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"DETERMINANTS OF THE PRICE PREMIUM FOR ECO VESSELS"

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Determinants of the Price Premium for Eco Vessels

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As regulations regarding shipping decarbonization and greenhouse gas emissions in general are becoming increasingly strict, ship owners have been facing the trilemma of investing in a cheaper but much more polluting conventional vessel or in a more expensive but eco-friendly one or postponing their investment decision. This paper quantifies the price premium paid for eco-friendly cargo-carrying vessels and examines the determinants of it. Weekly data from January 2019 until December 2023 indicates that eco vessels trade at an average premium of close to 25% compared to their conventional counterparts. However, the corresponding income premia are on average between 9% and 15%. Our findings further suggest that the price premium is time-varying and highly dependent on the prevailing market conditions; in expansionary freight markets, it is significantly lower than in normal/recessionary ones. Empirical estimation using nonlinear threshold autoregressive models indicates that recent price premia and changes in the fleet supply are strong drivers too with fuel costs and market liquidity having ambiguous effects. However, the magnitude and significance of these drivers vary based on the market state and segment. Finally, the paper documents the adverse effect that the current technological and regulatory uncertainty has on investment in newbuilding vessels. Our findings have important implications for industry participants, policymakers, and regulators.

Introduction

Shipping facilitates over 80% of global trade (UNCTAD, 2021), with world seaborne trade, measured in tonne-nautical miles, increasing at an average rate of 3.3% since 2000, based on Clarksons' Shipping Intelligence Network (SIN) timeseries. While shipping is less polluting per transport work (*i.e.*, tonne-nautical mile) compared to other transport modes, due to the scale of its operations, it accounts for 2.8% of global greenhouse gas (GHG) emissions (UNCTAD, 2023). In other words, if global shipping were a country, it would be the sixth largest carbon dioxide (CO_2) emitter in the world (Tiseo, 2023). Without any further action, shipping CO_2 emissions are expected to increase by 90-130% by 2050 compared to the 2008 levels (IMO, 2018).

As a result, shipping environmental regulations are becoming increasingly strict. The International Maritime Organization's (IMO's) Initial Greenhouse Gas Strategy was aiming at reducing CO_2 emissions from vessels by at least 40% by 2030, pursuing efforts towards 70% by 2050, vis-à-vis 2008 levels (IMO, 2018). However, the revised and more ambitious 2023 IMO GHG Strategy aims at GHG emissions peaking from international shipping as soon as possible and reaching net-zero by or around 2050 (IMO, 2023). To achieve that, among other measures, the shipping industry has started in recent years utilizing vessels that are more eco-friendly —in terms of reduced fuel consumption and, in turn, CO_2 emissions— compared to conventional ones.

From a technological perspective, eco-friendly vessels should trade at a price premium compared to their conventional (*i.e.,* non-eco) counterparts. From a financial perspective, though, for an investor to be willing to pay for such premium and for a capital provider to finance such acquisition, the eco vessel must generate higher cash flows or/and have a lower cost of capital than the conventional one.

Ioannis Moutzouris, Ph.D., an Onassis Senior Lecturer in Shipping Finance and Analytics at Bayes Business School (U.K.), during his presentation about shipping decarbonization at the 10th City of London Biennial Meeting, which took place at the International Maritime Organization in London on June 12-13, 2023.

Relevance of the Research Question

This article contributes to the shipping, asset pricing, and sustainable finance literatures by investigating whether such an eco price premium exists, analyzing its determinants, and relating the findings to shipping investment decisions and their effect on the industry. To the best of the authors' knowledge, this is the first paper that explicitly examines shipping sustainability from this perspective as previous research has focused on the technological and regulatory challenges related to sustainable shipping.

