4.6.8 Interest Rate Risk Exercise Answer

Unit: Unit 1 – Treasury Strategy

Module: Module 4 – Financial risk

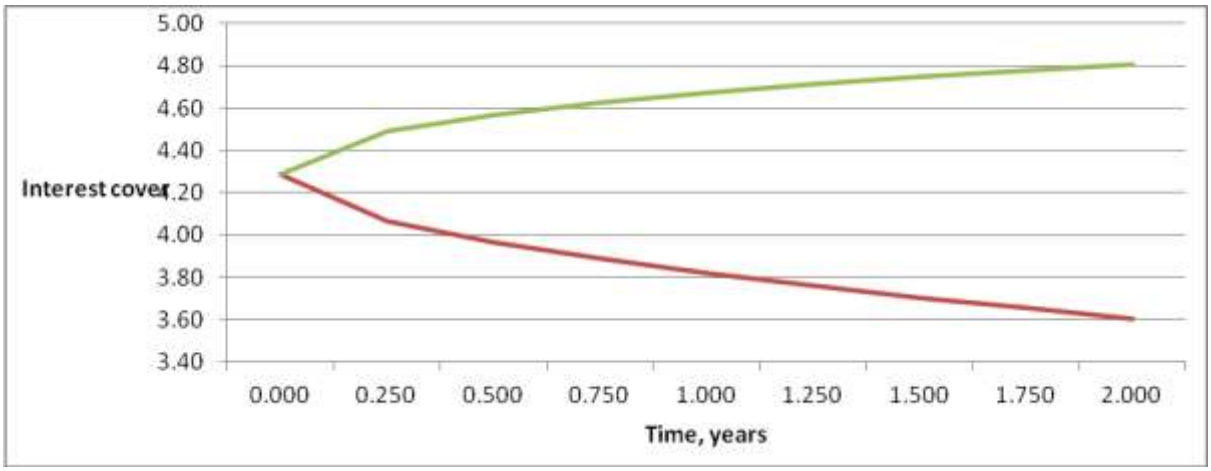
Date: 28 November 2012

Summary: Answers to exercise in modelling interest rate risk.

Answer 1

a) A graphical representation of this risk is roughly as follows:

Spoonbender SA: 2 standard deviation cone of uncertainty for interest cover, 100% floating



As the interest cover covenant is set at 4, this outcome sits inside the 2 standard deviation curve and possibly around 1 standard deviation. That would make a breach likely to occur on roughly 16% of occasions (1 SD either side of the mean accounts for 68% of all outcomes).

To calculate the probability of a breach accurately we proceed as follows:

The covenant is breached when the interest charge is 10 (EBITDA 40 / Covenant of 4).

The interest rate to achieve this is calculated as follows:

Debt (interest rate + margin) – cash (interest rate) = 10
175 (i + 0.04) -25 i = 10
i = 0.02 or 2%

The formula to derive an interest rate $i_{expected}$ at a given number of standard deviations is based on:

$$F = S_0 \times e^{Z \times \sigma \times \sqrt{t}}$$

$$i_{expected} = i \times e^{Z \times \sigma \times \sqrt{t}}$$

Where :
i = current interest rate
Z = number of standard deviations
σI = annualised volatility
t = time in years

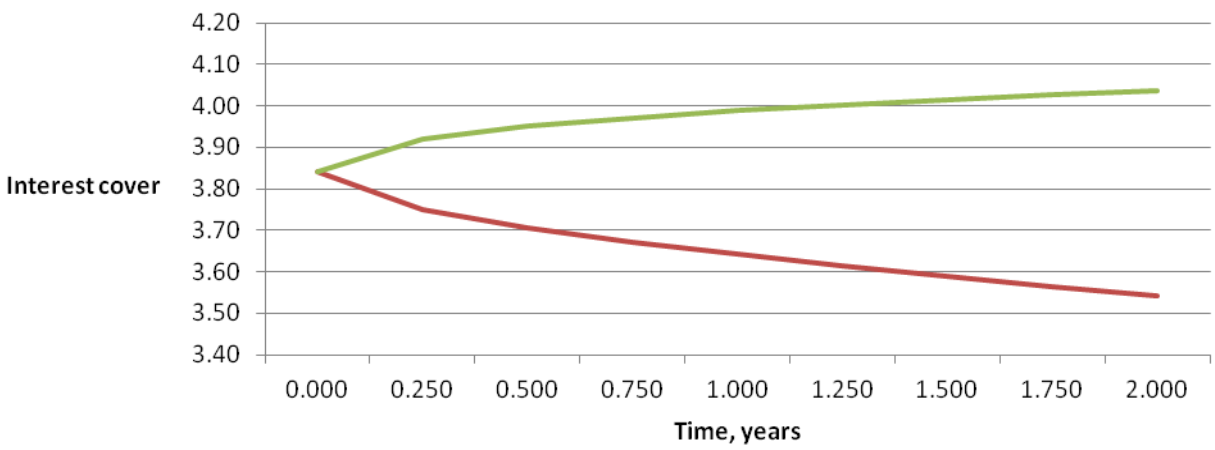
then, expressing this in Excel terms
0.02 = 0.0155 X EXP (Z X 0.2 X SQRT (2))

