

Attachment 3: Marsoft Credit Rating Model

The shipping business is characterized by a high degree of competition, an exceptional degree of earnings volatility, relatively low barriers to entry, and generally strong buyer power. Shipping is largely a commodity business, with little differentiation (in terms of service to customers) between various players.

The credit rating model described here is intended to capture these features of the business as well as the complementary characteristics of third party credit enhancements. It focuses on the following critical risk factors:

- The possibility that a vessel (or fleet of vessels) will not be able to earn enough in the market to service their loans.
- The consequences for vessel values in absolute terms and relative to the debt outstanding of defaulting in adverse market conditions.
- The structure of the credit (i.e. the terms and covenants of a shipping loan) relative to anticipated market conditions, vessel performance, and other factors.
- The availability of third parties (charterers or guarantors) to support a credit.

The Marsoft Rating Methodology

This section provides an overview of Marsoft's credit rating methodology. The first three parts cover the elements of the object rating. The object rating depends on anticipated market conditions, vessel type, and loan characteristics (i.e. amount borrowed, repayment terms, etc.). The fourth part describes how charters and guarantees are accounted for to determine the integrated rating of a project.

Object Rating

The two critical steps in modeling object risk are characterizing the probability distribution for vessel earnings and the relationship between earnings and vessel value. Taken together with the minimum cash flow necessary to service the loan, the two factors determine the probability of default and the value of the vessel in the event of default. Loss given default is the difference between debt outstanding and the value of the vessel given default.

The probability of default and loss given default are thus jointly and simultaneously determined in the rating model. In particular, loss given default accounts for the consequences of distressed market conditions that are likely to characterize default.

The shipping market is highly cyclical, and it is necessary to allow for a time-varying probability distribution for earnings to account for this factor. The rating system incorporates a specific scenario for the development of the mean of the probability distribution over time. In the current version of the rating system the variance of the probability distribution is fixed over time, and is estimated on the basis of historical earnings.

Project Risk Statistics

The rating system generates a time-series for a project's risk statistics (PD, LGD, EL) consistent with the time-varying earnings probability distribution as well as time-varying debt structure

(debt outstanding generally declines over the life of a loan, as does the breakeven rate). It also reports a single set of risk statistics for a project that capture its lifecycle risk profile. A comparison of a project's cumulative default probability with published cumulative default tables is the basis for equivalent letter ratings. A present-value based approach is used to generate consistent project average loss given default, probability of default, and expected loss.

Probability Distribution for Net Earnings

In a shipping project revenue to service debt is generated through the operation of one or more vessels. The shipping risk inherent in the project depends on the shipping market conditions over the life of the loan. Net spot earnings are the amount earned by a vessel on a short-term ("spot") charter, after deducting the direct cost of the voyage (e.g. fuel and port costs) and operating costs (e.g. crew and maintenance costs).

The figures below show the probability distribution for net spot earnings for a VLCC (a tanker used to carry crude oil in two million barrel lots). The parameters of the distribution were estimated on the basis of historical data available on a quarterly basis over the period 1990 – 2004. The figure on the left shows the probability distribution and the figure on the right the cumulative probability distribution.

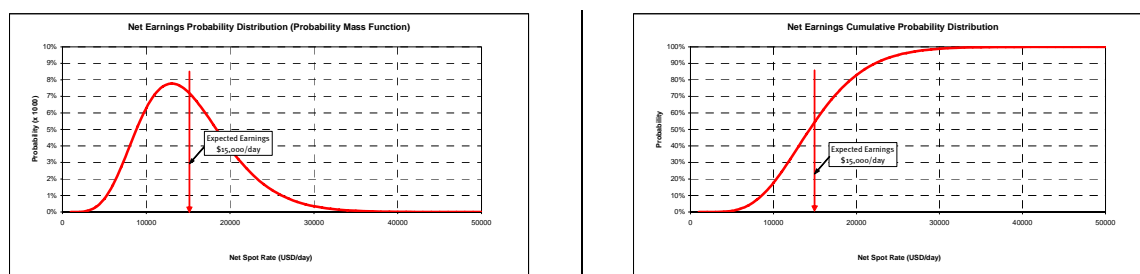


Figure 0-1. Probability Distribution for Net Spot Earnings

Given the probability distribution, it is possible to determine the likelihood that earnings will fall below a particular level of earnings. For example, there is a 55% chance that earnings will fall below \$15,000/day in any given quarter in this case, as can be seen in the rightmost figure. In the rating model the parameters of the probability distribution are calculated on a ship or fleet-specific basis for a particular project.