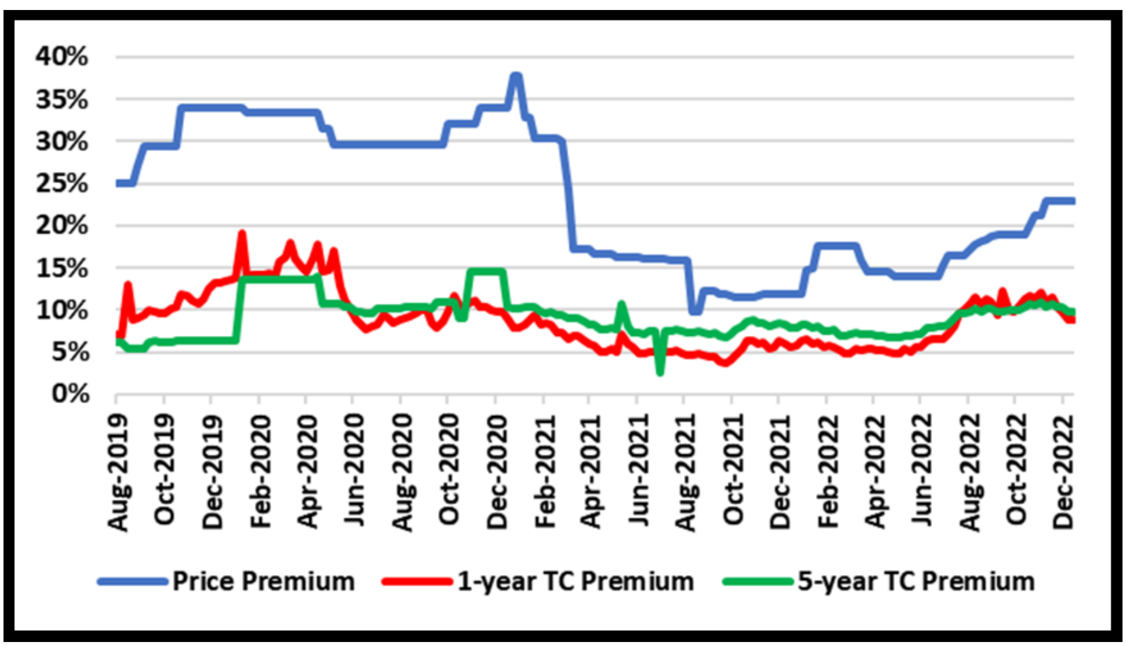
There is also a growing body of literature (Mackenzie *et al.*, 2024a; Mackenzie *et al.*, 2024b) examining the implications of environmental regulations on marine insurance, but neither those articles explicitly incorporate the financial dimension. While there exists a vast body of literature examining the determinants of vessel prices (*e.g.*, Greenwood and Hanson, 2015; Moutzouris and Nomikos, 2019), it focuses on a single vessel type and, thus, not on the price differential between eco and conventional vessels.

A further contribution of the paper lies in the fact that it provides an alternative model specification for the relationship between vessel prices and freight rates while controlling for various frequently incorporated shipping variables. Apart from the above contributions to the academic literature, the empirical findings have important implications for industry participants, policymakers, and regulators.

Data and Initial Findings

The empirical analysis is performed using weekly data from Clarksons' Shipping Intelligence Network (SIN) for a representative vessel type from each of the dry bulk and tanker sectors (which, combined, facilitate more than three quarters of the world seaborne trade), that is Capesize dry bulkers and Aframax tankers.[1] The sample period, given the limited data availability for eco-friendly vessels, ranges from August 16, 2019 to December 30, 2022 for Capesizes and from January 4, 2019 to December 8, 2023 for Aframaxes. The incorporated variables are the prices of second-hand vessels EP_t and CP_t – eco-friendly and conventional vessels, respectively – at period t; the time-charter (TC) rates $ETC_{t,}$ and CTC_t — for eco-friendly and conventional vessels, respectively; $Fuel_t$ costs; the percentage change in the fleet $Supply_t$ in terms of DWT,[2] capturing the supply in the sector; and sales of second-hand vessels scaled by the respective size of the fleet as a proxy for market liquidity, LQ_t.

Figure 1
Price and 1- and 5-Year Time-Charter Premia for the Capesize Sector



To examine the price differentials between eco and conventional vessels, the eco premium variables for prices, PP_t, and TC rates, TCP_t, are defined using the following formulas:

$$PP_t = \frac{EP_t}{CP_t} - 1 \qquad and \qquad TCP_t = \frac{ETC_t}{CTC_t} - 1$$

As suggested by Figure 1,[3] the estimated price premium for the Capesize vessels is 23.2% on average while the TC ones are close to 9.0%. Similarly, for the Aframax vessels, the corresponding figures are 24.9% and approximately 15%. This implies that TC premia on their own cannot explain the observed price premia.

