MONTE CARLO SIMULATION OF FIXED CHARGE COVERAGE RATIO: A CASE STUDY

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ABSTRACT

The ability to accurately predict a Fixed Charge Coverage Ratio depends on the ability to accurately predict underlying financial measures. In the past, the prediction of Fixed Charge Coverage Ratios was completed using historical averages. However, historical averages are not the best type of predictive measure because past performance does not always equate to future performance. Monte Carlo Methods can provide a method of accurately simulating the Fixed Charge Coverage Ratio of a particular type of loan.

Introduction

Bancorp has adopted a standard cash flow methodology called Fixed Charge Coverage:

$$\text{Fixed Charge Coverage Ratio} = \frac{\text{EBITDA - Cash Taxes - Cash Dividends - Unfinanced CAPEX}}{\text{Cash Interest + Mandatory Debt Retirement}}$$

The Data Set and Methodology

The data used for the simulation was gathered from the U.S. Bank Small Business Banking Database for the State of Montana. The database contains data for approximately 2000 loans held by U.S. Bank Montana. Of these 2000 loans, 30 were randomly chosen and four financial measures were gathered for each of the 30 loans. Using the random number generator, 30 numbers from the 2000 were randomly chosen. The simulation of the Fixed Charge Coverage ratio will be completed using Crystal Ball 2000.

For each of the variables (EBITDA, Cash Taxes Paid, Cash Dividends Paid, and Unfinanced Capital Expenditures), a distribution from the 30 samples was fitted using the Fit Command in Crystal Ball 2000. The following summarizes the distributions chosen by Crystal Ball for each of these variables:

Assumption	Distribution
EBTIDA	Extreme Value Distribution
Cash Taxes Paid	Exponential Distribution
Cash Dividends Paid	Logistic Distribution
Un-financed Capital Expenditures	Logistic Distribution

Two different simulations will be run in this analysis. The first is an analysis using 3 different types of loan amortization. These 3 different amortizations reflect status quo terms. That is, as the amount of the Principal of the loan increases, the term at which the loan is amortized also increases. The Interest Rate is held constant as a comparison point. For each of these 3 Principal, Term, and Interest Rate scenarios, 3 different values for Cash Interest and Mandatory Debt Retirement will be defined. The 3 different scenarios create 3 different values for Cash Interest and Mandatory Debt Retirement. Each will be plugged into the denominator of the forecast equation creating 3 different results. In the second analysis, the Principal amount and term will be held constant while varying the Interest Rate.

Simulation Results

The following table summarizes the results from the varied Principal and term with constant Interest Rate:

Principal Amount	Term	Interest Rate	Cash Interest + MDR	Prob(FCC>=1.25)
$100M	10 years	8%	$14,559.36	62.94%
$250M	15 years	8%	$28,669.56	58.74%
$1MM	20 years	8%	$100,372.80	36.88%

As the principal amount and term of the loan increases, the probability that the Fixed Charge Coverage Ratio will be 1.25 of greater decreases. Given the first scenario, with a principal amount of $100M and a term of 10 years, the probability of a Fixed Charge Coverage Ratio of 1.25 or greater is approximately 63%. This is a concrete probability that an analyst can present whereas in the past, this type of probability could not be presented. The analyst would favorably present a loan of this type for approval given that other Business Line Underwriting Guidelines were favorable.

Given the last scenario, with a principal amount of $1MM and a term of 20 years, the probability of a Fixed Charge Coverage Ratio of 1.25 or greater is approximately 37%. The analyst would be wary of recommending a loan of this size to a small business unless other Business Line Underwriting Guidelines of the firm could compensate for the size of the loan.

The following table summarizes the results from the varied interest rate with constant principal and term:

Principal Amount	Term	Interest Rate	Cash Interest + MDR	Prob(FCC>=1.25)
$250M	15 years	6%	$25,315.68	59.41%
$250M	15 years	10%	$32,238.12	56.97%
$250M	15 years	14%	$39,952.20	54.47%

As the interest rate increases, the probability that the Fixed Charge Coverage Ratio will be 1.25 of greater decreases. This is logical. Given the first scenario, with an interest rate of 6%, the probability of a Fixed Charge Coverage Ratio of 1.25 or greater is approximately 59%. Given the last scenario, with an interest rate of 14%, the probability of a Fixed Charge Coverage Ratio of 1.25 or greater is approximately 54%.

Conclusions

Simulations of this type allow the analyst to create a chart mapping out the interest rates and the probabilities of Fixed Charge Coverage Ratios. This gives the analyst an indication of the interest rate that a particular loan could bear while still making repayment probable. Overall, it can be concluded that using Crystal Ball 2000 is useful. Simulations are extremely easy to setup, run, and modify. This researcher plans to use this program extensively in the future with a number of different types of simulations. One possible area for further research would be adjusting the Fixed Charge Coverage Ratio for significant rental or lease payments. Rent and Lease Expense refers to operating lease payments reflected on the borrower's Income Statement. It does not include any portion lease payments that are capitalized. "Significant", in the Underwriting Policy of U.S. Bancorp, is not defined nor quantified, so each business analyst must decide if rent and lease expenses are significant enough to warrant a correction to the Fixed Charge Coverage Ratio. This is because Rent or Lease Expense is essentially a fixed charge for the business. Rent and Lease payments act essentially like debt for cash flow purposes. To compensate for this effect, EBITDAR is calculated and used in the calculation of the Fixed Charge Coverage Ratio. EBITDAR is Earnings Before Interest Expense, Tax Expense, Depreciation Expense, Amortization Expense, and Rent Expense. Cash Taxes, Cash Dividends, and Un-financed Capital Expenditures are still deducted from EBITDAR to arrive at the numerator of the Fixed Charge Coverage Ration. Rent Expense, Cash Interest, and Mandatory Debt Retirement comprise the denominator of the Fixed Charge Coverage