The parameters of the earnings probability distribution in the rating model are dynamic, changing over time to capture the cyclical character of the shipping industry. Figure 3-2 below illustrates this, with actual historical VLCC net earnings through 2004, a forecast of expected rates for the period 2005 – 2010, and the probability distribution for 2005 around that forecast.

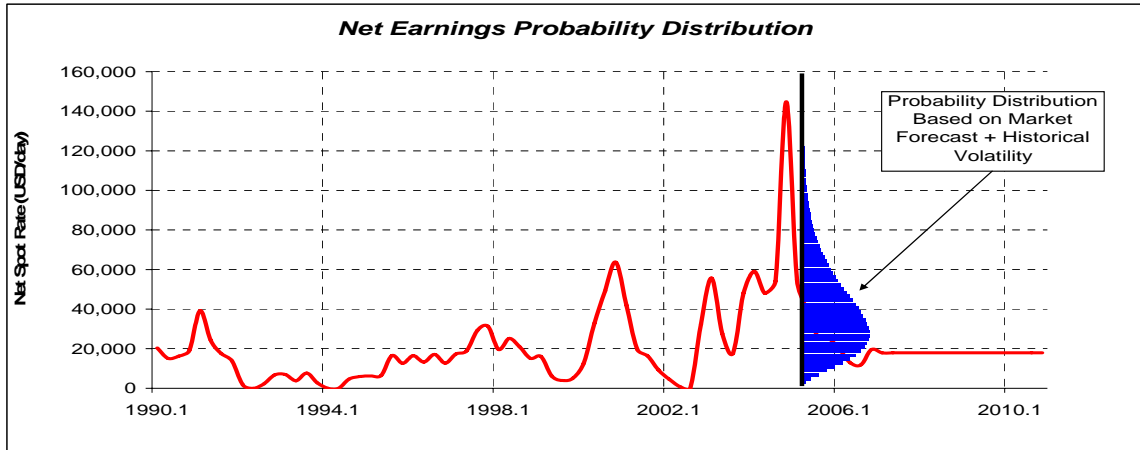


Figure 0-2. Actual and Forecast Net Earnings, with Probability Distribution

Relationship Between Earnings and Vessel Value

There is a close link between vessel values and net earnings in the shipping market. When rates are high values are high and when rates are low values are low. This relationship is illustrated in figure 3-3 below, which compares the value of a ten year old VLCC with net earnings for that ship. (Both the age and the vessel specifications have been kept constant in the figure below.)

The chart on the left in figure 3-3 shows the time-series of VLCC net earnings and values (for a ten year old vessel). The chart on the right of figure 3-3 shows the same information, but now organized in a cross-sectional perspective, in which vessel earnings (along the horizontal axis) are correlated with vessel values (along the vertical axis).

The relationship between earnings and values illustrated in the chart on the right below has been estimated statistically on the basis of historical information from 1990. The correlation between values and earnings is generally in excess of 90%.

