG) emission control have become systemic risk factors for businesses, particularly in the shipping industry, which faces increasing pressure to meet GHG targets set by the Paris Agreement and the International Maritime Organization (IMO). This study investigates the relationship between shipping corporates' green initiatives, represented by granted green patents, and their financial and operational performance. Using data from shipping companies listed on the Shanghai Stock Market between 2011 and 2019, we find significant positive correlations between green initiatives and costs of capital, but negative correlations with operational performance metrics like ROA and ROE, suggesting that these companies do not commercially benefit from their green initiatives, except in terms of reduced debt costs. The study also explores the impact of the Paris Agreement on these relationships, providing valuable insights for stakeholders regarding the financial implications of green initiatives in the shipping sector. Further research is recommended to expand the sample base and explore additional exogenous factors affecting green initiatives across various industries.

***Index terms* —** Green Initiates, Green Patent, Cost of Capital, Operational Performance, Shipping.

I. Introduction

Climate change has increasingly manifested through extreme weather events, particularly in major agricultural nations like the United States and Brazil, posing significant risks to global food security. The World Health Organization (WHO) has identified climate change as the foremost global health threat of the 21st century, attributing these changes largely to human-induced greenhouse gas (GHG) emissions. As the frequency of droughts, heat waves, and other extreme weather conditions rises, the material threats to food security become more evident, prompting a collective acknowledgment of the need for urgent action. The Paris Agreement, established during the 21st Conference of the Parties (COP 21) in 2015, set ambitious goals for reducing global GHG emissions and emphasized the necessity for international collaboration. This agreement was further reinforced by COP 27 in 2022, which aimed to provide financial support to developing nations facing climate impacts. As a result, many corporations have begun to tighten their governance regarding GHG emissions, recognizing climate change risks as systemic threats to financial and economic stability.

Our paper highlights that corporate responses to Climate Change Risks (CCR) have evolved significantly since 2000, particularly after the Paris Agreement. There is now a statistically significant correlation between carbon-related variables and financial market responses, indicating that investors are increasingly aware of the financial implications of GHG emissions. Corporations are actively publishing CCR and Environment, Social, and Governance (ESG) reports, reflecting their commitment to green initiatives. However, the measurement of corporate ESG performance remains inconsistent, complicating the assessment of their efforts to mitigate CCR. The study proposes that green initiatives, as reflected in ESG reports, can serve as indicators of corporate efforts to manage CCR and GHG emission risks.

Our paper contributes to the existing literature by examining the economic determinants and consequences of corporate green initiatives, specifically through the lens of granted green patents. It shifts the focus from industry categorization to a more nuanced understanding of individual corporate actions. By concentrating on the shipping industry — a sector characterized by significant GHG emissions and increasing regulatory scrutiny — the study provides valuable insights into how corporate green initiatives can impact financial performance and cost of capital. This approach allows for a more comprehensive evaluation of corporate behavior in response to climate change.

The study employs various empirical research methodologies, analyzing the relationships between granted green patents and financial metrics such as cost of capital, Return on Assets (ROA), and Return on Equity (ROE). It utilizes the Heckman Correction Model to mitigate potential sample selection bias, ensuring robust estimates of the relationships under investigation. The findings reveal a significant positive correlation between green patents and costs of equity, contrary to initial hypotheses. Additionally, the study explores the impact of the Paris Agreement as an exogenous shock, noting its limited influence on the relationships between green initiatives and financial outcomes.

The findings indicate that, overall, shipping companies do not achieve commercial benefits from their green initiatives, as evidenced by negative relationships with operational performance metrics. The findings have implications for investors and governing bodies, suggesting that current policies may need to be reevaluated to better support corporate green initiatives. Furthermore, the study encourages further research

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into the effects of additional regulatory frameworks and the evolving landscape of corporate sustainability.

Future empirical studies are encouraged to explore the impacts of the IMO Initial Strategy and subsequent regulatory frameworks on corporate behavior in the shipping industry. Additionally, examining the potential for green patents to yield positive operational outcomes as more green technologies are adopted could provide valuable insights. The study also highlights the need for improved consistency in ESG performance measurement, which could enhance transparency and accountability in corporate sustainability efforts. Lastly, expanding the research to other industries sensitive to CCR may yield broader insights into the economic impacts of green initiatives across various sectors.

