OPTIMIZATION OF CAPITAL STRUCTURE AND EQUITY SIZE AS A FUNCTION OF HEDGING POLICY

By Finn Dalheim

As freight derivatives markets are becoming increasingly efficient, lower costs of hedging may change the optimal capital structure of a shipowning company.

What type and level of hedging pays off for a company in terms of lower cost of capital and increased capacity for expansion?

ECONOMIC CAPITAL REQUIREMENTS

With the steady growth in the market for freight derivatives instruments, large scale "strategic" hedging programs in bulk shipping have become a realistic proposition. The similarities between active portfolio management in finance and in shipping are becoming even more pronounced than in the past. A shipping company now has the possibility to significantly modify its market risk exposure, rapidly and with low costs, without changing its physical trading pattern. This has interesting implications for the optimal capital structure and required equity size of a shipowning company. Risk management can be viewed as a direct substitute for equity capital. The better the company hedges its market exposure, the less equity it requires to support its business. The use of hedging to reduce exposures effectively increases a company's debt capacity. Thus, a company's decision to hedge financial risk should be made jointly with the corporate capital structure decision.

To illustrate this, as an example, we look at the economic capital requirements of two shipowning compa-

Example: Market Value of Company "A" and "B", August 2002

Asset/ Liability	Market Value (million USD)	Number of Vessels	Total Value (million USD)
Panamax	16.5	10	165.0
Capesize	27.5	5	137.5
Total Fleet	44.0	15	302.5
Loans			181.5
Net Equity			121.0

Table 1

nies as a function of various types of hedging.

Company "A" and "B" each own 10 Panamax bulkers and 5 Capesize bulkers, with an average age of 5 years. To simplify the calculation of its portfolio market value, we assume that the average value of each Panamax vessel is 16.5 million USD and each Capesize vessel 27.5 million USD.

Based on observed monthly returns over the 10 year period 1993 to 2002 for Capesize and Panamax bulkers, we have calculated the probability density function for the value of the total (fleet) portfolio of 15 vessels after one month. Figure 1 shows the distribution of the results from a Monte Carlo simulation with 10000 runs (scenarios) of the unhedged portfolio value. From this simulation we can calculate the Value-at-Risk (VaR(1M,95%)) of the portfolio, defined as the worst loss that the portfolio can be expected to have over one month with a probability of 95%.

Assuming a liquid market for secondhand tonnage, each company always has the option to sell, and charter back if necessary, one or more of its vessels to increase its cash reserves.

The only significant liability of both companies is a bank loan of 60% of its total fleet value, i.e. (302.5*0.6)= 181.5 million USD. Since this is financed at a floating interest rate of LIBOR plus 100, there is no VaR for the loan principal, the only VaR for this liability is the net present value (NPV) of the interest expenses over the period in question.

The Chairman of the Board and majority shareholder of Company "A" has most of his wealth invested in shares in the company. He is aware that his investments are not well diversified according to modern portfolio theory. Partly in order to compensate for this, he has decided to implement a risk management program in Company "A", and to appoint a Risk Manager and a Freight Derivatives Trader. The risk management strategy for Company "A" states that the primary goal of its risk management is to secure against the unlikely but very costly event of a default situation in a low freight market, while retaining most of the upside potential in accordance with the company's market view. Company "B" does not have an explicit risk management strategy and remains fully unhedged.

MARKET RISK MANAGEMENT

There are a number of ways to achieve this goal. Company "A" could choose to sell Over-The-Counter (OTC) FFA/swaps or buy put options (swaptions) on average rate swaps over the coming 12 months at a level that should secure its net equity value against falling

