INTERNATIONAL FINANCE
FINANCIAL MODEL
Lesson 8
Risk analysis and excercises

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Summary

Risk management
- Premise
- Process: identify – analysis - mitigation
- Risk matrix

Excercises:
- Term sheet sample and assignment
- Excercise C (in class)
- Excercise D (assignment)

Risk management

- Which are the main project risks?
- Which could be a possible variation depending on the project risk?

- Is it necessary to cover the risk?
- Is it economically favorable to have a coverage
- Sensitivity / Stress test

- Which is the economic impact on my business plan?

Risk management

- In financial analysis, Risk is the chance of a **deviation** from an expected outcome (base case)
- Risk analysis considers possible **negative events**, their **probability** and the related **impact on economic return**
- As **risk factor** refers to a specific risk, the **total risk** will be made up of one or more risk factors
- A **risk profile** is a graphical representation of the payoffs associated with changes in the risk factor
- Rather than focusing on impossible total risk elimination, a sponsor typically considers the **trade-off between risk taken and the expectation of reward**
- **Risk adversion might change** between players: sponsor and lender, and among sponsors between different kind of sponsors

Risk adversion – Sponsor vs Lender

Different perspectives according to different roles, strategies and risk profiles

Sponsor

- The trade-off between risk and economic outcome is the «decision maker»
- How to maximize the economic return, considering a fair risk reduction?

Lender

- The outstanding repayment plus interests has to be secured, with the guarantee to be repaid
- The more the risks can be covered, the more the lender is secured

Sensitivity vs stress test analysis

SENSITIVITY ANALYSIS

- **How different values of an input variable could change the economic outcome** *(what-if analysis)?*
- The more the input variable are **correlated**, the more the sensitivity analysis is complex.
- **Result of the risk analysis**, that identify which input variables can change and their possible range of variation
- Sensitivity analysis: possible outcome of a variable change; vs **scenario analysis:** possible scenario and their related economic outcome
- Mainly useful by sponsors to identify the best trade-off risk-return

STRESS TEST ANALYSIS

- How does the project react in the "**worst scenario"?**
- Stress test to **prove the robustness of the project to mitigate possible crashes**
- What happens if
  - *the inflation rate goes below the base case?*
  - *the interest rate goes over the base case?*
  - *oil prices rise of a defined percentage?*
  - *my construction costs increase?*
- Impact on the economic return with the maximum variables change, or maximum variables variation to keep a sustainable economic outcome
- Mainly useful by lenders to check the worst case

Risk matrix - Example

RISK IDENTIFICATION | **RISK ANALYSIS** | **RISK MITIGATION**

Risk area	Project Variable	Possible effect	Economic impact	Coverages
Construction and operation	• Delay in construction works	• High probability to have 1month delay • Low probability to exceed 6months	• IRR -0,5% with 1-month delay • IRR -5% with 6-months delay	• Liquidated damages for 1-month delay • Contract resolution for 6-months delay
	• Performance	(….)		
	• Up-to date			

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1. Risk identification

Construction and operation

- Delay in construction
- Lower performances
- Higher degradation
- Higher operating costs
- Extraordinary maintenance
- Default during construction
- Default during operation

Political / country risk

- Delay in construction
- Change in law
- Tax rate change

Supply and Market

- Higher construction budget
- Lower revenue drivers
- Higher operation costs
- Commodity price

Economical and Financiale

- Different inflation rate
- Different financial conditions
- Higher interest rate

1. Risk identification
Example - Construction delay

Effects

- **Delay in cash in**
- **Higher financial interests** during the grace period
- **Lower revenues**, for instance under subsidy scheme, if there is a decrease during the time *(i.e. public grant for completed project before a defined deadline)*
- **Higher G&A** costs
- Possible **litigation** with the final user of the asset
- Possible expiration of the **authorization** rights

Mitigants

Commercal guarantees, to mitigate a possible IRR reduction impact, for instance with:

- **Liquidated damages** to cover limited losses (for instance up to 10/20% of the contract price).
- **Clause of resolution** for extraordinary delay. The sponsor should carefully evaluate the counterpart's risk in case of default

Payment scheme, consistent with the guarantee / liquidated damages scheme *(for instance with a final payment)* or financial guarantees