II. Literature Review

The literature on climate change and its effects on financial markets is rapidly evolving. Studies by Bolton and Kacperczyk (2021) indicate a significant carbon premium in U.S. markets between 2005 and 2017, while earlier data from the 1990s show no such premium, reflecting a shift in investor awareness regarding Climate Change Risks (CCR) and greenhouse gas (GHG) emissions over the past decade. Their findings, along with those of Kim et al. (2022) and Düsterhöft et al. (2023), suggest that CCR and carbon emissions are increasingly recognized as systematic risk factors in financial markets. However, the existing literature presents contradictions; for instance, while Matsumura et al. (2014) argue that voluntary carbon disclosure can mitigate negative impacts on firm value, Lee et al. (2015) contend that such disclosures may be perceived as bad news by the stock market. These discrepancies highlight the sensitivity of empirical results to factors such as sample periods and regional contexts, particularly in light of rapidly changing regulations and policies regarding GHG emissions.

Given these complexities, our empirical study aims to further explore how well CCR and GHG emission risks are understood and addressed within financial markets, particularly in the context of Chinese stock markets, which may have responded to these issues later than U.S. markets. We will investigate whether financial markets can effectively identify CCR and GHG emission risks on a firm-by-firm basis and assess the responses of both equity and debt markets to these risks. This inquiry is particularly relevant in light of recent developments, such as the ambitious IMO GHG Strategy 2023, which has prompted renewed discussions about regulatory goals and their implications for various industries, including shipping. The ongoing evolution of climate-related regulations underscores the importance of continuously examining the correlations between CCR, GHG emission control, and financial market behaviors, while also recognizing the sensitivity of these relationships to industry-specific, temporal, and regional factors.

III. Empirical Results

A. Data and Variables

This empirical study examines shipping corporates listed on the Shanghai Stock Market, identifying a total of 42 companies based on the industrial classification by the Chinese Securities Regulatory Commission in 2012. We utilize the Wind Financial Terminal, a prominent financial information provider in China, to analyze granted green patents from 2011 to 2019, discovering 22,965 patents registered by 3,169 companies nationwide. For our analysis, we gather data on the number of green patents for the 42 shipping corporates, as well as key financial metrics such as Return on Assets (ROA) and Return on Equity (ROE), along with various control variables. Additionally, we obtain data on costs of debt and equity from CSMAR, a comprehensive database specializing in financial information for publicly traded companies in the Shanghai Stock Market.

Key Variable: The key independent variable in this study is the number of granted green patents, measured as the logarithm of one plus the count, sourced from the Wind Financial Terminal. This variable, denoted as g_i (Green Innovation), serves as a proxy for a firm's commitment to environmental sustainability through innovative efforts in sustainable technologies. Granted green patents reflect a company's investment in research and development that can enhance operational efficiencies, open new markets, and attract environmentally conscious investors, potentially lowering the cost of capital. The China National Intellectual Property Administration regularly publishes these patents, which cover areas such as renewable energy and carbon emission control. However, a notable decline in the number of granted green patents recorded post-2019 suggests that the registration process may have become more complicated, rather than indicating a decrease in innovation. This decline, along with concerns about the effectiveness of transferring green patents to production, is a key reason for limiting the study's sample period to 2019.

Dependent Variables: the cost of capital measures serve as the primary dependent variables for the first baseline test, representing the rates of return a company must achieve to meet the expectations of its equity and debtholders. This cost is divided into two components: the cost of debt, which is the interest rate paid to lenders, and the cost of equity, reflecting the return demanded by shareholders. Data for these metrics can be sourced from financial databases like CSMAR and WIND. The cost of debt, denoted as $cost_d$, is calculated as the proportion of finance expenses to total liabilities, indicating a firm's creditworthiness and debt management efficiency. The cost of equity, represented as $cost_e$, is innovatively estimated by taking the square root of projected earnings per share growth divided by the current stock price, highlighting market perceptions of the firm's growth potential and risk. The overall cost of capital, $cost_c$, is computed as the weighted average of the cost of debt and the cost of equity, reflecting the total financing costs associated with a company's capital structure.

