

INSTITUTE OF ACTUARIES OF INDIA

EXAMINATIONS

28th November 2024

CP2B - Actuarial Modelling

Time allowed: 3 Hours 15 Minutes

Total Marks: 100

Exam requirements

Read the background, which describes the approach that has been used to model, and documented the work that remains outstanding.

Read the audit trail, which has been written by your colleague for the calculations performed by him. This will assist you in following and understanding the calculations performed in the Excel model provided.

You are not required to add to or amend the audit trail.

You should assume that your colleague's calculations have been checked and are correct.

Expand the spreadsheet model to produce the following additional calculations. You should ensure that the additional work you undertake on the spreadsheet contains appropriate self-checks and you should not overwrite the existing calculations.

Q. 1) Additional information and modelling steps

i) Calculate the Realised, Unrealised and forgone profit/losses under each of the scenarios:

- | | |
|----------------------|-----|
| (a) 20/20 Formula | (1) |
| (b) 70/70 Formula | (1) |
| (c) 50/50/50 Formula | (2) |
| (d) 20/20/20 Formula | (2) |
| (e) 70/70/70 Formula | (2) |

ii) For each of the above Scenarios, show a summary of how the Realised / Unrealised and Forgone Profit/loss (profit/loss missed out on) changes as compared to the base scenario and comment on the same. Also create a graph to show the comparison of Total Profits/losses & Forgone Profits/losses under different scenarios. (7)

[15 Marks]

Q. 2) Prepare a summary in the specified worksheet within the same spreadsheet capturing the main features and results of the work completed by you and your team member. You can assume that the summary is being written for the Venture Capitalist, who will use this to decide on the best formula for exit strategy.

Your summary should include the following:

- Purpose of the exercise, inputs, methodology and assumptions used by you and your team member.
- Results: including realised, unrealised and forgone profit/loss under all scenarios.
- Charts on how the realised, unrealised, forgone and total profit/loss varies in each scenario.
- Summary results (realised, unrealised and forgone profit/loss) on how the results change under different scenarios along with relevant rationale.
- Chart summarising the impact of different scenarios.
- Key conclusions.
- Suggested next steps.
- Commentary on the results should cover, but not be limited to:
 - How different exit strategies compare to each other.
 - Key reasons for varying profit/losses in different scenarios.

- Next steps including what are the other aspects the VC should consider and other variables it can change to increase the profitability and reduce risk

The summary should cover the full scope of the project, including the additional scenarios, which was modelled in the spreadsheet provided to you.

You are not required to add to or amend the audit trail.

Marks available for the summary:

- i) Purpose, inputs and assumptions (10)
- ii) Methodology (20)
- iii) Input Checks and reasonableness checks (5)
- iv) Results, including charts. Results should include how the realised profits/losses, unrealised profits/losses and forgone profits/losses change with different scenarios. (10)
- v) Commentary on results and conclusions (15)
- vi) Next steps (15)
- vii) Drafting (10)

[85 Marks]

Overview of the Project

A venture capitalist (VC) has invested various sums of money in 125 different businesses. The VC believes that first 5 years are the most crucial years for a business and he keeps track of the quarterly change in valuation, compared to previous quarter, for each of the invested businesses. The amount of investment in each business has been provided. The quarter-on quarter change in valuation experienced during the first 5 years has also been provided. Currently, the VC follows a simple rule to decide the timing to exit a business, when the valuation goes above 50x or below 50% of the initial investment, which he calls the “50/50 Formula”. [when the valuation is exactly 50% or 50x, he does not exit the business until it crosses this threshold on either end.]

After the VC has exited a business, he keeps track of the change in valuation to understand whether the exit decision was right or not. Now, the VC wants to test how the gains/losses would change in the scenarios given below:

1. 20/20 Formula – Exit at valuation above 20x or 20% below initial investment
2. 70/70 Formula – Exit at valuation above 70x or 70% below initial investment
3. The VC has observed some short-comings in the current model and thinks of it as too rigid. Instead, he would like to try partial exits. Where “50/50/50 Formula” means that he exits 50% of the business when valuation goes above 50x or below 50%. This approach will ensure some stake in the business is unrealised, while also realising some profits/losses. The VC wants to analyse results for 50/50/50 Formula.
4. Similarly, 20/20/20 Formula
5. And 70/70/70 Formula

The objective of the project is to

1. Calculate the realised Profits/Losses

2. Calculate the unrealised Profits/Losses
3. Calculate the Profits/Losses forgone as a result of the exit
4. Analyse the above 3 items to arrive at the best exit strategy for the VC.