Insurance coverage could help to secure the package

1. Risk identification
Example - Revenues or Opex Variability

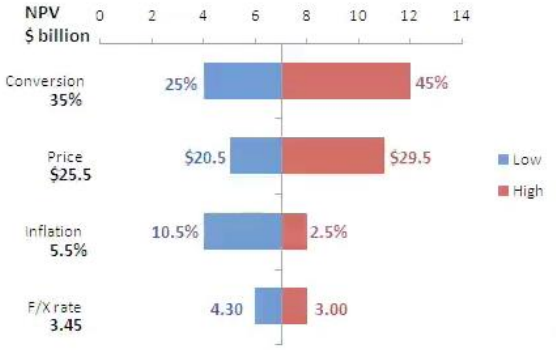
	Effects	Mitigants
REVENUES	• Less units for wrong forecast, lower performances, etc. • Different price per unit for market reasons, change in law, etc. • Different inflation rate adjustment • Different lifetime of the project	• [….]
OPEX	• Different drivers for annual expenses • Different inflation rate adjustment • Unexpected costs • Unexpected additional activities	• Long term contracts • Insurances • Turn-key contracts • Contracts with liquidated damages • Low expenses for partners change and activities easy to change (i.e. maintenance substitution)

2. Risk analysis
Which variables to choose

How to choose the variables to analyze in a financial model, among many input variables?

- **The most effective variables, with the highest impact on IRR**

  Understand the main variable and their possible change, and rank them in a «Tornado» chart, to have a visible impact on the relationship variable - IRR



- **The most effective variables in a portfolio approach (risk management)**

  Some variables can affect (or not affect) several project under porfolio, and have to be considered globally, even if they are not that relevant considering the stand-alone project

2. Risk Analysis
Example – Inflation rate variation

Operating costs breakdown
* With inflation rate adjustment

Driver for annual expenses

Cost breakdown M$	Base value	0	1	2	3	4	5	6	7	8	9
Inflation rate		100%	102%	104%	106%	108%	110%	113%	115%	117%	120%
Consumables and spare parts*	30						33	34	34	35	36
Maintenance*	50					54	55	56	57	59	60
Labour force*	35				19	38	39	39	40	41	42
Insurance	10					10	10	10	10	10	10
Other costs	variable				6	3	18	25	23	40	18
Contingency	15			15	15	15	15	15	15	15	15
Operating costs		**0**	**0**	**15**	**40**	**120**	**170**	**180**	**180**	**200**	**180**

Operating costs as the previous business plan

2. Risk Analysis
Example – Inflation rate variation

Excercise A, lesson 6 – Which IRR variation if inflation rate changes?

Base case: inflation rate 1%

P&L	0	1	2	3
Revenues		121,2	122,4	123,6
Costs		60,6	61,2	61,8
Ebitda		60,6	61,2	61,8
D&A		50,0	50,0	50,0
Ebit		10,6	11,2	11,8
Financial interests		6,7	4,6	2,4
Ebt		3,9	6,6	9,5
Tax		1,4	2,3	3,3
Net profit		**2,6**	**4,3**	**6,2**

Cash Flow	0	1	2	3
Net profit		3	4	6
D&A		50	50	50
Financial interests		7	5	2
Capex variation (-)	-150			
Cash flow before debt	**(150)**	**59**	**59**	**59**
Debt drawdown	111			
Principal repayment		(35)	(37)	(39)
Financial interests		(7)	(5)	(2)
Debt Service	**111**	**(42)**	**(42)**	**(42)**
Cash flow after debt	**(39)**	**18**	**17**	**17**

Levered IRR = 16.0%
ADSCR = 1.42x

Best case: inflation rate 2%

P&L	0	1	2	3
Revenues		122,4	124,8	127,3
Costs		61,2	62,4	63,7
Ebitda		61,2	62,4	63,7
D&A		50,0	50,0	50,0
Ebit		11,2	12,4	13,7
Financial interests		6,7	4,6	2,4
Ebt		4,5	7,9	11,3
Tax		1,6	2,7	4,0
Net profit		**3,0**	**5,1**	**7,4**

