Risk Analysis Assignment:1[1]

Project Vulcan It is end-2009, and BHRio "BHR" is looking to acquire part of a small struggling mining company, "Vulcan" that was affected by the recent crisis. At the time, as in other industries, some of the smaller mining companies came under substantial liquidity pressure as they had significant upcoming debt maturities and capital expenditure requirements. However they encountered problems renewing their credit facilities as the once-easy access to the credit market was drying up. Now, Vulcan was in the process of divesting some of its businesses, with the intention to use the sale proceeds to satisfy its liquidity needs and maintain its investment grade credit rating.

BHR is globally one of the largest, diversified mining companies. Given the current race for industrial consolidation, BHR´s strategy has been to make a transformational acquisition every few years and smaller bolt-ons almost yearly – just like it's peers such as Rio Tinto, BHP Billiton, Xstrata (now GlencoreXstrata) and Vale. They believed that acquiring Vulcan's zinc, copper and lead divisions would be of importance given synergies arising from their own assets being located in close proximity to Vulcan´s mines.

BHR is also aware that its peers are in confidential talks with banks and has asked your bank to advise them on the acquisition process quickly. They do not wish to overpay by engaging in a bidding war with the other bidders. Given the market volatility and the depressing fundamentals for some of these divisions e.g. zinc they do not want to overpay. At the same time, they are cognizant of this attractive opportunity and may end up paying more if it comes to a bidding war, in light of the ongoing industrial consolidation.

Given the time sensitive and confidential nature of the deal, your team has been asked to build a valuation model for the cashflows coming from ALL 3 Vulcan's divisions for 5 years using the accompanying template (i.e. if the acquisition goes through, all 3 divisions will be acquired given existing synergies and similarities in the operating process). Any synergies estimated by our client will be added afterwards, as will be the necessary premium "sweetener" to this valuation. So these should not be reflected in your assignment – at this stage the client is only looking at a basic valuation of Vulcan´s assets.

The opportunity: Vulcan

Vulcan operates across several divisions for base metals production, with the majority of its mines located in Peru. Globally it is considered a small producer, but fits in well location-wise with BHR´s assets, given their close proximity and will contribute to some synergies. This acquisition would hence make sense as part of BHR´s strategy to make small bolt-on acquisition for fuelling growth.

Below is some data on the 3 divisions it is divesting – for each of the 3 divisions please assume the expected mine life is 5 years left on average:

- For zinc, the company believes its mines can produce 500 tonnes per annum ("pa") although this can go down to 400 tonnes due to mine flooding or upto 600 tonnes if they are lucky with the mine conditions.

[1] This case was written by Sara Farooqi at the IE, Madrid. It is intended to be used as a basis for group assignment. The names of the companies are coded. In no way should this document (the model solution or any student solutions based off this assignment) be shared or posted physically or online without permission.

• For copper, the company believes its mines could produce 14,000 tonnes pa. However, given the ongoing union strike, it is more realistic that they would produce 10,000 tonnes pa, and in the worst case 7,000 tonnes pa.

• For lead, the company is equally likely to produce anywhere between 80 to 300 tonnes, with 200 tonnes being most likely.

• Fixed costs pa are: $1 million "mm" for Zinc, $0.25mm for lead and $3mm for copper.

• Operating costs by division can vary, but note all of these exclude depreciation/ depletion:

- For zinc: the median is expected to be $2,100/ tonne due to regular mine flooding, but in the best case can be $1,800/ tonne or in the worst case $2,500/ tonne if there is excess flooding. However there is a ¼ probability that the cost will be below $1,950/ tonne and a ¼ probability that the cost will be above $2,300/ tonne.
- For lead: uncertain and likely to vary between $2,400/ tonne to $3,200/ tonnes, with a median of $2,800/ tonne. However there is a ¼ probability that the cost will be below $2,600/ tonne and a ¼ probability that the cost will be above $3,000/ tonne.
- For copper: with median cost of $4,500/ tonne but can rise and fall to $5,500/ tonne and $3,800/ tonne depending on the extent of the trouble with labour unions. However there is a ¼ probability that the cost will be below $4,000/ tonne and a ¼ probability that the cost will be above $5,000/ tonne.

The company gives its own prediction of where the prices are headed for these metals i.e. "optimistic case". However the rating agencies and brokers have another view "Pessimistic case" and "Base Case", respectively. As the buy-side advisory, we need to include all 3 cases.

Prices ($/tonne):	Company price	Broker price	S+P Price
Copper	**$5,500**	**$5,200**	**$4,500**
lead	**$3,200**	**$2,800**	**$2,400**
zinc	**$2,600**	**$2,200**	**$1,800**

• BHR has decided to set the after tax discount rate to 9.66%

• Tax rate is 35%.

• Assume interest expense is 0 and interest paid is 0, for the purpose of modelling and as a starting point (these can be refined more later, as and when we get more precise estimates from the client). Also assume year to year changes in working capital to be 0 for now (again –similar rationale).

• The Depreciation, Depletion[2] and Amortization is $100,000 per annum.

• Also let´s assume for the sake of simplicity that the same cash flow arises for years 1 through 5.

• As per the spreadsheet attached "Vulcan base model"– you are asked to (first build), interpret and then refine the NPV model for the upcoming questions (which contain instructions). Create a report of 3 pages (excluding appendices) summarising your results, your interpretation of the results, and your conclusions and recommendations.

•You can include graphs and outputs in an appendix, but please make sure to summarise and interpret the results in your report as well (i.e. if you use a graph or a table, please make sure it is

[2] For mining companies, we need to account also for Depletion of reserves, in addition to Depreciation.

described/ analysed in your report. The graph/ table should add value to your analysis and arguments).