Firm Performance Measures: The operational performance at the firm level serves as the primary dependent variable for the second baseline test, reflecting how effectively a company

conducts its core business activities. While ideally, operational performance would be measured through operational profits and efficiencies on an individual firm or vessel basis to assess the impact of green patents, insufficient transparency hinders such empirical studies. The published Carbon Intensity Indicator (CII) ratings may allow for some correlation analysis between CII ratings and operational performance, as indicated by Return on Assets (*ROA*) and Return on Equity (*ROE*). For this study, conventional indicators like ROA and ROE are utilized, as they are widely recognized for evaluating asset utilization and shareholder returns, with higher values often signaling operational excellence and effective corporate governance.

Control Variables: The empirical study employs various variables to assess corporate performance in the shipping industry, focusing on *firm size, book-to-market ratio, leverage, growth in operating income, cash flow from operations, firm age, chairman-general manager duality, board size, independent directors*, and *digitization level*. Firm size, measured by the natural log of total assets, reflects a company's resource availability for sustainable investments and its visibility to external stakeholders, while the book-to-market ratio indicates market valuation relative to book value. Leverage assesses financial risk, and growth in operating income signals operational success. Cash flow from operations reveals liquidity and investment capacity, especially concerning green patents. Firm age suggests stability and experience, and governance metrics like duality, board size, and independent directors evaluate decision-making efficiency and oversight. Additionally, the digitization level highlights the industry's technological adoption, though results may be limited due to the sample period ending in 2019. Overall, these variables are interconnected and provide insights into the dynamics of corporate governance and performance within the shipping sector.

B. Summary Statistics

Using data from Wind Financial Terminal and CSMAR, we analyze financial data from 42 shipping companies listed on the Shanghai Stock Market. We initially extract financial information, such as expenses, total liabilities, projected earnings per share, and current stock prices, from CSMAR to calculate the cost of debt and cost of equity for each firm on an annual basis. Unfortunately, CSMAR provides only 187 observations for cost of debt and 93 for cost of equity from 2011 to 2019. We then turn to Wind Financial Terminal for Return on Assets (ROA) and Return on Equity (ROE), resulting in 202 and 201 observations, respectively. Notably, the 93 cost of equity observations overlap with the cost of debt data, and both the ROA and ROE observations overlap with the cost of debt. Consequently, the maximum number of observations for green innovation is limited to 202. We also gather data for nine control variables from Wind Financial Terminal, achieving 202 observations for each, along with 199 for growth in operating income and 194 for chairman-general manager duality.

TABLE I: SUMMARY STATISTICS

Variable	Obs	Mean	Std. Dev.	Min	Max
g_i	202	0.057	0.230	0.000	1.609
$cost_d$	187	0.024	0.021	-0.053	0.062
$cost_e$	93	0.088	0.052	0.019	0.272
roa	202	0.033	0.040	-0.138	0.206
roe	201	0.055	0.081	-0.535	0.328
size	202	23.426	1.324	20.056	26.292
bm	202	1.730	1.287	0.051	7.622
lev	202	0.454	0.164	0.031	0.892
growth	199	0.148	0.341	-0.592	2.343
cashflow	202	0.060	0.045	-0.172	0.232
firmage	202	2.785	0.397	1.386	3.466
dual	194	0.046	0.211	0.000	1.000
board	202	2.298	0.189	1.609	2.708
indep	202	0.361	0.042	0.333	0.600
digital	202	283.392	122.151	7.580	462.228

C. Baseline Analysis

The following empirical model outlined aims to explore the correlations between granted green patents by shipping companies and their costs of capital, hypothesizing a negative correlation where increased green patents lead to lower capital costs. This assumption is based on the premise that investors are more inclined to support companies with strong green initiatives, reflected in the number of granted green patents, thereby offering capital at lower costs compared to other firms.

$$Cost\ of\ capital_{it} = a_0 + \beta_1 * Green\ Initiate + Control\ Variables_{it} + Year + Firm + \epsilon_{it}$$

The dependent variable, cost of capital, is divided into costs of equity and costs of debt, representing the returns required by investors. The model operationalizes the green initiative through the logged number of granted green patents and incorporates various control variables—such as firm size, book-to-market ratio, leverage, growth, cash flow, firm age, duality, board composition, independence, and digitization level—to account for potential confounding factors affecting the relationship between green initiatives and capital costs.