Cash Flow	0	1	2	3
Net profit		3	5	7
D&A		50	50	50
Financial interests		7	5	2
Capex variation (-)	-150			
Cash flow before debt	**(150)**	**60**	**60**	**60**
Debt drawdown	111			
Principal repayment		(35)	(37)	(39)
Financial interests		(7)	(5)	(2)
Debt Service	**111**	**(42)**	**(42)**	**(42)**
Cash flow after debt	**(39)**	**18**	**18**	**18**

Levered IRR = 18.7%
ADSCR = 1.44x

Worst case: inflation rate 0%

P&L	0	1	2	3
Revenues		120,0	120,0	120,0
Costs		60,0	60,0	60,0
Ebitda		60,0	60,0	60,0
D&A		50,0	50,0	50,0
Ebit		10,0	10,0	10,0
Financial interests		6,7	4,6	2,4
Ebt		3,3	5,4	7,6
Tax		1,2	1,9	2,7
Net profit		**2,2**	**3,5**	**5,0**

Cash Flow	0	1	2	3
Net profit		2	4	5
D&A		50	50	50
Financial interests		7	5	2
Capex variation (-)	-150			
Cash flow before debt	**(150)**	**59**	**58**	**57**
Debt drawdown	111			
Principal repayment		(35)	(37)	(39)
Financial interests		(7)	(5)	(2)
Debt Service	**111**	**(42)**	**(42)**	**(42)**
Cash flow after debt	**(39)**	**17**	**17**	**16**

Levered IRR = 13.4%
ADSCR = 1.40x

How to cover from different inflation rate?

3. Risk mitigation
Risk matrix construction

Crossed effects on different output and a possible correlation

Affecting both revenues and operating costs

The possible variation from the base case

Risk	Description	Risk Area	Possible Mitigation	Possible variation	Economic Impact
Inflation rate	The real inflation rate is lower than expected	Economical and Financial	Using the same index factor for operation expenses could mitigate the effect of a possible lower inflation rate on revenues		
Gross production					
Performance					
Price per unit					

A lower production might reflect in lower operating costs

A lower price per unit could be the result of a lower purchase power (driving also lower operating costs)

3. Risk mitigation
Example - Revenues

Risk	Description	Risk Area	Possible Mitigation
Inflation rate	The real inflation rate is lower than expected	Economic and Financial	• Using the same index factor for operation expenses could mitigate the effect of a possible lower inflation rate on revenues
Gross production	The gross production is lower than expected	Construction and operation	• Historical analysis on weather conditions • Price adjustment with the project developer, in case of lower resources than declared
Performance	The plant is performing less than expected	Construction and operation	• Warranty bond with the plant contractor • Strong maintenance contract with guarantee of performance
Price per unit	The revenue per unit is lower than expected	Market risk	• Using long-term contract • Take or pay • Regulated asset based revenues

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Next steps

How sponsor and lender react facing possible risk?

How different sponsors could react facing the same risk?

How to build a risk matrix and a sensitivity analysis?

How to build a **stress test** and **scenario analysis**?

Risk matrix and sensitivity
Sample of risk matrix

Risk	Area	Description	Possible range of variation	Probability
Performance	Construction and operation	The plant is not performing as expected	Base case 90% 85%-92%	High
Construction schedule	Construction and operation	Delay in construction works	Delay of 1 year	Medium
Inflation rate	Economical and FInancial	The real inflation rate is different than expected	Base case 2% 1,5%-2,2%	High
Maintenance costs	Construction and operation	Different maintenance costs than expected	Base case 50M$/y ±10%	High
Price per unit	Supply and market	The revenue per unit is different than expected	Base case 0,10 M$/GWh ±10%	High
Construction cost	Construction and operation	The construction costs are higher than expected	Base case 750 M$ ±10%	Medium
(…)				

