Melbourne Centre Academic Research Grant Program

Proposal of Project: 'Integrated Framework for Financial Ship Risk'

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Background and aims of project

Aims

The project 'Integrated Framework for Financial Ship Risk' will develop an approach to measure financial ship risk. The framework will allow the prediction of likelihood and severity of credit losses to ship financing companies such as banks and leasing firms. The analysis will be based on secondary market ship prices as well as shipping company information such as public ratings, market and book values. The derived risk drivers as well as relationships may be applied to secured loan and lease portfolios.

Background

Shipping is one of the world's most capital intensive industries. Debt financing of ships involves operating and financial leases as well as secured bank loans (compare *Stopford*, 1997).

The earnings of the shipping industry are highly related to the business cycles of particular countries as well as their aggregates. The risk in lease financing involves the risk that lessees do not meet their lease obligations (credit event) and that lessors incur costs from repossessing, refurbishing and remarketing the respective ships. Note that next to the general economy particularly interest rates are a major driver of (re-) lease rates. The risk in secured lending involves the risk that obligors will not meet interest and principal payments (credit event) and that ship values which typically serve as collateral are insufficient to cover outstanding amounts.

Therefore financial ship risk management involves the forecasting of the

- Probability of default, i.e., a measure for the likelihood of credit events as well as
- Ship values or ship lease rates, i.e., a measure for the severity of credit events.

Please note that both dimensions are highly dependent on each other. According to the seminal work of *Merton* [1974] and *Black/Scholes* [1973], credit events occur when a company's asset value falls below the value of debt. The asset value of a shipping company depends to a large degree on the value of its ship portfolio.

Significance and innovation

The proposed project is significant and innovative with regard to several aspects:

- The measurement of credit risk has so far focused on bank loan portfolios. Especially the measurement of credit risk to leasing companies has been neglected.
- The measurement of credit risk has so far focused on publicly listed obligors. In the shipping industry little information is available on the shipping companies but a lot of information is available on ship prices. The measurement of credit risk based on the value of the assets of a company is expected to provide valuable information.
- The likelihood and severity of loss events are generally modelled in independent modules. Recent studies suggest that both measures are correlated (see e.g., *Altman* et al, 2003). In extension to this research, the applicant suggests a simultaneous framework to incorporate the dependency.
- The outcome will be particularly valuable for the ship finance industry. The drivers of ship risk will be identified and benchmarks for models and model estimates developed. Please note that financial risk modelling in this industry is still at an early stage. One advanced study by *Tsolakis* et al (2003) focuses on the modelling of ship values but does not look at the implications on the credit risk of shipping companies.

Description of Approach

The proposed project consists of three parts:

Part 1: Model for ship values

A model for ship values will be developed. In this model, historic ship values for the categories tanker, bulk carrier and other dry cargo carrier will be modelled by:

- Idiosyncratic factors which represent ship-specific variables such as the age, model, condition or tonnage;
- Systematic factors which represent macroeconomic variables such as GDP, an interest rate or the unemployment rate;
- A time specific random effect.

Note, that future lease rates can be derived from the model and the yield curve of the lessor's country of financing. The factor loadings will be estimated by a nonlinear regression model with time-specific random effects. Versions of these models were applied in the previous research of the applicant for the estimation of the loss distribution of loan portfolios (see 'List of publications over the last five years').

Part 2: Model for shipping company credit risk

Similar to the model for the ship values, a model for the probability of default will be developed based on the rating history of selected shipping companies. The model will include idiosyncratic factors (which represent obligor-specific variables such as the country, firm size, financial ratios or the long-term average credit quality of a shipping company), systematic factors and a time-specific random error. The random error may be correlated to the one mentioned in Part 1. This could imply that in a given year a high probability of default may come along with a low ship value and therefore a high loss given default to the lender or lessor. In addition to the above mentioned risk drivers, the forecasted ship prices will be included as risk drivers into the analysis. Please note that the suggested model type is comparable to a Merton-style structural model (compare *Hamerle* et al, 2004).

Part 3: Forecasting single and multiple exposure risk

In the third project part, the exposure to a single financing contract or a portfolio thereof will be forecast. The objective of this exercise is to determine the impact of cross-collateralization and diversification on the credit risk of a ship loan or lease portfolio (compare *Hallerstrom* et al, 2000). The credit portfolio risk will be measured by the percentiles of the simulated forecast loss distribution which is based on the forecast probabilities of default and ship values or ship lease rates.

The analysis will initially be based on a portfolio of selected shipping companies with known ship portfolios. In a subsequent project a real portfolio given by a bank or lease firm could be evaluated (compare section 'Nature of expected outcomes'). This could particularly be motivated by an intended risk transfer to another party.

Nature of expected outcomes

The project will improve the risk management frameworks for the banking and leasing industry. The findings will be summarized in a project research report. In addition, the applicant expects the following proceedings from this important study:

- At least one research paper will result from the proposed project. The paper will be published on the internet site of the *Melbourne Centre for Financial Studies*, presented at international conferences and submitted to a refereed journal such as the *Journal of Banking and Finance*, *Journal of Risk* or *Journal of Maritime Economics & Logistics*.

- It is expected that the results will earn the interest of banks as well as leasing firms. This may lead to future research collaborations. The applicant intends, next to ship finance, a future extension of the research to aircraft and train finance. Ideally, this will be structured as an *Australian Research Center* grant. In addition, existing ship loan or lease portfolios could be evaluated which should be funded by the participating companies.

References

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