All the calculations should be done for base scenario as well as the 5 scenarios.

You are not expected to include the additional modelling you undertake in the audit trail, but the approach and results of all elements of the scenario should be included in the summary.

Audit Trail

Background

The VC wants to understand the profitability of different exit strategies and the effect of introducing partial exit strategies. The profitability study should focus on realised, unrealised, forgone & total profit/loss under each strategy.

Objective

The objective of the project is to calculate the realised, unrealised, forgone & total profit/loss under six scenarios as listed below and come up with the best strategy for the VC. The scenarios are as under:

- (a) 50/50 Formula
- (b) 20/20 Formula
- (c) 70/70 Formula
- (d) 50/50/50 Formula
- (e) 20/20/20 Formula
- (f) 70/70/70 Formula

Data & Inputs

The following inputs have been received from the VC in “Data” sheet

- Column A: The amount of initial investment in INR
- Column B: Business Serial number identifier from 1 to 125.
- Columns C:V: The quarter-on-quarter percentage change in valuation experienced in first five years (20 quarters)

Assumptions

- The VC only exits a business at the end of a quarter.
- Only one exit (full or partial) is made from a business in the first five years.
- There are no re-investments in any of the businesses.
- The VC can exit businesses at the exact valuation suggested by the experienced change in valuation i.e., there are no transaction costs associated with exit.
- Taxes are ignored while calculating profits/losses.

Calculations – “50/50 Formula”

The sheet “50/50 Formula” presents the calculation model currently used by the VC to decide when to exit a business. The sheet also shows calculations for the realised, unrealised, forgone & total profit/loss under this strategy.

- Column A: The amount of initial investment in INR
- Column B: Business Serial number identifier from 1 to 125.
- Range C9:V134: Cumulative percentage valuation for each of the 125 businesses at the end of each of the 20 quarters since initial investment. Such cumulative percentage is

calculated using Product function in excel and the quarter-on-quarter percentage change given in “Data” sheet.

- Column X: Current status for each business based on Exit conditions, split into Unrealised, Realised Profit or Realised Loss. Any business which reached a cumulative valuation of below 50% or above 50x over the 5-year period is marked as Realised Loss or Realised Profit respectively. All other businesses are marked as Unrealised.
- Column Y: Valuation as at the end of 5 years for each of the 125 businesses, calculated as initial investment times cumulative valuation as at the end of 5 years.
- Column Z: Realised value for each of the realised investments, calculated as Initial Investment times the cumulative valuation as at the end of quarter where valuation goes below 50% or above 50x.
- Column AC:AV: Exit Identifier at end of each quarter, where 0 represents unrealised business and 1 represents exited business, using a combination of IF statements in Excel for each of the 125 businesses.
- Range O1:P3 : Exit Conditions, Valuation Floor 50% and Valuation Cap 50x
- Range E1:E5 : Number of businesses split into Unrealised, Realised Loss and Realised Profit, using COUNTIFS excel function.
- Range F1:F5 : Amount of Initial Investment in Lacs, split into Unrealised, Realised Loss and Realised Profit, using SUMIFS excel function.
- Range G1:G5 : Amount Withdrawn for realised businesses in Lacs, split into Realised Loss and Realised Profit, using SUMIFS excel function.
- Range H1:H5 : Current Valuation (as at end of 5 years) in Lacs, split into Unrealised, Realised Loss and Realised Profit, using SUMIFS excel function.
- Range I1:I5 : Total Profit/Loss in Lacs, split into Unrealised, Realised Loss and Realised Profit, calculated as Current Valuation less Initial Investment for Unrealised Investments and Amount withdrawn less Initial Investment for Realised Investments.
- Range J1:J5 : Forgone Profit/Loss in Lacs, split into Realised Loss and Realised Profit, calculated as Current Valuation less Amount withdrawn.
- Range D6:H6 : Data completeness checks.
- Range D7:E7 : Reasonableness checks to ensure that Current valuation is sum total of Initial Investment, Total Profit/Loss and Forgone Profit/Loss.
