



LISBON  
SCHOOL OF  
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MANAGEMENT

UNIVERSIDADE DE LISBOA

Corporate Investment Appraisal

Masters in Finance

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Clara C Raposo

Problem Set 5: Investment Decision Rules

GUIDELINE TO SOLUTIONS

Question 1

1. Compute FCFF

(a) Start with Depreciation

t	1	2	3	4	5
Annual Depreciation	15	15	15	15	15
Total Depreciation					75
BV at t=0					150
BV at t=5					75
MV at t=5					80
Capital Gain at t=5					5

(b) Earnings Forecast

t	0	1	2	3	4	5
Sales	0	100	102	104,04	106,1208	108,243216
Cost of Goods Sold	0	40	41,6	43,264	44,99456	46,7943424
Selling Expenses	0	8	8,16	8,3232	8,489664	8,65945728
Administrative Expenses	0	6	6,24	6,4896	6,749184	7,01915136
EBITDA	0	46	46	45,9632	45,887392	45,77026496
Annual Depreciation	0	15	15	15	15	15
EBIT	0	31	31	30,9632	30,887392	30,77026496

(c) Determine Operating CF

t	0	1	2	3	4	5
EBIT	0	31	31	30,9632	30,887392	30,77026496
EBIT(1-Tc)	0	21,7	21,7	21,67424	21,6211744	21,53918547
Annual Depreciation	0	15	15	15	15	15
Operating CF	0	36,7	36,7	36,67424	36,6211744	36,53918547

(d) Analyse the Net Working Capital

t	0	1	2	3	4	5	6
NWC	0	8	8,32	8,6528	8,998912	9,35886848	
Change of NWC	0	8	0,32	0,3328	0,346112	0,35995648	
NWC "recovery"							9,35886848

(e) FCFF

t	0	1	2	3	4	5	6
Operating CF	0	36,7	36,7	36,67424	36,6211744	36,53918547	0
Capital Expenditure	150	0	0	0	0	0	0
Selling of Fixed Asset	0	0	0	0	0	80	0
Capital Gain Tax	0	0	0	0	0	1,5	0
Change in NWC	0	8	0,32	0,3328	0,346112	0,35995648	0
Residual Value of the NWC	0	0	0	0	0	0	9,35886848
FCFF	-150	28,7	36,38	36,34144	36,2750624	114,679229	9,35886848

## 2. Calculate Discounted Payback

t	0	1	2	3	4	5	6
FCFF	-150	28,7	36,38	36,34144	36,2750624	114,679229	9,35886848
Discounted FCFF	-150	26,09090909	30,0661157	27,30386176	24,77635571	71,20677859	5,282837272
Accumulated Discounted FCFF	-150	-123,9090909	-93,84297521	-66,53911345	-41,76275774	29,44402086	34,72685813

Discounted Payback 4,586499748 anos

## 3. Compute NPV

t	0	1	2	3	4	5	6
FCFF	-150	28,7	36,38	36,34144	36,2750624	114,679229	9,35886848

NPV \$34,73

## 4. Calculate IRR

t	0	1	2	3	4	5	6
FCFF	-150	28,7	36,38	36,34144	36,2750624	114,679229	9,35886848
IRR	17%						

## 5. Compute Profitability Index

FCFF	-150	28,7	36,38	36,34144	36,2750624	114,679229	9,35886848	
Capital Expenditure	150	0	0	0	0	0	0	
Selling of Fixed Asset	0	0	0	0	0	80	0	
FCFF+CapEx	0	28,7	36,38	36,34144	36,2750624	34,67922899	9,35886848	or
FCFF+CapEx	0	28,7	36,38	36,34144	36,2750624	114,679229	9,35886848	
PI	1,346139149	note: considering the residual value of the fixed assets as "negative investment".						
PI	1,231512388	note: considering residual value of fixed assets as "normal" cash flow.						

Should go ahead with the project as NPV is larger than zero, which is confirmed by IRR larger than 10% and PI>1.

### Question 2

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

R 11%

NPV(A)	127,485886178362
NPV(B)	113,757000243487

EA(A)	52,16889082
EA(B)	66,42654028

If it's a one-shot investment, project A is better (higher NPV).  
 If there is possibility of repetition, with same cash flows in real terms,  
 then project B reveals superiority (higher Equivalent Annuity and same discount rate).

### Question 3

Life	4
CapEx_0	1100000
Annual Depreciation	
Unit Sale Price	28
Unit Variable Cost	17
Fixed Costs	380000
Quantity	110000
Tax rate	23%
Discount Rate	8%

years

in full, straight line

a)

t	0	1	2	3	4
Sales	0	3080000	3080000	3080000	3080000
Variable Costs	0	1870000	1870000	1870000	1870000
Fixed Costs	0	380000	380000	380000	380000
Depreciation	0	275000	275000	275000	275000
EBIT	0	555000	555000	555000	555000
EBIT(1-Tc)	0	427350	427350	427350	427350
Operating CF	0	702350	702350	702350	702350
CapEx	1100000				
Res. Value Fixed Asset					0
Change NWC					
Res. Value NWC					
FCFFt	-1100000	702350	702350	702350	702350
NPV	1226272,28				

Project should go ahead, positive NPV.

b)

Sensistivity Analysis to variable "number of units sold"

	NPV
Quantity	1226272,286
0	-1859636,291
20000	-1298562,004
40000	-737487,7174
60000	-176413,4307
80000	384660,856
100000	945735,1428
120000	1506809,429
140000	2067883,716
160000	2628958,003
180000	3190032,29
200000	3751106,576

NPV is indeed sensitive to number of units sold.

As long as number of units is no lower than 60 000 (much less than half of what's expected) there is no particular danger, in terms of making the project lose money.

All depends on how confident we are about our central projection of "110 000" units.

Question 4

Life	5	years
Residual value	0	
Discount Rate	15%	
Tax Rate	25%	

	Scenario		
	Pessimistic	Expected	Optimistic
Market Size	100000	150000	200000
Market Share	20%	25%	30%
Sale Price	115	120	125
Unit Variable Cost	75	70	65
Fixed Cost	750000	750000	750000
CapEx	1500000	1500000	1500000

Analysis of the Expected Scenario

t	0	1	2	3	4	5
Sales		4500000	4500000	4500000	4500000	4500000
Variable Costs		2625000	2625000	2625000	2625000	3187500
Fixed Costs		750000	750000	750000	750000	750000
Depreciation		300000	300000	300000	300000	300000
EBIT	0	825000	825000	825000	825000	262500
EBIT(1-Tc)	0	618750	618750	618750	618750	196875
Operating CF	0	918750	918750	918750	918750	496875
CapEx	1500000					
Res. Value CapEX						0
Inv. Work.Capital						

Res. ValueWC						
FCFFt	-1500000	918750	918750	918750	918750	496875
NPV	1579792,496	Based on NPV, go ahead with project (NPV>0).				
IRR	54%	Information confirmed by IRR>15%				

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

### Scenario Summary

	Current Values:	Pessimistic	Optimistic
Changing Cells:			
\$C\$10	150000	100000	200000
\$C\$11	25%	20%	30%
\$C\$12	120	115	125
\$C\$13	70	75	65
\$C\$14	750000	750000	750000
\$C\$15	1500000	1500000	1500000
Result Cells:			
\$B\$33	1579792,496	-1122882,551	5916643,154
\$B\$34	54%	-26%	146%

Scenarios reveal project performs well in the expected and optimistic cases, but quite badly in the pessimistic scenario.

Should go back to the project and assess how confident you are about each scenario taking place.