Figure 2
Price Premium and Eco-Friendly/Conventional TC Rates for Capesize Sector

Furthermore, Figure 2 indicates that, when the price premium is low, freight market conditions are more prosperous, and the opposite. A potential explanation for this finding is that the eco vessel provides more secured income compared to its counterpart. Namely, in normal/recessionary shipping markets, where the demand for vessels is relatively normal/low, a period charterer would prefer leasing first the eco-friendly vessel (as it is more fuel-efficient but also because of ESG principles that become increasingly important). Accordingly, the residual demand for vessels is not significant, which results in a larger TC premium and, *ceteris paribus*, price premium during that period. Expansionary markets, in contrast, are equivalent to high demand for seaborne trade and tight supply of vessels. While eco vessels are still first employed realising very high TC rates, the increased residual demand pushes the TC rates of conventional ones high too –a relatively larger increase compared to the increase in the TC rates of the eco ones. As a result, the TC and price premia decrease during expansionary periods.

Methodology and Main Empirical Results

The authors further investigate the determinants of the documented eco price premium through a two-step empirical approach. First, since eco vessels have only recently become available, the time span of the available data is relatively limited. Hence, to develop a robust framework, the paper adopts the approach proposed by Caner and Hansen (2001) which allows testing for the presence of a unit root and of nonlinearity using a Wald test for threshold effects and Wald and t-tests for unit roots. The tests reject the null hypotheses of no threshold and of a unit root suggesting that the price premium follows a two-regime stationary nonlinear data-generating process driven by market conditions. Second, having tested various model specifications, the threshold autoregression (TAR) model of Hansen (1996) is chosen as the most appropriate and best performing one. In turn, this allows testing and analyzing the relationship between eco price premia and various shipping explanatory variables as freight rates, fuel costs, fleet supply, and liquidity in the second-hand market for vessels, depending on freight market conditions. Namely, Regime 1 captures the eco price premium dynamics in normal/recessionary market conditions and Regime 2 in expansionary ones.

The estimation results (Table 1) confirm that TC rates cannot determine on their own the eco price premium since the slope coefficient of TCP, while significant in all cases, is well below 1. Instead, mainly past price premia and growth in the supply of the fleet also possess significant explanatory power. This is in line with the previous finding of the paper that price premia are on average significantly lower than the TC ones. Furthermore, it is evident that the impact of the TC premium is more pronounced during expansionary phases of freight markets, which are also characterized by less persistence of price premia. Those findings are consistent across the dry bulk and tanker sectors.

The explanation for this could be related to the fact that, in expansionary markets, where sentiment is high (Papapostolou *et al*., 2014), an increase in the TC premium can have a greater impact on the valuation of the eco-friendly vessel than the previous price premium but also than fuel costs. In contrast, in normal/recessionary markets where investors are less optimistic and, thus, more conservative and capital availability is reduced, past price premia and fuel costs can play a more significant role in vessels' valuation.

Table 1
Estimation Results for the Model with the 1-year TC Rate

	$j =$ Capesize Threshold: $CTC_{t-3,j,0.5}$		$j =$ Aframax Threshold: $CTC_{t-4,j,1}$	
	Regime 1 $CTC_{t-3,j,0.5} <$ 32,875	Regime 2 $CTC_{t-3,j,0.5} \geq$ 32,875	Regime 1 $CTC_{t-4,j,1} <$ 32,000	Regime 2 $CTC_{t-4,j,1} \geq$ 32,000
Obs. (n)	87	83	153	61
c	0.0003*** (0.0094)	0.0376*** (0.0062)	0.0041** (0.0180)	0.0514** (0.0220)
$PP_{t-1,j}$	0.9143*** (0.0000)	0.5707*** (0.0000)	0.8513*** (0.0000)	0.5598*** (0.0000)
$TCP_{t-1,j}$	-	0.5372*** (0.0015)	-	0.2502*** (0.0009)
$TCP_{t-2,j}$	0.0562*** (0.0042	-	0.0569*** (0.0007)	-
$Supply_{t-4,j}$	1.8858* (0.0500)	2.1317* (0.0631)	-	-
$Supply_{t-8,j}$	-	-	1.2876** (0.0463)	2.7643** (0.0474)
$Fuel_{t-3}$	0.0019* (0.0530)	0.0476 (0.4800)	-	-
$Fuel_{t-4}$	-	-	0.0529*** (0.0026)	0.0011* (0.0911)
$LQ_{t-4,j}$	0.0031* (0.0140)	0.0046 (0.9713)	-	-
$LQ_{t-8,j}$	-	-	0.0018* (0.0215)	0.0021 (01874)
$\bar{R}^2$	0.8933	0.8872	0.9120	0.8841
$F - Stat$	1051.62*** (0.0000)		378.11*** (0.0000)	
$LR\ Test$	49.56*** (0.0030)		44.59*** (0.0000)	
Boostraps (n)	1000		1000	
Trimming	0.15		0.15	