Risk matrix and sensitivity

Sample of risk matrix and IRR sensitivity

Risk matrix and sensitivity			
Risk		*Δ IRR*	*Mitigants*
Performance	Base case 90% Variation ±2%	*(2,7)%* *2,6%*	- Warranty bond with the plant contractor - Strong maintenance contract with guarantee of performance
Construction schedule	Base case 2 years Variation +1 year	*(3,5)%*	- Reliable counterpart - Strong construction contract with liquidated damages for delay
Inflation rate	Base case 2,0% Variation ±0,2%	*(0,7)%* *0,8%*	- Using the same index factor for operation expenses could mitigate the effect of a possible lower inflation rate on revenues
Maintenance costs	Base case 50 M$/year Variation ±10%	*(1,4)%* *1,3%*	- Strong turn-key maintenance contract - Strong market analysis
Price per unit	Base case 0,10 M$/GWh Variation ±10%	*[…]* *[…]*	- Using long-term contract - Take or pay - Regulated asset based revenues
Construction cost	Base case 750 M$ Variation ±10%	*[…]* *[…]*	- Reliable counterpart - Strong construction contract on turn-key basis

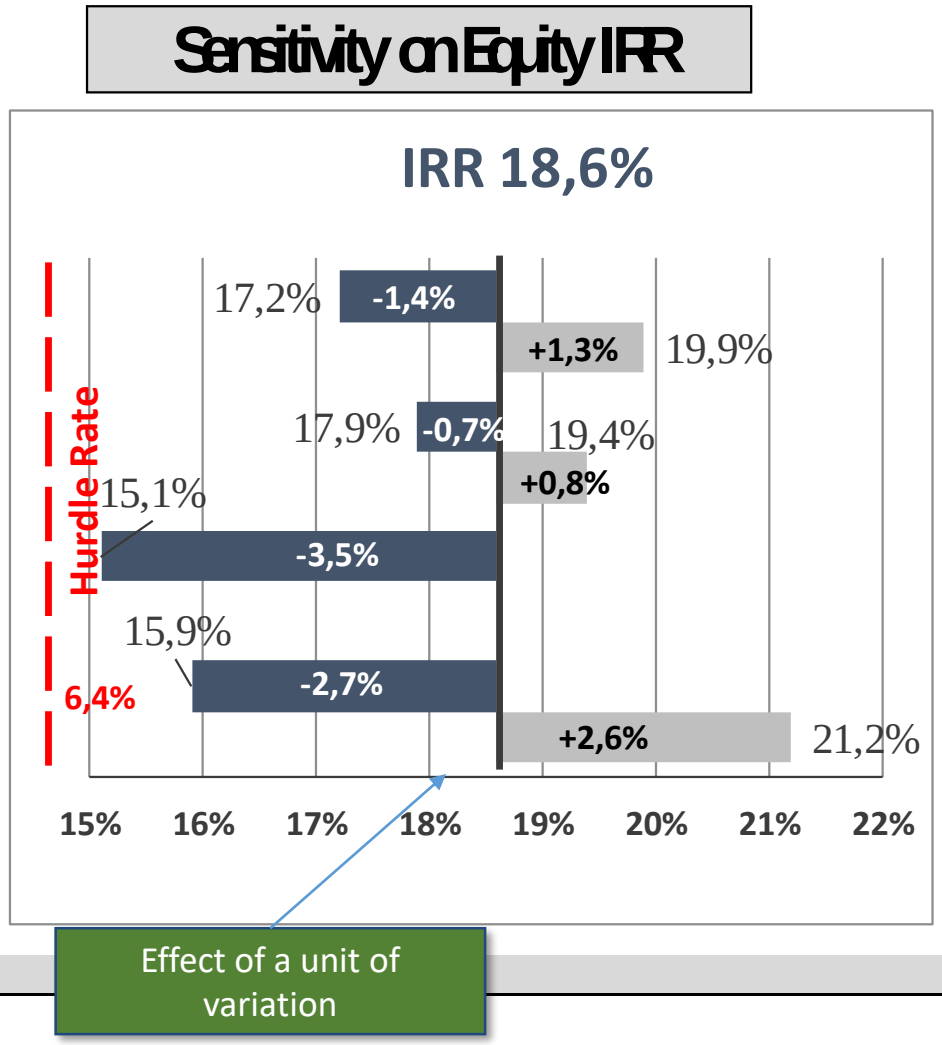
Risk matrix and sensitivity
Sample of graphical representation