The estimated coefficients, particularly β_1, is of interest – a positive (negative) significant estimated coefficient indicates a significant positive (negative) relationship between the registered green initiatives of shipping companies and their cost of capital, costs of equity (and cost of debt respectively). The empirical results are reported in Table 2.

TABLE II: BASELINE ANALYSIS I

	(1)	(2)	(3)
	$cost_d$	$cost_e$	$cost_c$
g_i	-0.0134***	0.100**	0.0627**
	(-3.692)	(2.022)	(2.015)
size	-5.09e-05	-0.0104	0.00326
	(-0.0150)	(-0.408)	(0.173)
bm	0.00114	-0.00622	-0.00838
	(0.868)	(-0.670)	(-1.184)
lev	0.000281	0.122	0.0489
	(0.0249)	(1.327)	(0.817)
growth	-0.00109	-0.0148	-0.00228
	(-0.476)	(-0.434)	(-0.0924)
cashflow	0.110***	0.318	0.415**
	(5.132)	(1.143)	(2.094)
firmage	0.0156	-0.0811	-0.0154
	(1.263)	(-1.100)	(-0.298)
dual	0.00672	0.0201	0.00624
	(1.121)	(0.737)	(0.354)
board	0.0151	-0.169	-0.114
	(1.102)	(-1.418)	(-1.474)
indep	0.0557	-0.306	0.169
	(1.547)	(-1.106)	(0.684)
digital	8.11e-05	-0.000333	-0.000316
	(1.513)	(-0.820)	(-0.997)
Constant	-0.0732	0.960	0.192
	(-0.725)	(1.381)	(0.382)
Time Effect	Yes	Yes	Yes
Firm Effect	Yes	Yes	Yes
Observations	176	86	86
R-squared	0.802	0.626	0.651

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The findings reveal a significant negative correlation between green initiatives (g_i) and the cost of debt ($cost_d$), with a coefficient of -0.0134 and significant at 1% level, indicating that increased green patents are associated with lower costs of capital for shipping companies. In contrast, the cost of equity ($cost_e$) and cost of capital ($cost_c$) show positive relationships with coefficients of 0.100 and 0.0627, respectively, suggesting that while green initiatives may lower debt costs, they are associated with higher equity costs. Other control variables, such as cash flow, exhibit significant positive effects on costs, particularly cash flow's strong correlation with both cost of capital measures. Overall, the model demonstrates robust explanatory power with R-squared values of 0.802 for model (1), 0.626 for model (2), and 0.651 for model (3), while controlling for both time and firm effects across the analyzed data.

The second study aims to explore the impact of green initiatives, represented by granted green patents, on the operating performance of shipping companies, specifically through Return on Assets (ROA) and Return on Equity (ROE). The model hypothesizes a positive correlation between green initiatives and operational performance, positing that an increasing number of granted green patents may enhance operational efficiency and, consequently, improve ROA and ROE. Unlike the previous analysis of cost of capital, where contrasting correlations were observed between dependent variables, this model anticipates a consistent positive relationship between ROA and ROE, as indicated by their high correlation. Additionally, the model incorporates various firm characteristic variables, detailed in Table 1, to control for factors that may influence the baseline analysis results. The following empirical model is examined:

$$Operational\ Performance_{it} = a_0 + \beta_1 * Green\ Initiate + Control\ Variables_{it} + Year + Firm + \epsilon_{it}$$

The estimated coefficients, particularly β_1, is of interest - a significant negative estimate indicates a negative relationship between the shipping companies' green initiatives and their operating performance. Empirical results detailing the impact of these green initiatives on firm performance are presented in Table 3.

TABLE III: BASELINE ANALYSIS II

	(1)	(2)
	ROA	ROE
g_i	-0.0129**	-0.0239**
	(-2.396)	(-2.244)
size	-0.00578	-0.0120
	(-1.026)	(-0.886)
bm	0.00208	0.00437
	(0.675)	(0.722)
lev	-0.0689***	-0.0228
	(-3.499)	(-0.636)
growth	0.0132*	0.0292**
	(1.839)	(2.112)
cashflow	0.129	0.290*
	(1.547)	(1.887)
firmage	-0.0114	-0.00254
	(-0.583)	(-0.0620)
dual	-0.0129*	-0.0202
	(-1.792)	(-1.591)
board	-0.0298	-0.0475
	(-1.233)	(-0.980)
indep	-0.00788	0.0441
	(-0.127)	(0.341)
digital	-7.24e-05	-0.000133
	(-0.922)	(-0.798)
Constant	0.271*	0.386
	(1.783)	(1.072)
Time Effect	Yes	Yes
Firm Effect	Yes	Yes
Observations	191	190
R-squared	0.733	0.614