Probability Distribution of Fleet Value from Monte Carlo Simulation

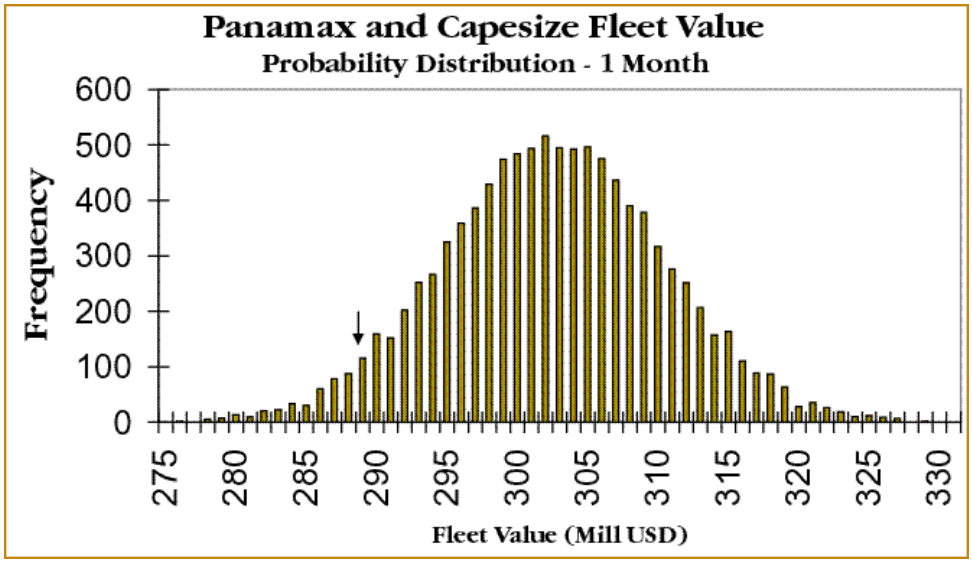

Figure 1

below 64 million USD. This corresponds to keeping the gross portfolio value of its assets above 238.5 million USD. The most convenient settlement basis for the derivatives instruments would be the average spot TC rates for Panamax or Capesize vessels. When the company expects a flat to falling market over the coming 12 months, it may decide that a one-year, "no-cash collar" is the most efficient way of hedging its exposure. A potential benefit of 3000 USD/day is given up by selling a call option to finance a put option at approximately 3000 USD/day below the present forward market. In a low market, the company will usually benefit here from forward prices being higher than spot (contango).

Risk management is not costless, so why should a bulk shipping company spend resources on measuring and managing its risk exposure?

Since there is considerable evidence that rates in the dry bulk spot market follow a close to lognormal distribution (the logarithms of the returns are normally distributed), with somewhat fatter tails, there is always a certain risk of low freight rates causing a default situation. Default situations can be very costly to a company and its owners, so a primary goal for risk management is the elimination of such costly "lower-tail" outcomes.

Due to specialized information and extensive experience, some companies probably have a comparative advantage in bearing freight market risk, while others mistakenly think and act as if they do. Who has met a chartering manager who doesn't think that he has an above average ability to forecast the direction of the market for the next six to twelve months, although he will usually concede that it is unusually difficult right now? Even if only half of them are right, at least that half of the market should benefit from selective hedging in accordance with their market views. There is actually considerable evidence that some individuals, after more than about ten years of active involvement in a market, can have special knowledge and market understanding that gives them consistently better than random forecasting ability. Any company that thinks it has a comparative advantage in forecasting dry bulk freight rates should take a close look at its actual historical performance in its position taking. Also, increased derivatives trading in freight is likely to make the market more efficient and thus reduce some of its previous comparative advantages.

DIFFERENCES IN CAPITAL REQUIREMENTS FOR OWNERS AND OPERATORS

One of the competitors of Company "A" and "B", Company "C" prefers not to invest in owned tonnage but to charter in a mix of Panamax and Capesize tonnage on 12 months time charters. We have simulated the probability density function for Panamax and Capesize timecharter based

on the observed monthly rates for the last 10 years. As shown in Table 2, the VaR for Company "A's" hedged vessel portfolio is about 6.5 million USD and for Company "B's" portfolio –12.9 million. USD (1M, 95%), compared to about 6.7 million USD for Company "C's" timecharter portfolio. In order for Company "C" to have the same VaR (1M, 95%) as Company "B" at present market levels, our simulations show that its portfolio would have to include about 19 Panamaxes and 10 Capesizes on 12 months' time charters.

Assuming the same type of credit risks and operational risks, and approximately the same liquidity for the instruments in a portfolio, in this case vessels and time charters, two companies with the same portfolio VaR should have approximately the same economic capital requirements.

In a shipping company, economic capital is the cushion that protects against the risk inherent in the business, risks that would otherwise affect the security of its loans. The purpose of economic capital is to provide confidence to claim holders such as creditors and customers. Economic capital is designed to absorb unexpected losses, up to a certain level of confidence. The choice of confidence level and risk horizon is a strategic decision that should be made by senior management and the Board of Directors. A typical level is about 99 percent for one year, which means that there remains a probability of 1 percent that actual losses will exceed the amount of economic capital.