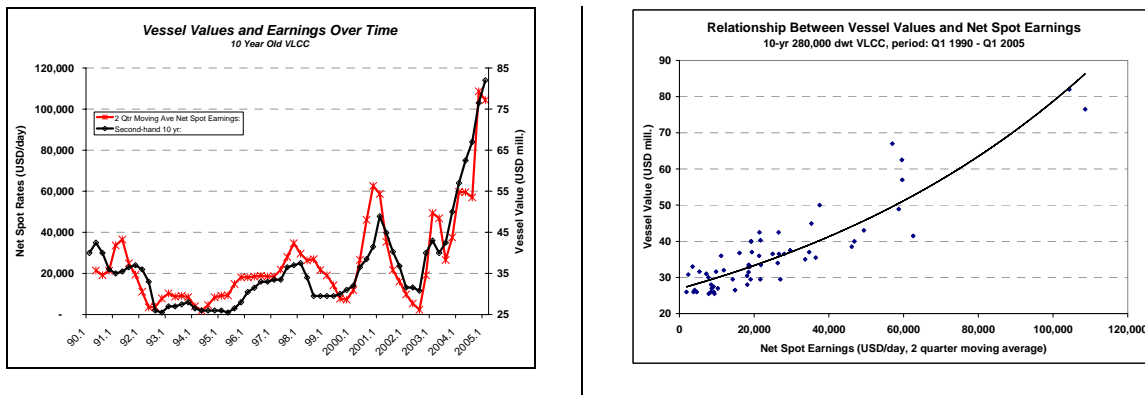


Figure 0-3. Net Earnings and Vessel Values, VLCC vessel type

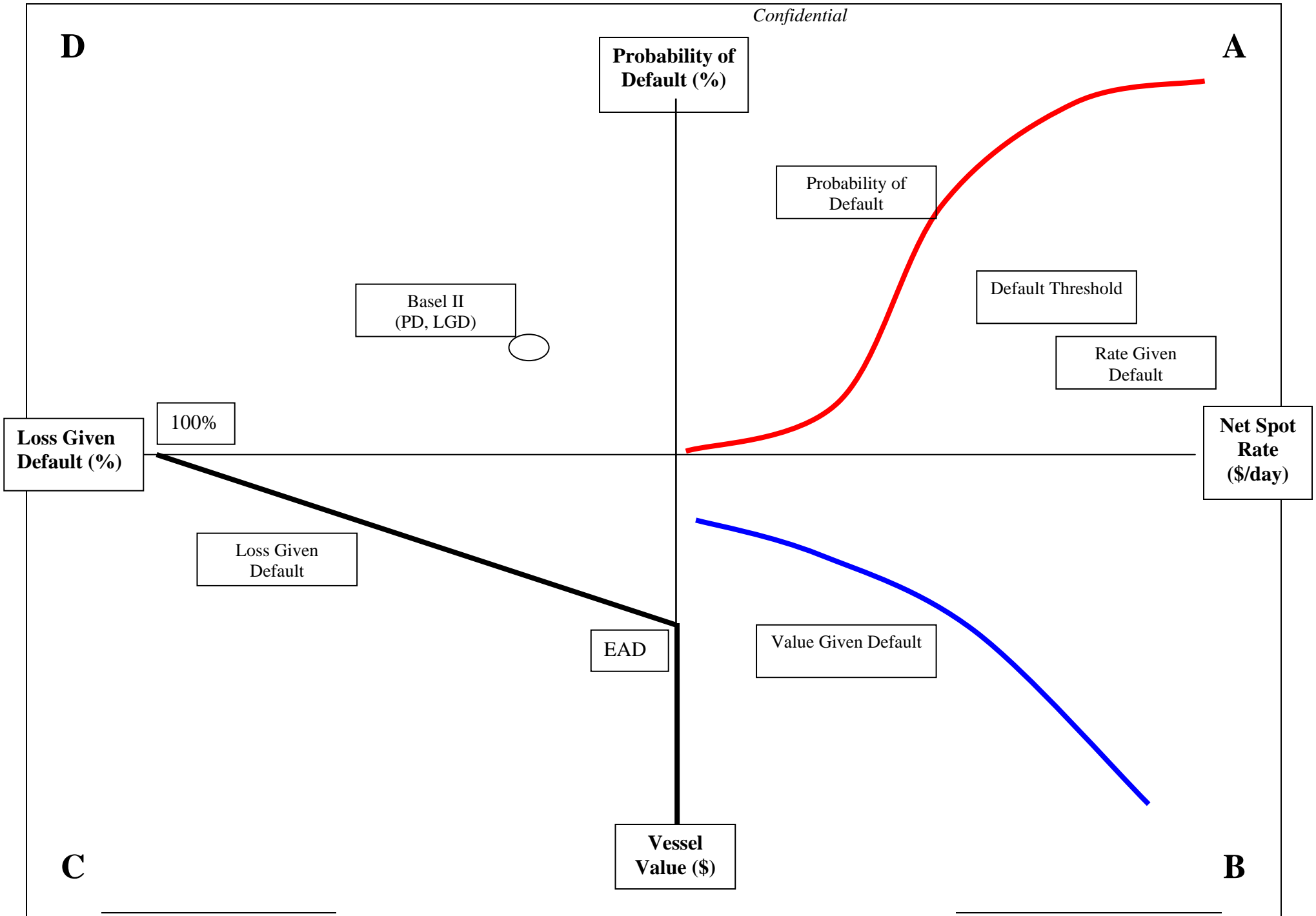


Figure 0-4. Joint and Simultaneous Determination of PD and LGD.

Simultaneous Determination of PD and LGD

Figure 3-4 opposite illustrates the simultaneous determination of the probability of default and loss given default in the rating model. It combines the net earnings probability distribution as well as the value/earnings relationship described above with the debt outstanding.