- Please submit an e-copy (word document) to me before the deadline (24th july 2023, 9am) – please see Blackboard for further instructions. No excel files please.

- The assignment is out of 25 points with the points for each question indicated before every question.

- As before, 1 copy per group needs to be handed in, with the names of all the students indicated on the front page.

- Good luck!

1. The Model

Please download the file "Vulcan template.xls" from Blackboard/ class page

Online to your own computer. Start Excel, but first make sure that @Risk is not running. In Excel, open the file "Vulcan template.xls". Using the template, build an NPV model for the problem for the most expected case (i.e. develop a base case model).

Please paste this in the appendix of your report and describe it. If your model has constraints, objectives and decision variables, please describe them.

TIPS

– Save your model regularly, and save a backup version of your report once in a while!

– Close any other applications (e.g. Internet Explorer), because they will reduce your PC's available memory and slow it down, especially when you reach Question 4 and onwards; then ensure you have only one Excel workbook open after you've launched @Risk.

– Interpret your results, do not just report them.

– You can change the format of cells using Format\Cells.

– Think about what the decisions are in your model (variables under your control), the uncertainties (outside your control) and the objectives. I suggest using appropriate colours (green, red, blue) to highlight them.

BEFORE CONTINUING to 1.2, YOU CAN CHECK WITH THE FILE "VULCAN BASE MODEL" THAT YOUR MODEL IS CORRECT (FOR EVERYONE).

2. Scenario Analysis – 5 points

Save your model as "Vulcan SA". As mentioned in the case, Vulcan faces several uncertainties. Evaluate a pessimistic and optimistic scenario, and examine the impact on NPV. What can you conclude?

3. Sensitivity Analyses – 5 points

Please conduct a full blown sensitivity analysis. When performing the one way and two way sensitivity analyses, please focus on the top 2 sources of uncertainty. You can perform sensitivity analysis using data tables and graphs in Excel. What can you conclude about Vulcan from all of these analyses?

TIPS

– You can construct a one-way data table using the Data\Table command. Suppose you want to examine different values for the Copper Production. First, in an empty part of the spreadsheet, make a list with different values for the Copper Production (in a column). In the cell above and to the right of that column, enter "=B55" (or enter "=", click on cell B55 and press [enter]). Then, select the range consisting of the values and the column to the right of that, including the cells above. Select Data\Table. In Column input cell, refer to the cell where the data table values need to be substituted into the model. Press [OK], and the data table will be completed.

– Based on a data table, a graph can be constructed as follows: Select Insert\Chart\Line. Press [Next] and specify the data range by selecting, with your mouse, the column of the data table containing the results (except the first value). Select Series in Columns. Select the Series tab on top of the window, enter "NPV" in Name, and in Category (X) axis labels, select (using your mouse), the first column of values (without the label on top).

– You can also construct a two-way data table using the Data\Table command. Suppose you want to examine different values for Copper and Zinc productions simultaneously. First, in an empty part of the spreadsheet, make a column with a list of different values of Copper production; for instance, in cells G11:G16. Then, in the cell above and to the right of that column, make a row with a list with different values for the Zinc production; for instance, from H10:M10. Then, in cell G10 enter "=B55" (or enter "=", click on cell B55 and press [enter]). Then, select the whole range of cells (G10:M15) and select Data\Table. In Column input cell, refer to the cell where the Copper Production needs to be substituted into the model. Finally, in Row input cell, refer to the cell where the Zinc production needs to be substituted into the model. Press [OK], and the data table will be completed.

4. Simulation – 5 points

Save your model in a new workbook called "Vulcan Sim" and close all other Excel files. Please make sure you do not have any other tabs. Evaluate the model now after running the simulation and make your valuation recommendation. What is the average NPV? What does this mean? What is the probable range of the NPV (90% confidence)? What is the upside (being over $8mm) and downside potential (having a negative NPV)? In your write up please describe all the input assumptions.

TIPS

– For the uncertainties, choose the relevant distribution to define each uncertainty.

– Add the Output as cell "B55" –the NPV. – Before using the automated @Risk simulation tool, simulate the model step-by-step by pressing the [F9]-key. First, click on the little "dice symbol" that you will find in the center of the menu bar and under the two boxes that are labelled "iterations" and "simulations". This will enable one iteration at a time, each time you press the [F9]-key.

– If the simulation is very slow, decrease the number of iterations in the "simulation" box, or ask me to come and have a look.

– If you click on "Excel Reports" and then "Quick Report" you can save the simulation results.

5. Simulation Model with Correlation – 5 points

Save your model in a new workbook called "Vulcan Sim Corr" and close all other Excel files. Please make sure you do not have any other tabs as the software would then run simulations on all the tabs. That day you see that the monthly correlation (based off a 2 year average) of Zinc prices with

Copper prices is 0.75 and 0.5 with Lead prices at the time. The correlation of Lead price and Copper price is 0.7. (Source: London Metal Exchange). You can use this information to refine your existing model. Evaluate the model now after running the new simulation and make your recommendation.

TIPS

– Define the Correlation matrix in @RISK and run the new simulation model.

6. Further refinement for the client – 5 points

Save your model from Question 5 in a new workbook called "Vulcan Final Sim" and close all other Excel files. Please make sure you do not have any other tabs.

NPV can vary depending on the discount rate being used. Your client is interested in a robust model but is unsure of the discount rate and believes that it can vary between 7%- 11%. Consider 10 simulations (between 7% and 11% - including the original 9.66%) and rerun (e.g. for 0.07, 0.075, 0.08,….0.11).

Ultimately we want to recommend a relatively robust model to the client, but point out any significant trends / changes across the different simulations.

Comment and describe the results from these simulations, then evaluate the model and make your recommendations.