

## CASS BUSINESS SCHOOL

### Shipping Risk Management

Academic Year: 2022 – 2023

### Coursework Assignment for MSc Insurance and Risk Management Students Only

**Notes:**

This coursework carries 100% of the overall mark for the Shipping Risk Management unit and should be completed by **groups of two students**. Students are free to choose their partners in doing the coursework and producing the report. Any attempt to copy or replicate other groups' work will be considered as plagiarism and will result in the failure of both parties.

Answers should not exceed 10 pages. Therefore, answer each question briefly and precisely without omitting relevant points. Tables containing summary of the results should be included in the main text and data, estimation output, etc. should be relegated to appendices or on an excel spreadsheet which can also be uploaded on Moodle. Mention clearly and explicitly any assumptions made in solving the problems.

The deadline for uploading the coursework report on Moodle is: **Monday 10<sup>th</sup> July 2023**.

**Objectives:**

The aim of this coursework is to familiarize yourselves with the concepts of shipping derivatives and risk managements. In particular, students will learn how to: execute a freight hedging strategy in dry and wet bulk shipping operations, use freight options in risk management, manage bunker risk in shipping operations, analyse credit risk assess default probabilities, and finally assess and monitor risk exposure of freight derivatives using VaR.

### Question 1: Container Market Hedging

The following table presents the forward curve for FBX01 (China/East Asia to North America West Coast) on 01/09/2021. Rates are quoted in US\$/FEU.

BFA FBX

Baltic Exchange Forward Assessment for FBX

FBX01-FFA Change Date:

Routes	Period	Value	Change
FBX01CURMON	Sep 21	25,750 \$ 01/09/21	+0
FBX01CURQ	Q3 21	18,808 \$ 01/09/21	+0
FBX01+1Q	Q4 21	20,250 \$ 01/09/21	+0
FBX01+2Q	Q1 22	14,000 \$ 01/09/21	+0
FBX01+3Q	Q2 22	10,500 \$ 01/09/21	+0
FBX01+4Q	Q3 22	9,000 \$ 01/09/21	+0
FBX01+1CAL	Cal 22	10,500 \$ 01/09/21	+0
FBX01+2CAL	Cal 23	8,500 \$ 01/09/21	+0

**A:** Explain how a Shipper can use the Forward rates above to hedge the risk arising from fluctuations in Container Freight Rates.

**B:** Walmart anticipates that it will need to ship 100 FEU boxes from China to USWC for each month of the 4<sup>th</sup> quarter of 2021 (Q4-21) and the first quarter of 2022 (Q1-22). Walmart is mindful of the high volatility in container freight rates and is looking into the FBX FFA market to hedge its exposure. Advise Walmart on what would be the best strategy to hedge its freight rate risk.

**C:** Using the data from the attached spreadsheet, (tab: FBX-01) calculate the effectiveness of the strategy for Q4-21 and Q1-22

[20 marks]

## Question 2: Financial Markets and Derivatives Terminology

A cargo forwarder is new to the area of risk management. He is therefore reaching out to you to ask for your guidance with respect to the following terms:

**A:** Basis and Basis Risk

**B:** Backwardation and Contango

**C:** What is a Clearing House and how Marking to Marking Works?

In each case, provide the definition and give an example of how it would apply to the Container FFA market.

[20 marks]

## Question 3: Freight Options and Bunker Swaps

A) Consider the following option quotes on 23/02/18 for BCI 5TC Options.:

Capesize	Q3 18	Premium (\$)	Q4 18	Premium (\$)	CAL 19	Premium (\$)
Put	12,500	690	12,500	479	12,500	1,687
	13,500	954	13,500	667	13,500	2,113
	19,700	3,724	22,750	4,335	17,000	3,940
ATM	19,750	3,754	23,750	4,798	18,000	4,350
	20,700	3,390	24,750	4,424	19,000	4,003
Call	25,000	2,127	25,000	4,334	25,000	2,469
	26,000	1,908	26,000	3,995	26,000	2,284

Source: Clarksons – 23/2/18

1. Show, with the help of a diagram, how a shipowner and a charterer can use options to hedge their freight income or cost for the last two quarters of 2018. Determine the cost of the option hedge in each case. Using the data from the realised spot Baltic assessments, determine the payoff of those option positions at the expiration of the contracts.