This table reports the conditional least squares estimates for the threshold models with two regimes including the estimated threshold, the number of observations that lie in the first and second regime, respectively. LR is the likelihood ratio test for the null of no threshold whose p-value is computed through the bootstrap as suggested by Hansen (1996) with N bootstrap replications. The trimming % is the percentage of observations that are excluded from the sample so that a minimal percentage of observations lie in each regime. Figures in ( ) are p-values. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

In other words, if in expansionary markets, where TC rates for either vessel are already high, there is a larger increase in the TC rate for the eco vessel compared to the one for the conventional one, this signals to shipowners that investing in the eco vessel is indeed a reasonable decision. In contrast, in normal/recessionary markets, factors such as fuel costs gain more importance.

The slope coefficients for the fleet supply are significantly positive in all cases. While vessels with modern eco engines constitute less than 50% of the total fleet, their fraction has rapidly increased, that is from less than 19% of the total fleet in early 2019 to more than 33% at the end of 2023. This decreased appetite for conventional vessels and the increased supply of eco ones might be driving the prices of the conventional vessels down and, thus, the price premium up. Furthermore, fleet supply has a larger effect on the price premium in expansionary markets as investor sentiment and capital availability are increased.

A further interesting finding is that an increase in fuel costs has a bigger effect on the price premium in normal/recessionary markets. This is because, in normal/recessionary markets, fuel prices amount to a much larger fraction of the vessel's income compared to expansionary ones. As such, a period charterer would prefer leasing first the eco-friendly vessel as it is more fuel-efficient (but also a ship owner operating the vessel in the spot market would realize a higher profit). Finally, second-hand vessel transactions have a small impact on price premia. The authors re-estimate the model using the 5- year TC rates and the main results are similar to the ones discussed above.