The upper right-hand quadrant A shows the net earnings probability distribution, analogous to figure 3-1. The default threshold shown there is a function of the loan repayment terms and other factors, as described in chapter 4. It is possible to determine the probability that earnings will fall below that threshold using the probability distribution and in the rating model that corresponds to the probability of default.

It is also possible to calculate the expected value of net earnings conditional upon them being below the default threshold. In the rating model that conditional expectation is termed the rate given default. The extent to which the rate given default falls below the threshold rate depends on the parameters of the probability distribution and the threshold rate.

The lower right-hand quadrant B shows how the value of the vessel, consistent with the project being in default, is determined. The value/earnings relationship is illustrated by the blue curve showing values rising as earnings rise. The value given default of the vessel is determined by inserting the rate given default into the valuation model, as shown by the intersection of the rate given default line and the vessel value curve.

The loss given default is given by a comparison of the value given default and the exposure at default, as illustrated in the lower left-hand quadrant C. If the value exceeds the exposure at default, the loss given default is zero. If the value falls to zero the loss given default is 100%. The relationship for intermediate values is illustrated by the linear relationship between vessel values and LGD in quadrant C.

The object risk assessment (from a Basel perspective) converges in the upper left-hand quadrant D. It shows the simultaneous determination of PD and LGD on the basis of the analysis of net earnings in quadrant A, the earnings/value relationship in quadrant B, and the value/loss relationship in quadrant C.

This presentation helps demonstrate how the rating model accounts for certain important risk correlations. Consider, for example, the correlation between PD and LGD as a result of changing market conditions versus the correlation as a result of changing debt structure:

- Suppose the market outlook deteriorates – what are the consequences for PD and LGD? A deterioration in the market would be reflected in a leftward movement in the earnings probability function in quadrant A. Since the default threshold is unchanged, that leftward shift is reflected in a higher PD. The rate given default will also fall, so the value given default would decline and the loss given default increase. PD and LGD are positively correlated in the rating model with respect to changes in market conditions.
- Now consider a case in which market conditions are fixed but the interest paid by the project is increased, resulting in a higher default threshold. In this case the probability of default increases (since the default threshold shifts to the right) but the value given default rises (since the rate given default also shifts right and the earnings/value curve

doesn't shift). LGD thus falls. PD and LGD are thus negatively correlated in the rating model with respect to changes in the default threshold.

Note that this latter correlation becomes ambiguous in the event that the default threshold increases because the level of debt increases. In this case the value/LGD curve in quadrant C rotates outward by the amount of the increase in EAD. Even though the value given default is higher the loss given default may increase if the change in EAD is large enough.

The Market Outlook

As noted in section 3.1 above, the parameters of the earnings probability distribution may change over time. In the current implementation of the rating system the mean of the distribution may change but its variance is fixed at historically observed levels. There is a great deal of flexibility in how the expectation of the distribution is specified in the rating model. Typical settings involve:

- An initial period of time in which an explicit market forecast is utilized. The forecast is usually based on market scenarios developed by Marsoft but other scenarios can be utilized. The duration of the initial period is a policy parameter in the rating system, set at system calibration. The historical performance of the Marsoft scenarios is described in section 5.3.
- A "long-term" outlook beginning at the end of the initial period in which the expectation of the earnings distribution is set to long-term average earnings. The period over which the long-term average is estimated is a rating system policy parameter, set at system calibration. In the current implementation of the rating system the long-term average and variance are estimated using the same span of time.

The notion behind the combination of an initial period in which an explicit market forecast is utilized and a subsequent period in which the market is presumed to return to average is based on the observation that the shipping market is to some extent predictable. To obtain the most meaningful rating it is essential to take that information into account.

In addition to setting the expectation of the rate distribution, the input market scenario must include a forecast of vessel values consistent with that rate outlook. The earnings/value combination in the market forecast is used as a baseline for the value given default calculations. Specifically, the difference between the rate given default and the expected rate in the market forecast (measured in percentage terms) is multiplied by the earnings elasticity described in section 3.2 above to determine the appropriate change to apply to the forecast values in order to determine the value given default.

Figure 3.2 above illustrates this combination of initial and long-term market forecast. The actual data is through the first quarter of 2005, just as the market has fallen off from its extraordinary peak at the end of 2004. The Marsoft Base Case forecast set as the basis for the initial period shows a declining market for two years, but one in which rates remain well above average through mid-2006. By the end of 2006, however, rates are forecast to fall slightly below the long-term \$20,000/day average. In the second quarter of 2007 the long-term market outlook replaces the Marsoft forecast and rates are assumed to remain at their long-term average from that point.