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The empirical results for the operational performance indicators, Return on Assets (ROA) and Return on Equity (ROE), reveal significant findings regarding the impact of green initiatives (gi) and other variables. The coefficient for green initiatives is negative and statistically significant for both ROA (-0.0129) and ROE (-0.0239), suggesting a detrimental effect

on performance. Other notable variables include leverage (lev), which negatively affects ROA (-0.0689) and shows no significant impact on ROE, and growth, which positively influences both ROA (0.0132) and ROE (0.0292). Cash flow positively affects ROE (0.290) but not ROA, while dual leadership structure and firm size exhibit negative coefficients for both performance measures. The model accounts for firm and time effects, with R-squared values of 0.733 for model (1) and 0.614 for model (2), indicating a reasonable fit for the data with 191 and 190 observations, respectively.

D.Heckman Correction Model

The study employs an empirical model to explore the relationships between shipping companies' granted green patents and their costs of capital, and assume that investors are more inclined to support companies with robust green initiatives, leading to more favorable financing terms compared to those without such initiatives. Similarly, it also explore the relationships between shipping companies' granted green patents and their operational performance results, with assumption that companies with robust green initiatives are able to improve its operational efficiencies with positive impacts upon operational performance results.

To address potential sample selection bias, the study plans to utilize a Heckman correction model, which consists of two equations: one for the selection process and another for the outcome variable. This approach is crucial because companies that invest in green initiatives might differ systematically from those that do not, potentially affecting their cost of capital and operational performance. Factors such as access to financial resources, location-based subsidies, and the specific nature of a company's fleet may influence their motivation to invest in green patents. The Heckman correction model will thus help estimate the true impact of green initiatives on costs of capital while controlling for these biases. We only report the second stage regression result here:

$$Cost\ of\ capital_{it} = a_0 + \beta_1 * Green\ Initiate + IMR_{it} + Control\ Variables_{it} + Year + Firm + \epsilon_{it}$$

The Heckman correction model addresses sample selection bias by incorporating the inverse Mills ratio (IMR), a term that reflects the selection process within the outcome equation. The IMR is derived from estimates obtained in the selection equation and serves as a covariate in the outcome model. By including this adjustment, the Heckman correction model aims to provide more accurate estimates of the correlations between granted green patents and the dependent variables, thereby enhancing the validity of the findings.

To assess the robustness of the results, the outcomes from the Heckman correction model will be compared with those from standard empirical models. This comparison will help determine whether the inclusion of the IMR significantly alters the correlations observed between green patents and the dependent variables. The empirical results from this two-step approach are detailed in Table 4, highlighting the effectiveness of the Heckman correction in addressing selection issues and our baseline findings are robust and consistent.