Maintenance cost ±10%

Inflation rate ±0,2%

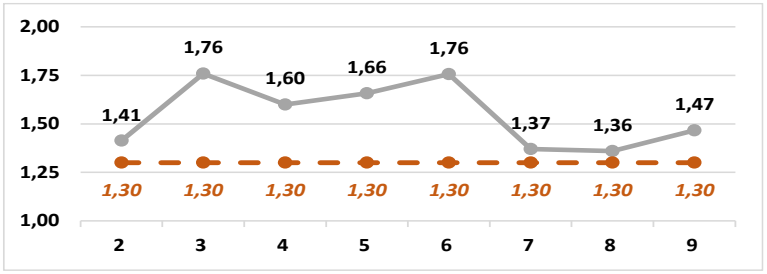
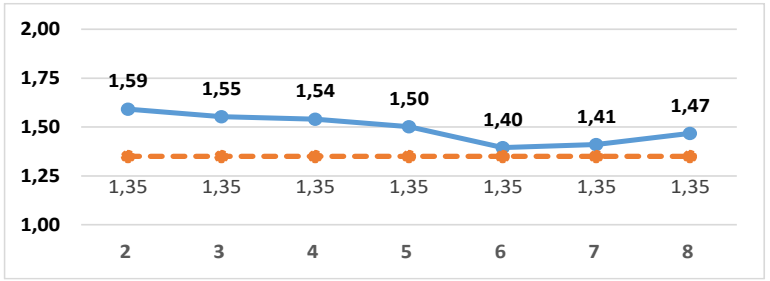
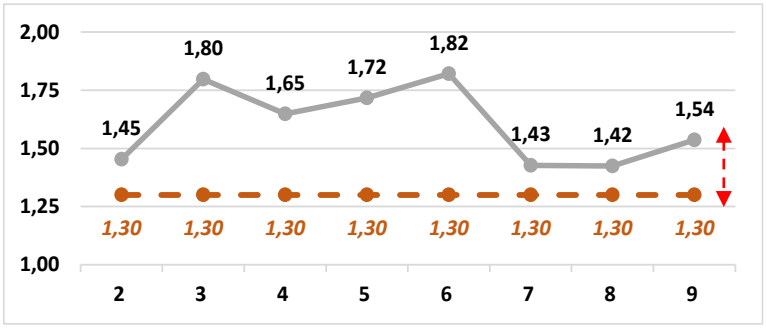
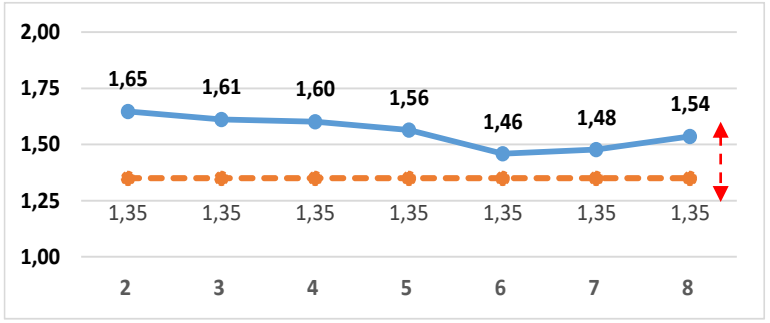
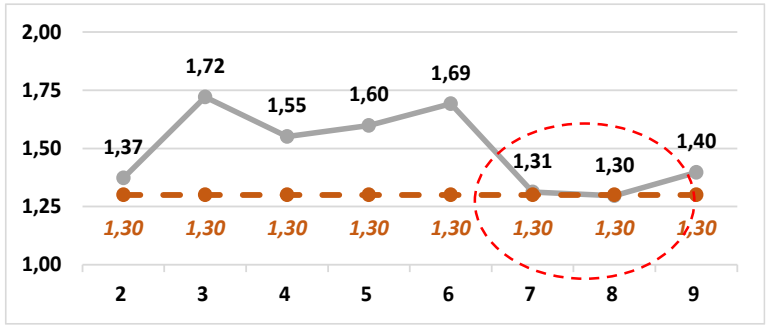
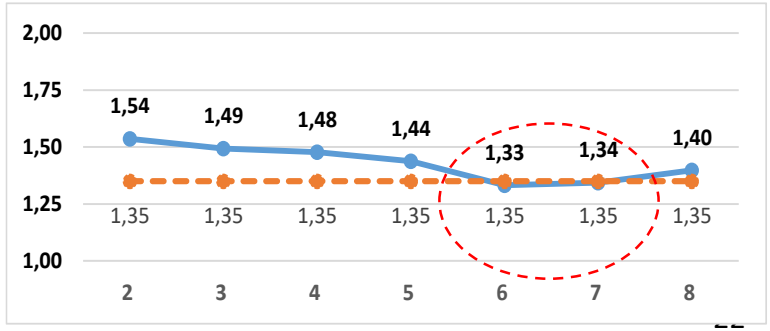
Construction schedule
+1 year

