



LISBON  
SCHOOL OF  
ECONOMICS &  
MANAGEMENT

UNIVERSIDADE DE LISBOA

Financial Markets and Management

MiM

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Problem Set 2: Investment Decision Rules

GUIDELINE TO SOLUTIONS

Question 1

1. Compute FCFF

(a) Start with Depreciation

t	1	2	3	4
Annual Depreciation	40	40	40	40
		Total Depreciation		160
		BV at t=0		200
		BV at t=4		40
		MV at t=4		80
		Capital Gain at t=4		40

(b) Earnings Forecast

t	0	1	2	3	4
Sales	0	120	121,8	123,627	125,481405
Cost of Goods Sold	0	50	51	52,02	53,0604
Selling Expenses	0	8	8,16	8,3232	8,489664
Administrative Expenses	0	6	6,24	6,4896	6,749184
EBITDA	0	56	56,4	56,7942	57,182157
Annual Depreciation	0	40	40	40	40
EBIT	0	16	16,4	16,7942	17,182157

(c) Determine Operating CF

t	0	1	2	3	4
EBIT	0	16	16,4	16,7942	17,182157
EBIT(1-Tc)	0	10,88	11,152	11,420056	11,68386676
Annual Depreciation	0	40	40	40	40
Operating CF	0	50,88	51,152	51,420056	51,68386676

(d) Analyze the Net Working Capital

t	0	1	2	3	4	5
NWC	0	8	8,24	8,4872	8,741816	0
Change of NWC	0	8	0,24	0,2472	0,254616	-8,741816

(e) FCFF

t	0	1	2	3	4	5
Operating CF	0	50,88	51,152	51,420056	51,68386676	0
Capital Expenditure	200	0	0	0	0	0
Sale of Fixed Asset	0	0	0	0	80	0
Capital Gain Tax	0	0	0	0	12,8	0
Change in NWC	0	8	0,24	0,2472	0,254616	-8,741816
FCFF	-200	42,88	50,912	51,172856	118,6292508	8,741816

## 2. Calculate Discounted Payback

t	0	1	2	3	4	5
FCFF	-200	42,88	50,912	51,172856	118,6292508	8,741816
Discounted FCFF	-200	37,28695652	38,49678639	33,64698348	67,82665914	4,346227539
Accumulated Discounted FCFF	-200	-162,7130435	-124,2162571	-90,56927361	-22,74261446	-18,39638693

Discounted Payback Can't identify it. Project does not payback the investors' money.

## 3. Compute NPV

t	0	1	2	3	4	5
FCFF	-200	42,88	50,912	51,172856	118,6292508	8,741816

NPV (\$18,40)

## 4. Calculate IRR

t	0	1	2	3	4	5
FCFF	-200	42,88	50,912	51,172856	118,6292508	8,741816
IRR	11%	Below the cost of capital (15%).				

## 5. Compute Profitability Index

t	0	1	2	3	4	5
FCFF	-200	42,88	50,912	51,172856	118,6292508	8,741816
Capital Expenditure	200	0	0	0	0	0
Sale of Fixed Asset	0	0	0	0	80	0
FCFF+CapEx	0	42,88	50,912	51,172856	38,62925076	8,741816
FCFF+CapEx	0	42,88	50,912	51,172856	118,6292508	8,741816
PI	0,880744082	note: considering the residual value of the fixed assets as "negative investment".				
PI	0,908018065	note: considering residual value of fixed assets as "normal" cash flow.				

Should not go ahead with the project as NPV is lowerer than zero, which is confirmed by IRR lower than 15% and PI<1 (Note: this is PI version 1, with NPV/Investment).

## Question 2

CashFlows	Ano 0	Ano 1	Ano 2	Ano 3
Equip A	-850	400	400	400
Equip B	-400	300	300	

a)

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R	13%
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NPV(A)	94,461039145553
NPV(B)	100,430730675856

EA(A)	40,0063254
EA(B)	60,20657277

If it's a unique investment, Project B is superior (NPV higher).

If it is possible to replace the equipment over time and continue the project,  
then project B confirms superiority (higher Equivalent annuity).

Question 3

Life	5	years
CapEx_0	1100000	
Annual Depreciation	220000	in full, straight line
Unit Sale Price	28	
Unit Variable Cost	17	
Fixed Costs	380000	
Quantity	70000	
Tax rate	32%	
Discount Rate	8%	

t	0	1	2	3	4	5
Sales	0	1960000	1960000	1960000	1960000	1960000
Variable Costs	0	1190000	1190000	1190000	1190000	1190000
Fixed Costs	0	380000	380000	380000	380000	380000
Depreciation	0	220000	220000	220000	220000	220000
EBIT	0	170000	170000	170000	170000	170000
EBIT(1-Tc)	0	115600	115600	115600	115600	115600
Operating CF	0	335600	335600	335600	335600	335600
CapEx	1100000					
Change NWC						
FCFFt	-1100000	335600	335600	335600	335600	335600

NPV 239953,4884

Project should go ahead, positive NPV.

b)

Sensistivity Analysis to variable "number of units sold"

	NPV
Quantity	239953,4884
	-
20000	1253320,065
	-
30000	954665,3547
	-
40000	656010,6439
	-
50000	357355,9331
	-
60000	58701,22233
70000	239953,4884
80000	538608,1992
90000	837262,91
100000	1135917,621
110000	1434572,332
120000	1733227,042

NPV is sensitive to this variable "Quantity".

If the quantity goes below 70000 (the forecasted value), the project loses money.

It all depends on our confidence regarding his "central" value of 70000.

Question 4

Life	5	years
Residual value	0	
Discount Rate	12%	
Tax Rate	32%	

	Scenario		
	Pessimistic	Expected	Optimistic
Market Size	150000	200000	300000
Market Share	20%	25%	30%
Sale Price	115	120	125
Unit Variable Cost	75	70	60
Fixed Cost	1000000	1000000	1000000
CapEx	1750000	1750000	1750000

**Analysis of the Expected Scenario**

t	0	1	2	3	4	5
Sales		600000	600000	600000	600000	600000
Variable Costs		350000	350000	350000	350000	350000
Fixed Costs		100000	100000	100000	100000	100000
Depreciation		350000	350000	350000	350000	350000
EBIT	0	1150000	1150000	1150000	1150000	1150000
EBIT(1-T <sub>c</sub> )	0	782000	782000	782000	782000	782000
Operating CF	0	1132000	1132000	1132000	1132000	1132000
CapEx	1750000					
Inv. Work.Capital						
FCFF <sub>t</sub>	-1750000	1132000	1132000	1132000	1132000	1132000

NPV	2330606,7
IRR	58%

Based on NPV, go ahead with project (NPV>0).  
Information confirmed by  
IRR>12%

Scenario Analysis based on "Data", "What if Analysis", "Scenario Manager"

The project is viable according to the "Expected" scenario, but would not survive the Pessimistic Scenario as one can conclude from the NPV analysis.

The final investment decision crucially relies on the degree of confidence allocated to the Expected scenario.

Changing Cells:

\$C\$10	200000	150000	300000
\$C\$11	25%	20%	30%
\$C\$12	120	115	125
\$C\$13	70	75	60
\$C\$14	1000000	1000000	1000000
\$C\$15	1750000	1750000	1750000

Result Cells:

\$B\$31	2330606,66	-856015,5	10542286,8
\$B\$32	58%	-10%	194%

Notes: Current Values column represents values of changing cells at time Scenario Summary Report was created. Changing cells for each scenario are highlighted in gray.