Value-at-Risk Examples for Vessels and Timecharter Portfolio

Value-at-Risk	Comparison (1M,95%) (Figures in $ mill)	Mean	95 %	VaR
Company "A"	Hedged Vessel Portfolio	302.1	295.6	6.5
Company "B"	Unhedged Vessel Portfolio	302.1	289.2	12.9
Company "C"	Timecharter Portfolio	40	33.3	6.7

Table 2

Determining VaR at the 99% confidence levels is complicated by the fact of "fat tails". While the assumption of lognormal price distributions (normal returns) works reasonably well up to 95%, reliable predictions for the 99% level and above require more sophisticated methods involving extreme value theory (EVT). However, since our purpose in this analysis is primarily to consider the effect of various hedging policies on capital structure, we can use a simplified approach to get rough indications.

From the results of the Monte Carlo simulation shown in Figure 1, we find the unhedged portfolio value after one month at the 99% confidence level to be 283.6 million USD, giving a VaR (99%,1M) of 18.5 million USD. By using the "square root of time" rule of thumb, this translates into a VaR (99%, 1Year) of about 64 million USD. In this case, if Company "B" has an economic capital corresponding to a net equity capital of about 64 million USD, it will have enough to cover its losses in 99 years out of 100. This is a simpli-

fied "base case", with the vessels completely unhedged, i.e. operating in the spot market with no long term timecharters or COAs and no use of derivatives instruments.

DETERMINANTS OF OPTIMAL CAPITAL STRUCTURE

Having too little equity capital in a shipowning company will be costly because of the high risk of default and the corresponding high credit costs and reputation costs. Keeping more equity capital than necessary is also costly since it means that a number of profitable investments opportunities will not be taken. Although difficult to calculate with a high degree of confidence, there exists at any point in time an optimal capital structure for the company given its market environment. This capital structure should ensure a cash level sufficient to cover all covenants/obligations.

From a shipowner's point of view, the following four factors are crucial in determining the optimum capital structure for the Company at any point in time:

a. Value-at-Risk/Economic Capital (risk of default)
b. Cost of equity
c. Cost of credit and its sensitivity to market risk exposure
d. Cost of hedging

Reducing the VaR and thus improving the ability of the company to service its debt, should have an impact on how many points above LIBOR the company has to pay for its loans in a normal market situation. In addition comes the value of the reduced risk of default, which can be calculated as the probability of default and near default multiplied by the estimated total costs to the shareholders of an actual default and near default situation respectively.

The cost of hedging against an expensive "lower-tail outcome" can be approximated by the cost of a far out of the money put option.

HEDGING POLICY CHOICES IN PRACTICE

In today's markets it's normally not possible to lock in an acceptable return on the investment from buying a standard Panamax or Capesize vessel and simultaneously fix its employment in the open market on a secure, long term contract of affreightment (COA). The economic law of arbitrage pricing will prevent this from happening except under very special circumstances.

A common view in the industry is that a well-run dry bulk shipping company today probably derives about 40-50% of its profitability from position taking on market movements, another 20-30% from close customer relations giving the ability to deliver superior performance at extra margins, and the last 20-40% from optimising vessel trading patterns and substitution of vessels and cargoes.

If this is a reasonably correct picture, it implies that the ability of the management of a bulk shipping company to forecast market rates for some time period ahead is a key factor in the company's overall competitive situation. In this case it becomes important for the company to have the ability to adjust its market exposure according to its market views with a minimum of costs and resources.

Since there is no way to hedge vessel values directly with derivatives, the best way today to modify VaR for the portfolio of Company "A" will be with the use of freight swaps/FFAs, futures or options either on timecharter rates or voyage rates or a mix of the two.

Hedging the value of a portfolio of vessels with freight derivatives instruments is not completely straightforward in practice. The linear correlation between Panamax timecharter rates and vessel values over the 10-year period is about 0.66. However, as can be seen from the chart in Figure 2, the relationship is probably not really linear, especially at very low levels limited by lay-up rates and scrapping prices. Also, the expected efficiency of a hedge will depend to a large extent on the actual price ratio and forecasted correlation and volatility for the hedging period at the start of hedging. In addition, the introduction of trading in derivatives instruments brings new risk exposures to the organization, mainly related to credit risk and operational risk. Some of the choices the company will have to make are the following: Which instruments to use, which time period to cover, how large should the size of the hedge be?