TABLE IV: HECKMAN CORRECTION MODEL

	(1) $cost_d$	(2) $cost_e$	(3) $cost_c$	(4) ROA	(5) ROE
g_i	-0.0133***	0.106**	0.065**	-0.013**	-0.024**
	(-3.905)	(2.202)	(2.245)	(-2.384)	(-2.234)
IMR	-0.0541*	-0.285	-0.145	-0.0620	-0.0678
	(-1.794)	(-0.888)	(-0.632)	(-1.010)	(-0.528)
size	-0.0220*	-0.133	-0.0588	-0.0296	-0.0382
	(-1.731)	(-0.905)	(-0.559)	(-1.170)	(-0.690)
bm	0.00800**	0.0300	0.00998	0.00980	0.0129
	(1.992)	(0.725)	(0.327)	(1.202)	(0.770)
lev	0.0986*	0.638	0.310	0.0442	0.101
	(1.750)	(1.085)	(0.743)	(0.382)	(0.421)
growth	0.0404*	0.192	0.102	0.0606	0.0812
	(1.744)	(0.801)	(0.602)	(1.286)	(0.830)
cashflow	0.192***	0.704	0.611	0.224*	0.394
	(3.815)	(1.287)	(1.585)	(1.801)	(1.569)
firmage	0.0210*	-0.0446	0.00307	-0.0032	0.00629
	(1.712)	(-0.549)	(0.054)	(-0.151)	(0.146)
dual	-0.0329	-0.186	-0.0983	-0.0581	-0.0697
	(-1.413)	(-0.803)	(-0.591)	(-1.245)	(-0.711)
board	0.00229	-0.256	-0.158	-0.0444*	-0.0635
	(0.153)	(-1.585)	(-1.432)	(-1.812)	(-1.239)
indep	0.00936	-0.568	0.0357	-0.0620	-0.0149
	(0.215)	(-1.34)	(0.100)	(-0.876)	(-0.099)
digital	-0.0001	-0.00129	-0.0008	-0.00028	-0.00036
	(-0.988)	(-1.156)	(-1.021)	(-1.292)	(-0.801)
Constant	0.590	4.627	2.051	0.995	1.182
	(1.542)	(1.051)	(0.650)	(1.353)	(0.733)
Time Effect	Yes	Yes	Yes	Yes	Yes
Firm Effect	Yes	Yes	Yes	Yes	Yes
Observations	176	86	86	191	190
R-squared	0.805	0.632	0.654	0.735	0.615

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

A further analysis discussed the financial metrics of shipping companies before and after the 2015 Paris Agreement, assessing the impact of this landmark agreement on the relationship between green initiatives, represented by granted patents, and various financial variables. The findings indicate that prior to the agreement, companies benefitted from lower costs of debt but faced higher costs of equity and capital, consistent with baseline analyses. Post-Paris Agreement, the correlation between green initiatives and cost of capital became statistically significant, while the negative correlation with costs of debt lost significance. Interestingly, costs of equity remained insignificantly correlated with green initiatives, suggesting the Paris Agreement did not materially influence this aspect. Operational performance metrics, such as Return on Assets (ROA) and Return on Equity (ROE), shifted from insignificant negative correlations before the agreement to insignificant positive correlations afterward, indicating a potential positive influence of global climate initiatives on corporate performance. The study highlights the evolving dynamics of corporate finance in response to environmental policies, emphasizing the need for further research into the implications of such agreements on financial decision-making in the sustainability context.

IV. Conclusion and Discussion

The paper studied the relationship between shipping companies’ green initiatives, as represented by granted green patents, and their costs of capital and operational performance. Empirical evidence shows that the increased investment in green initiatives correlates with higher costs of capital and lower operational performance. This suggests that the capital market perceives the risks associated with greenhouse gas (GHG) emissions from shipping more critically than anticipated, even prior to the implementation of specific climate regulations like the Paris Agreement in 2015. Subsequent analysis indicated that while correlations with cost of debts and equity remained, the significance shifted post-2015, with some metrics showing weak positive correlations with operational performance.

The findings highlight the complex relationship between green initiatives and financial metrics, emphasizing that while the Paris Agreement may have positively influenced operational performance, the capital market's response remained conservative. Notably, shipping companies with lower financial slack faced higher costs of equity despite their green initiatives, while those with higher slack benefitted from lower costs of debt. This indicates that the capital market differentiates between companies based on their financial health when evaluating the impact of green initiatives, potentially leading to disparities in how these firms are supported.

The study contributes to existing literature by proposing the use of granted green patents as a measurable indicator of green initiatives, enhancing transparency in assessing corporate environmental efforts. It underscores the necessity for further research to explore the effects of industry-specific regulations, like the Initial Strategy and the IMO GHG Strategy 2023, on the relationship between green initiatives and financial performance. Additionally, it calls for a deeper examination of how financial slack influences capital costs, suggesting that the benefits of green initiatives may not uniformly translate into commercial advantages.

In conclusion, the results indicate that from 2011 to 2019, shipping companies with more granted green patents experienced higher costs of capital and lower operational performance, complicating efforts to control GHG emissions in the sector. Regulatory bodies are urged to reconsider how they motivate corporate investment in green initiatives, recognizing that such investments do not always equate to financial benefits. The positive shift in correlation following the Paris Agreement, albeit weak, suggests potential for future improvements in operational performance linked to green initiatives, while the nuanced impacts of financial slack warrant further investigation to understand their role in shaping these dynamics.

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