Further Discussion and Conclusions

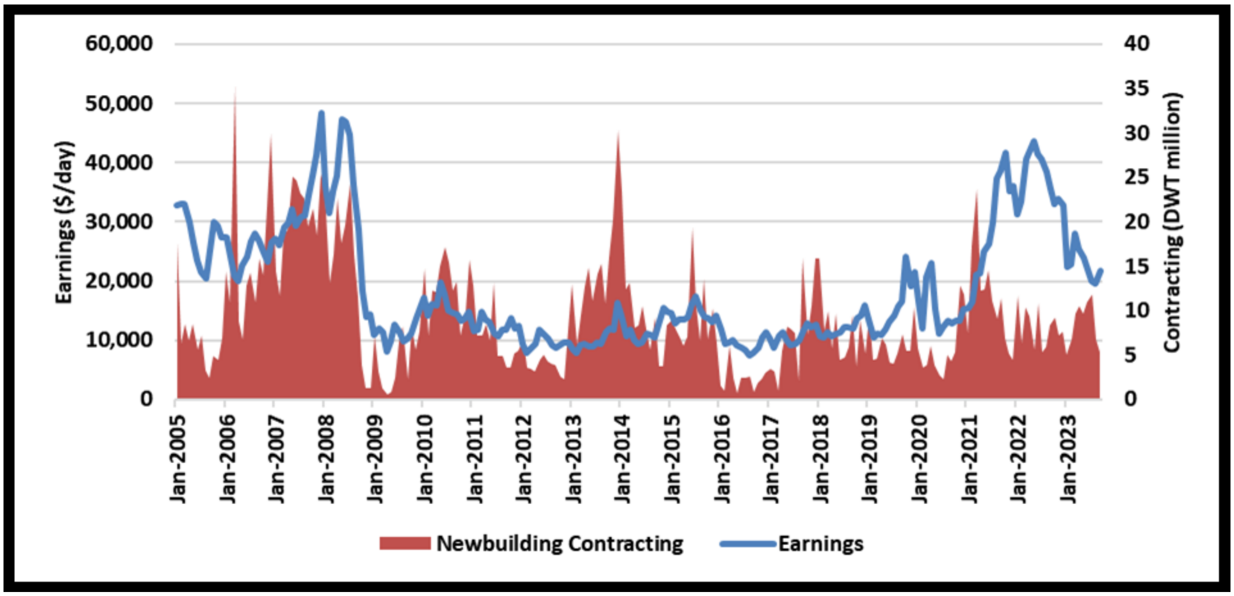
The authors find that eco-friendly vessels trade at an average premium of close to 25% compared to their conventional counterparts. However, the long-term cash flows generated by the former investment are only around 10-15% higher than for the latter. Furthermore, a brief analysis[4] on the cost of capital between standard and green/sustainability-linked loans reveals that the latter are cheaper by only 23 basis points. Therefore, neither the prevailing time-charter rates nor the cost of capital can explain on their own the observed price differential and justify the eco-friendly investment. Instead, the TAR model estimation suggests that the magnitude of the price premia can also (mainly) be attributed to the persistence of price premia and fleet supply, that is on expectations about the future.

To better understand this finding, it is useful to consider the increasingly strict regulations in the form of the revised and more ambitious 2023 IMO GHG Strategy, the Carbon Intensity Indicator, the inclusion of shipping in the EU Emissions Trading System but also the potential adoption of market-based-measures (such as carbon taxes) in the coming years. These are expected to give a strong competitive advantage to eco vessels against their conventional counterparts, expressed in high spreads between eco and non-eco freight rates and, thus, vessel prices. Thus, investing in the more expensive eco vessel, can be perceived as a rather medium- to long-term strategy.

To add to this complexity, this second-hand investment decision is associated with much less technological and regulatory uncertainty compared to the case of newbuilding vessels. The latter can have an economic life of more than 20 years and require in-depth consideration of factors such as future availability and price of alternative fuels, the required vessel specifications and technology to burn those, the current and forthcoming regulations (which can vary among jurisdictions) but also safety concerns related to alternative fuels as ammonia. Therefore, shipowners not only face the dilemma of whether to invest in a cheaper but more polluting conventional vessel or in a more expensive but eco-friendly one but also whether it is rational to postpone their investment decision for when there is more clarity regarding technology and regulations (Moutzouris, 2024). The latter has important implications on new building investment decisions.

Figure 3

Average Vessel Earnings and Investment in Newbuilding Vessels



Source of Data: Clarksons' Shipping Intelligence Network.

Namely, traditionally, the investment decision of shipowners was associated with the current and expected freight market conditions; however, the introduction of this "decarbonization risk" has, on the one hand, weakened the effect of freight rates on new building investment and, on the other hand, adversely affected shipping investment as a whole. Regarding the former fact, while from January 2005 to March 2018 there was a 58% correlation between investment in newbuilding vessels and freight market conditions, this has decreased to 21% from April 2018 and the adoption of the Initial IMO Strategy on the reduction of GHG emissions from ships. With respect to the latter fact, the average monthly investment in the period from April 2018 to September 2023 has decreased by 29% compared to the period from January 2005 to March 2018 (Figure 3). Related to that, as of September 2023, the average age of dry bulk and tanker vessels were circa 13 and 12 years, respectively, and the order books 6% and 8% of the fleet, correspondingly. This underinvestment in newbuilding vessels can have important adverse effects on the mid- to long-term supply of the fleet and the well-functioning of the shipping industry and, in turn, the efficient facilitation of world seaborne trade.

This research was motivated by the recent regulatory developments around shipping decarbonization and numerous related discussions and events with various stakeholders, including ship owners/operators, financiers, ship brokers, market analysts, charterers, and regulators. The main outcomes of those discussions are aligned with the findings presented here. As such, to reach the IMO environmental targets without threatening the well-functioning of the shipping industry and world trade, there is an increasing need for consensus among the different regulatory authorities and the various stakeholders.