OPTIMIZATON PROCESS

Computing the optimal capital structure for a shipowning company, given its chosen hedging policy and resulting risk exposure as measured by VaR, can be a relatively straightforward task. The real challenge, however, usually lies in determining the optimal hedging policy, and the most difficult variable to assess here is the company's comparative advantage in bearing market risk for e.g.

the next 12 months.

A good way to start an optimization process is to answer some key questions in a risk-taking audit for the firm. Which major risks is the company exposed to? Which of its major risks has the company proved that it can handle well over a complete business cycle? What is the source of the company's comparative advantage in taking positions?
Which risk management activities have consistently added value in the past without introducing other sources of volatility?

Correlation chart of Panamax TC Rates vs Vessel Values

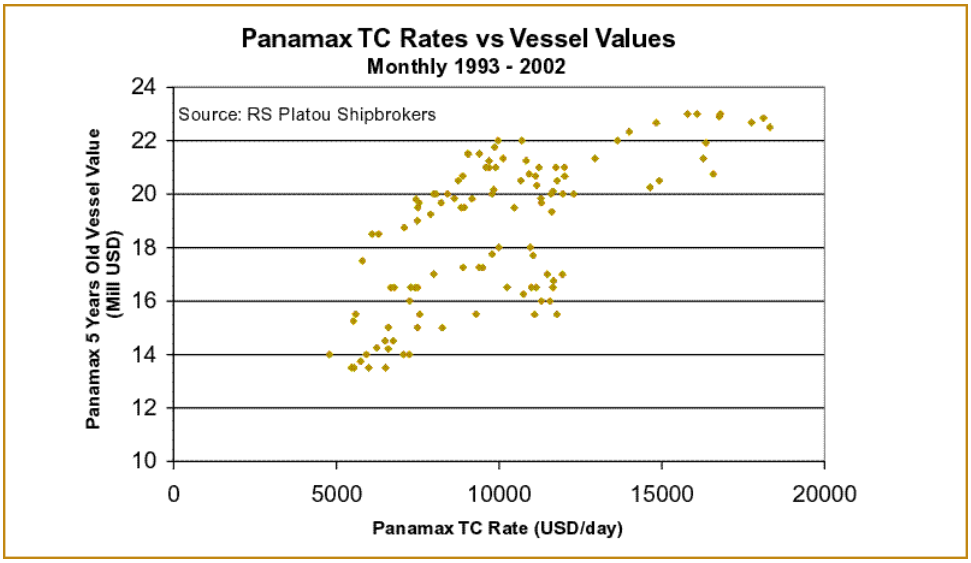

Figure 2

Senior management must consider which of the risks should be hedged and which risks the company should assume as part of its business strategy. The objectives should be set in clear, executable directives.

After having answered the questions above, the next steps should be to evaluate suitability of various hedging instruments, to organize the hedging activity and to execute the required hedging transactions. Next, best practices for reporting monitoring and maintenance of hedges should be implemented. This also includes looking at organizational issues like measuring and rewarding managerial performance.

RESULTS, CONCLUSION

In a fiercely competitive industry like bulk shipping, with low barriers to entry, high exit barriers and a chronic tendency towards overcapacity, the question of finding the optimal capital structure for a firm is closely connected with the question of what is an optimal company size in this industry. Assuming that a company with 10 Panamax and 5 Capesize vessels is below the optimal size, the preferred choice for the owner of Company "A" would probably be to use the increased debt capacity resulting from its hedging activities to expand the activities of the company. We should not be surprised to see Company "A" with 20 Panamax and 10 Capesize vessels in its portfolio over the next few years, and with an improved return on its equity capital. And Company "B"? With no clear hedging policy, it will probably continue to feel that it needs to have its present level of equity capital in order to be able to meet its commitments at all times. It may have maintained the same fleet size, and it will continue to give its owners a relatively low rate of return on equity. Unless, of course, it is taken over by Company "C, the operator that rapidly introduced the use of freight derivatives for active risk management as part of its expansion strategy.

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