Assignment 2

Paper 1

# Question 1:

**Physical contracts (Time Charter):**

Physical contracts, like Time Charter, gives the charterer control over a vehicle commercially. They also give access to a transportation service for a certain period. The charterer can freely decide the operational route and other logistics to optimize the profit. Another advantage is that time charters have fixed rates, thus simplifying accounting.

Physical contracts also have disadvantages. They are not flexible. Once a vessel is chosen it cannot be changed since contract termination can be very costly. There is also a default or counterparty risk since they are bilateral contracts.

**Financial Contracts (Forward Freight Agreement, Freight Options):**

Financial contracts, being cash-settlement provides the advantages of providing higher flexibility since they are not tied to a particular vessel. They also have lower risk since they are cleared by a clearing house.

Financial contracts do not provide access to a vessel. They also induce a chance for cash flow differences (basis risk) due to differences in vessel specifications, trading patterns and contract timings.

# Question 2:

Convenience Yield is the value we associate with having access to a vessel, which is available for transportation services. We can choose its operations, trading routes and logistics to optimize profits. A time charter generally costs higher than freight derivatives because it includes this convenience yield.

In periods with high demand for vessels, the convenience yield is high since having access to a vessel becomes expensive. In periods with low demand, there is excess supply of vessels hence convenience yield is low.

Example – During the 2008 global financial crisis, there were geopolitical tensions, especially in the Middle East were at their peak. There was a rush to buy and secure oil. This led to a shortage of oil carrying vessels, leading to a very high convenience yield.

# Question 3:

The author empirically evaluates the dynamic differential between the time series of TC and FFA rates. They address the characteristics of the time-varying risk premium or convenience yield that this differential represents from a theoretical point of view. The Efficient Market Hypothesis and No Arbitrage principles were used, asserting discounted cash flow from TC and equivalent FFA should be equal. However, the differences in risk and convenience yield result in a persistent differential.

The author used Johansen cointegration test to statistically test the for the co-integration of the time-charter and FFA rates. Then performed Likelihood Ratio tests on the restriction implied by the EMH.

Next the author wanted to assess the differential between the two series and its time-varying dynamics. The autoregressive-moving-average model (ARMA-X) was used, with added linear terms describing the average. Then the author incorporated vessel and contract specific variables into the model to analyse their effects on TC-FFA differential.

# Question 4:

**Macro Level:**

**Convenience yield:** TC-FFA differentials in the Capesize, Panamax and Supramax follow an ARMA-X process. The AR coefficients suggest that the differential is mean reverting. The coefficient of ln(TC) is positive and highly significant. This means TC-FFA differential is directly related to level of freight rates in the market.

**Risk Premium:** The coefficients of market default probability (DEF) are positive and significant. This means as default risk increases, so does TC-FFA differential. Addition premium is required to offset the risk present in physical contracts compared to financial contracts. We can infer that higher freight rates could mean higher default risk, thus higher risk premium.

**Micro Level:**

**Convenience yield:** Vessel specific features like age, speed, size and consumption are highly significant and have their expected signs in the table. Younger and larger ships get to charge a premium while older and smaller ships have to give a discount. The coefficients of contract terms also follow expected signs (negative impact of delivery location in the Pacific and Indian Oceans on the TC rate).

**Risk Premium:** The coefficient of market default probability (DEF) is significant only in the case of Capsize model. It is insignificant in both Panamax and Supramax models. Therefore, the risk premium due to default risk is more pronounced in the Capesize segment and lower in other vessel segments.

# Question 5:

The paper mentions a hedging strategy involving TC-FFA differentials. If the TC-FFA differential is positive, the operator can charter in a vessel in an index-linked TC, charter it out to a fixed rate TC and simultaneously buy FFA for the equivalent duration. This will result in two index-linked cash flows to cancel out, leaving the TC-FFA price differential as profit. If the TC-FFA differential is negative, we can simply reverse this setup. The operator sells an FFA, charters in a fixed rate TC while subletting on a spot index-linked TC with the same duration. The profit is the sum of the absolute value of all daily TC-FFA differentials.

Table 7 contains estimated coefficients for the valuation of TC rates based on vessel and contract-specific factors, as well as the FFA curve. We can use them to optimize our hedging strategy. The table shows that every additional unit of DWT increases the TC-FFA differential. High speed vessels and those lower fuel consumption also have higher TC-FFA differential. Therefore, they require a higher FFA position to avoid under hedging.TC with longer contract periods and more forward days reduce the TC-FFA differential. Vessels delivered in the Pacific or Indian Oceans typically earn less than those delivered in the Atlantic. FFA positions should be reduced in these cases to avoid over hedging. An increase in default probability (DEF) adds to the TC-FFA differential, particularly for larger vessels like Capesize so FFA positions should be increased to cover additional risk.

Paper 2

# Question 1:

The phrase "Bermuda Triangle" has been used metaphorically by the author. It is a region in the western part of the North Atlantic Ocean where ships and aircrafts have disappeared under mysterious circumstances. It is said to be an area that is difficult to traverse. The author compares it to the interconnected and complex relationship between the weather, electricity and insurance derivatives. The trisection of these three markets presents unique challenges which are difficult to traverse.

Weather conditions have been a cause for variability in revenue for utilities (like electricity) for a long time. This led to volatility in electricity prices, which in turn affected the risk management strategies of power marketers and producers. Simultaneously, insurance companies are heavily exposed to weather related risk, like hurricanes, tsunami, earthquakes. This leads to significant financial losses.

The convergence of these factors creates a complex and interdependent environment where the pricing and hedging of derivatives become critical. The author highlights this intricate relationship to emphasize the need for innovative financial instruments, like weather derivatives, to manage the risks. Economic actors whose revenue could be hurt by extreme weather conditions will hedge their risk by buying weather derivatives. However, the complexity lies in the analysis of how much to buy so one is neither over hedging, nor under hedging. Thus, they must carefully navigate in this “Bermuda Triangle” of interconnected markets.

# Question 2:

The author states that power marketers, power producers, and insurance/reinsurance companies are closely monitoring the growth of the weather derivatives market in the U.S. These are the major sectors facing direct exposure to weather-related risks.

Weather significantly affects demand for energy sources like gas and electricity. This impacts the revenue and operational stability of power marketers and power producers. Extreme weather conditions can lead to unexpected shifts in energy consumption. This results in a volumetric risk, caused due to fluctuations in demand. Traditional financial derivatives are tied to equity, exchange rates or interest rates. They lack the capability to handle these types of risks. Thus, weather derivatives become an important tool for ensuring smooth cash flow and mitigate risk. Therefore, any development in weather derivatives is closely watched by power marketers and producers.

Natural disasters like earthquakes, tsunamis and hurricanes lead to large scale claims in insurance/reinsurance companies. This makes it critical for them to hedge against this risk, otherwise they may face large financial losses. Weather derivatives are based on National Weather Service data. They prove to be a viable solution to manage the impact of extreme weather conditions. Insurance companies can maintain stable finances when faced with these adverse weather conditions if they use weather derivatives as a part of their hedging strategy. Thus, they too watch any development in weather derivatives is closely.