Endnotes

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1 Capesize vessels have a typical cargo-carrying capacity of 180,000 deadweight tonnes and are mainly associated with the trade in iron ore and coal but also grains. Aframax have a typical cargo-carrying capacity of 115,000 deadweight tonnes and are involved with the transportation of oil.

2 A measure expressed in metric tons (1,000 kg) or long tons (1,016 kg) of a ship's carrying capacity, including bunker oil, fresh water, crew, and provisions. This is the most important commercial measure of the capacity.

3 For conciseness, the figures focus on the Capesize sector, but the patterns are similar for the Aframax one.

4 Based on data from Marine Money Deal Database and Clarksons' SIN, a sample of 69 shipping loans for the period 2020 to 2023 is collected and the average spread is calculated. The null hypothesis of equal means between standard and GLs/SLLs spreads at the 5% significance level cannot be rejected.

References

Caner, M. and B. E. Hansen, 2001, "Threshold Autoregression with a Unit Root," *Econometrica*, Vol. 69, No. 6, November, pp. 1555-1596.

Greenwood, R. and S. Hanson, 2015, "Waves in Ship Prices and Investment," *Quarterly Journal of Economics*, Vol. 130, No. 1, February, pp. 55-109.

Hansen, B., 1996, "Inference When a Nuisance Parameter Is Not Identified Under the Null Hypothesis," *Econometrica,* Vol. 64, No. 2, March, pp. 413-430.

International Maritime Organization (IMO), 2018, "Initial IMO GHG Strategy." Accessed via website:
https://www.imo.org/en/MediaCentre/HotTopics/Pages/Reducing-greenhouse-gas-emissions-from-ships.aspx
on May 7, 2024.

International Maritime Organization (IMO), 2023, "IMO Strategy on Reduction of GHG Emissions from Ships." Accessed via website:
https://www.imo.org/en/OurWork/Environment/Pages/2023-IMO-Strategy-on-Reduction-of-GHG-Emissions-from-Ships.aspx
on May 7, 2024.

Mackenzie, A., Bryce, C. and I. Moutzouris, 2024a, "Emerging Risks in Marine Decarbonisation: Time to Set Sail," Atrium Underwriters White Paper, Produced in Collaboration with Bayes Business School - City, University of London, February. Accessed via website:
https://www.atrium-uw.com/media/vz0nfiku/5647_27-atrium-marine-decarbonisation-whitepaper-v4a.pdf
on May 7, 2024.

Mackenzie, A., Bryce, C. and I. Moutzouris, 2024b, "The Insurance Implications of IMO Greenhouse Gas Initiatives," Working Paper, Bayes Business School - City, University of London.

Moutzouris, I., 2024, "Letter: Why Shipowners are Wary of Commissioning Green Vessels," *Financial Times*, January 23. Accessed via website: https://www.ft.com/content/a2189cd2-cd1e-4479-b853-2f861b1f33c2 on May 7, 2024.

Moutzouris, I. and N. Nomikos, 2019, "Earnings Yield and Predictability in the Dry Bulk Shipping Industry," *Transportation Research Part E: Logistics and Transportation Review*, Vol. 125, May, pp. 140-159.

Papapostolou, N., Nomikos, N., Pouliasis, P. and I. Kyriakou, 2014, "Investor Sentiment for Real Assets: The Case of Dry Bulk Shipping Market," *Review of Finance*, Vol. 18, No. 4, July, pp. 1507-1539.

Tiseo, I., 2023, "Shipping Emissions Worldwide - Statistics and Facts," Statista.com, December 18. Accessed via website: https://www.statista.com/topics/11288/shipping-emissions-worldwide on May 7, 2024.

United Nations Conference for Trade and Development (UNCTAD), 2021, "Review of Maritime Transport."
Accessed via website: https://unctad.org/publication/review-maritime-transport-2021 on May 7, 2024.

United Nations Conference for Trade and Development (UNCTAD), 2023, "Review of Maritime Transport."
Accessed via website: https://unctad.org/publication/review-maritime-transport-2023 on May 7, 2024.

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