Performance ±2%



Risk matrix and sensitivity

Sample on sensitivity on covenants (lender side)

	DSCR	LLCR
Base case		
Performance + 2%		
Performance -2%		

[...]

Stress test analysis
Sample of stress test on IRR (Sponsor side)

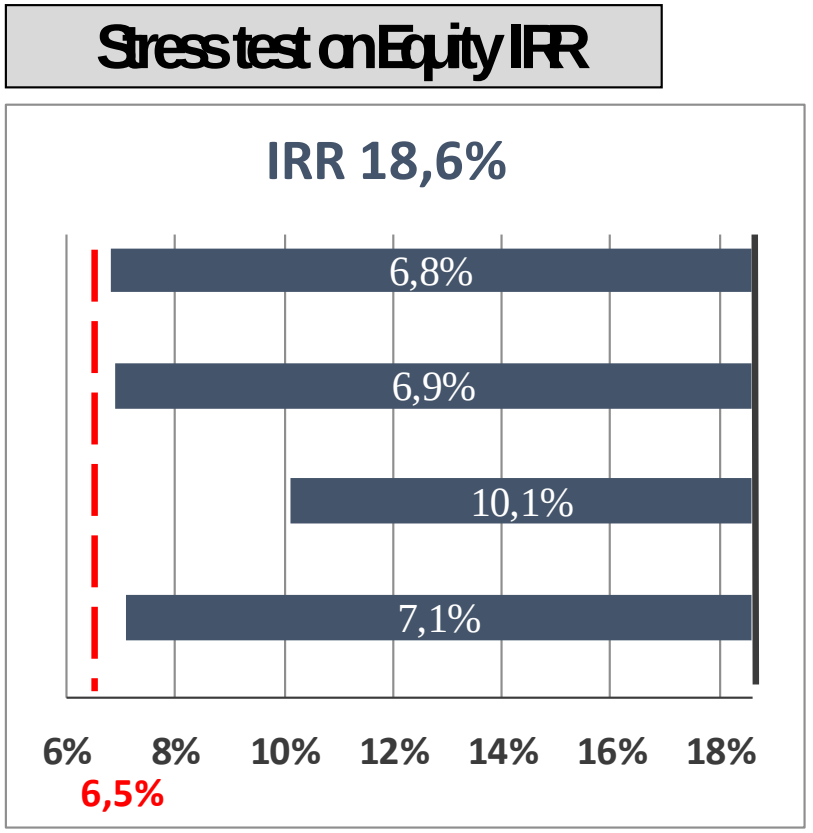
Price per unit 0,915M$/GWh

Maintenance cost 83M$/y

Inflation rate 0%

Performance 82,5%

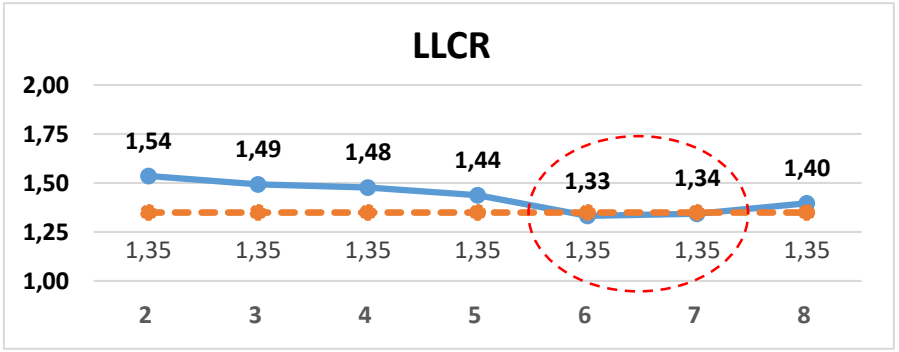
Maximum allowed variation, not to underperform the hurdle rate



- Which is the risk of these scenario happen?
- Which is my stress test considering a combination of variables?