[5 marks]

2. Construct a collar that guarantees the freight cost for the last two quarters of 2018 for a charterer to be between 26,000 and 13,500 \$/day. Using the data from the realised spot Baltic assessments in 2018 determine the payoff of those option positions at the expiration of the contracts. With the benefit of hindsight, what would have been the best strategy that the company should have followed?

[5 marks]

**B) It is 12<sup>th</sup> June 2023**, you are working for a liner shipping company and your 12,500 TEU ship takes 5000mt of 380cst bunker every month in Rotterdam. Currently you are about to negotiate the price to hedge your bunker exposure for the next 12 months (July 2023 to June 2024). The following forward curve for Rotterdam 380cst is shown on CME screen.

- a) Assuming a flat interest rate term structure of 4% for each of the next 12 months, calculate the swap rate for a 12-month fixed for floating swap.
- b) Briefly discuss what other risks are involved in using a series of forward or a swap contract to hedge your bunker exposure in this case.

**Rotterdam Fuel Oil 380 cst (Platts) Futures Quotes on 12 June 2023**

Maturity	Forward Rate		Maturity	Forward Rate
Jul-23	595.153		Apr-24	577.975
Aug-23	598.225		May-24	573.6
Sep-23	599.35		Jun-24	568.725
Oct-23	597.725		Jul-24	563.725
Nov-23	594.475		Aug-24	558.475
Dec-23	591.475		Sep-24	552.6
Jan-24	588.85		Oct-24	546.225
Feb-24	585.725		Nov-24	539.225
Mar-24	581.975		Dec-24	532.85

[10 marks]

**Question 4: Risk Analysis and Value at Risk**

Given the Baltic Assessments for 2 quarters ahead FFAs for Average 5TCs of Capesize and 4TC of Panamax (5TC\_C+2Q and 4TC\_P+2Q) from 1 Jan 2018 to 7 June 2022 in Excel worksheet “BFA CSZ & PMX”,

- a) Estimate the Rolling Volatility (annualised standard deviation) of the series using a 62-day window.
- b) Estimate the Exponentially Weighted Average Volatility (RiskMetrics approach) for the series over the same period as in part a), and plot the two volatilities, assuming  $\lambda=0.94$ .

variance 
$$\sigma_{x,t+1}^2 = \lambda\sigma_{x,t}^2 + (1 - \lambda)r_{x,t}^2$$

- c) Estimate and plot the 1%-5day VaR for the two FFA prices from 8 June 2021 to 7 June 2022, using the Exponentially Weighted Average Volatility, and 250 days rolling volatility.

[20 marks]

### Question 5: Credit Risk Assessment

You are working for an investment bank's shipping division in charge of credit assessment of clients. You are given two projects to look at and evaluate their credit risk.

- 1- The first project involves a 5-year loan for the purchase of a 7-year old MR tanker whose current market value is \$28m.
- 2- The second project involves a 5-year loan for the purchase of a 10-year old Suezmax tanker whose current market value is \$38m.

Both projects are set to operate on a one-ship-one-company basis and the companies would like to borrow as much as possible to the full price of the vessel. However, your bank has a strict policy of taking the vessel as collateral and only approving loans with a maximum default probability of 15%, in order to reduce its credit risk exposure. It is also known that both borrowers have good business and credit history; therefore, according to the assigned credit rating of borrowers, default may occur if value of the asset falls 5% below the amount borrowed.

- a) Assuming that the volatility of the second price for 7-year old MR tanker is 25%, the volatility of the second price for 10-year old Suezmax tanker is 30%, the risk free rate is 4%, determine the maximum amount of funds that you are permitted to provide to each shipping company for the purchase of these vessels.
- b) What would be the yield on each of these asset-backed loans and their risk neutral recovery rates?
- c) What would be each loan amount, yield on the loan if it was sold in the market, and recovery rate for each project, if the bank increases the acceptable level of probability of default for this loan to 20%?
- d) Discuss what other alternatives the bank has to reduce its credit risk exposure to this deal.
- e) **Optional:** build a GBM model for the evolution of ship prices and find the probability of default at the end of year 3, using MC simulation.

[20 marks]