This is most easily solved with the solver function in Excel and turns out to be:
Z = 0.9012

For most purposes the graph interpretation is probably accurate enough. Using the Normal distribution tables, the cumulative value for the entire distribution from –∞ to (mean plus 0.9012 standard deviations) is 0.819. , so the probability of default is (1-0.819) or 18.1%.

b) This is probably best investigated using the spreadsheet and the graphical representation of the problem. The same spreadsheet used earlier is used for this. Cell B2 allows the user to change the amount of floating rate debt and the spreadsheet automatically recalculates the new scenario. The following graph is extracted from the spreadsheet and shows the 2 standard deviation curves for the scenario where the debt is shifted to 100 floating and 75 fixed.

Spoonbender SA: 2 standard deviation cone of uncertainty for interest cover, €100 m floating, €75 m fixed

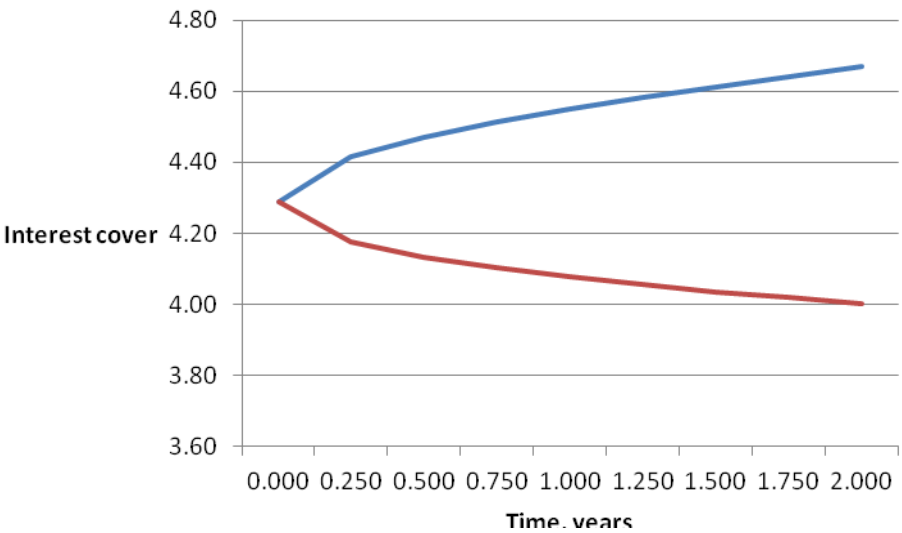


This makes a default almost certain as both curves fall below the covenant level of 4.0 almost all the time. This makes the probability of default at year 2 somewhere between 90 and 95%. In fact no amount of fixing reduces the probability of default because the fixed interest rate is so high. The only alternative available to Spoonbender if it wishes to reduce this risk is to consider option based products.

Answer 2

We can expect that because the performance of Spoonbender is positively correlated with interest rates, that the probability of a covenant breach will have become lower. Higher interest rates are compensated for by a better performance, thus leading to more income to offset the higher interest expense. This is modeled in the graph shown below:

Spoonbender SA: 2 standard deviation cone of uncertainty for interest cover, all debt floating, business improves as interest rates rise



Without detailed calculations we can see that the covenant is passed on all occurrences inside the cone of 2 standard deviations. In fact at the 2 year point, the curve exactly meets the covenant. We can see from the normal distribution tables that the Z score for 2.0 SDs is 0.977, so the probability of default is 2.33%.

Notes

There has been some simplification in this example. In particular we consider that a full year's performance is achieved at exactly the 2 year point, whereas the interest rate will have changed throughout the year and the rate at the start of the year is less likely to be as high as at the end. Some interest rates would be fixed for some period even inside a fully floating rate scenario. These are challenges for any modelling of interest rate risk. Nevertheless there are some powerful lessons to be learnt here.

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