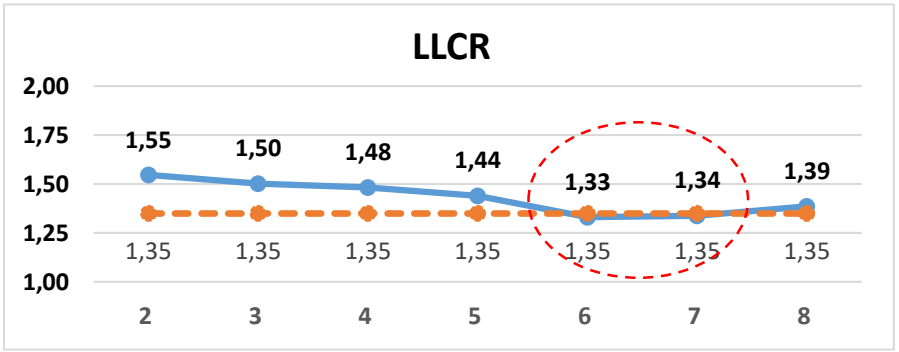
Stress test analysis
Sample of stress test on covenant (Lender side)

Performance -2%



- Performance 88% (-2%)
- LLCR covenant break-up with LLCR min of 1,33

Inflation rate –0,5%



- Inflation rate 1,5% (-0,5%)
- LLCR covenant break-up with LLCR min of 1,33

In this project, the lender is much less flexible to variable change than the sponsor. Few variations can break the covenant, while the sponsor would be still convenient for the sponsor perspective

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Sample term sheet

Referring to the bank term sheet:

- Please model the debt repayment (Senior Debt Facility and VAT Facility) and calculate DSRA and Arrangment Fee
- Consindering the exercise B of lessons 6 and 7, please apply Distribution Conditions to recalculate distributions and double check if cash flow after debt (SPV) is the same of cash flow for shareholders (distributions)

Excercise C

Under the following assumptions:

- Initial investment (Asset Value) at year 0 of 60 M€, to be amortized with D&A rate of 20%
- Project life 5 years (years of investment + 5 years)
- Revenues 20 yearly + inflation rate
- Costs 5 yearly + inflation rate
- Inflation rate 2% *(100% year 0, 102% year 1)*
- Tax rate 35% on EBT
- No Working Capital
- Debt structure: leverage 70%, repayment in 4 years with fixed installment (principal + interests) with interest rate of 5.0%
- For Ke calculation: (i) beta of a pool of comparables of 0.8, (ii) riskfree rate of 2.0%, (iii) market risk premium 6.5%

Please calculate the maximum decrease of the annual revenues allowed to satisfy: Levered IRR > Ke

Excercise D (assignment)

Project

- People mover, one-to-one electric transportation system from the city center to the city airport of a primary city. The project is running and fully operating
- The project package means the project rights (authorization for the use of the line in a monopoly system) and the necessary tools to operate the system (trains, stations, devices, etc.)

Input

- **CAPEX**: Initial asset book value: 90 M€ (price to be considered), asset remaining life 30 years, amortization rate 1/30 yearly; investment period 8 years; At the end of the investment period, the asset is sold at its residual book value
- **REVENUES**: Drivers are yearly passenger and ticket per passenger, Passengers are expected of 2.0 M per year *(2.0 M tickets),* Price per ticket is 7 € per ticket, with an yearly adjustment according to inflation rate
- **OPERATING COSTS**: Salaries 0.5 M€/year, Maintenance 1 M€/year, other services and general expenses: 2 M€/year, Contingency of 5% of the annual costs. All the previous costs adjusted according to the inflation rate
- **OTHER ASSUMPTIONS**: Inflation rate: annual 2% (according to historical value and market forecast, Tax rate: flat 35% on the annual EBT, No leverage, the project has to be considered full equity (debt free)

TO DO

- **Draw the business plan (profit & losses, cash flow) with the previous assumptions**
- **Identify some possible risks and the related effects**