



LISBON  
SCHOOL OF  
ECONOMICS &  
MANAGEMENT

UNIVERSIDADE DE LISBOA

Corporate Investment Appraisal

Masters in Finance

2015-2016

Fall Semester

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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	12	12	12	12	12
Total Depreciation					60
BV at t=0					120
BV at t=5					60
MV at t=5					80
Capital Gain at t=5					20

(b) Earnings Forecast

t	0	1	2	3	4	5
Sales	0	100	104	108.16	112.4864	116.985856
Cost of Goods Sold	0	40	41.6	43.264	44.99456	46.7943424
Selling Expenses	0	8	8.4	8.82	9.261	9.72405
Administrative Expenses	0	6	6.24	6.4896	6.749184	7.01915136
EBITDA	0	46	47.76	49.5864	51.481656	53.44831224
Annual Depreciation	0	12	12	12	12	12
EBIT	0	34	35.76	37.5864	39.481656	41.44831224

(c) Determine Operating CF

t	0	1	2	3	4	5
EBIT	0	34	35.76	37.5864	39.481656	41.44831224
EBIT(1-Tc)	0	23.8	25.032	26.31048	27.6371592	29.01381857
Annual Depreciation	0	12	12	12	12	12
Operating CF	0	35.8	37.032	38.31048	39.6371592	41.01381857

(d) Analyse the Net Working Capital

t	0	1	2	3	4	5	6
NWC	0	8	8.4	8.82	9.261	9.72405	
Change of NWC	0	8	0.4	0.42	0.441	0.46305	
NWC "recovery"							9.72405

(e) FCFF

t	0	1	2	3	4	5	6
Operating CF	0	35.8	37.032	38.31048	39.6371592	41.01381857	0
Capital Expenditure	120	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	6	0

Change in NWC	0	8	0.4	0.42	0.441	0.46305	0
Residual Value of the NWC	0	0	0	0	0	0	9.72405
FCFF	-120	27.8	36.632	37.89048	39.1961592	114.5507686	9.72405

## 2. Calculate Discounted Payback

t	0	1	2	3	4	5	6
FCFF	-120	27.8	36.632	37.89048	39.1961592	114.5507686	9.72405
Discounted FCFF	-120	25.27272727	30.27438017	28.46767844	26.77150413	71.12701478	5.48897272
Accumulated Discounted FCFF	-120	-94.72727273	-64.45289256	-35.98521412	-9.213709992	61.91330478	67.4022775

Discounted Payback 4.129538826 anos

## 3. Compute NPV

t	0	1	2	3	4	5	6
FCFF	-120	27.8	36.632	37.89048	39.1961592	114.5507686	9.72405

NPV \$67.40

## 4. Calculate IRR

t	0	1	2	3	4	5	6
FCFF	-120	27.8	36.632	37.89048	39.1961592	114.5507686	9.72405
IRR	25%						

## 5. Compute Profitability Index

t	0	1	2	3	4	5	6
FCFF	-120	27.8	36.632	37.89048	39.1961592	114.5507686	9.72405
Capital Expenditure	120	0	0	0	0	0	0
Selling of Fixed Asset	0	0	0	0	0	80	0

FCFF+CapEx	0	27.8	36.632	37.89048	39.1961592	34.55076857	9.72405	or
FCFF+CapEx	0	27.8	36.632	37.89048	39.1961592	114.5507686	9.72405	
PI	1.958422142	note: considering the residual value of the fixed assets as "negative investment".						
PI	1.561685646	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	-800	400	400	400
Equip B	-400	300	300	

R 12%

NPV(A)	160.732507288630
NPV(B)	107.015306122449

EA(A)	66.92081555
EA(B)	63.32075472

If it's a one-shot investment, project A is better.

If there is possibility of repetition, with same cash flows in real terms, then project A confirms superiority (higher Equivalent Annuity and same discount rate).

Question 3

Life	4	years
CapEx_0	450000	
Annual Depreciation		in full, straight line
Unit Sale Price	26	
Unit Variable Cost	16	
Fixed Costs	180000	
Quantity	100000	
Tax rate	36%	
Discount Rate	11%	

a)

t	0	1	2	3	4
Sales	0	2600000	2600000	2600000	2600000
Variable Costs	0	1600000	1600000	1600000	1600000
Fixed Costs	0	180000	180000	180000	180000
Depreciation	0	112500	112500	112500	112500
EBIT	0	707500	707500	707500	707500
EBIT(1-Tc)	0	452800	452800	452800	452800
Operating CF	0	565300	565300	565300	565300
CapEx	450000				
Res. Value Fixed Asset					0
Change NWC					
Res. Value NWC					
FCFFt	-450000	565300	565300	565300	565300

NPV 1303812.548

Project should go ahead, positive NPV.

b)

Sensistivity Analysis to variable "number of units sold"

	NPV
Quantity	1303812.548
0	-681752.693
20000	-284639.6447
40000	112473.4035
60000	509586.4518
80000	906699.5001
100000	1303812.548
120000	1700925.597
140000	2098038.645
160000	2495151.693
180000	2892264.741
200000	3289377.79

NPV is indeed sensitive to number of units sold.

As long as number of units is no lower than 20000 (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 "100 000" units

Question 4

Life	5	years
Residual value	0	
Discount Rate	12%	
Tax Rate	40%	

	Scenario		
	Pessimistic	Expected	Optimistic
Market Size	110000	120000	130000
Market Share	20%	25%	30%
Sale Price	115	120	125
Unit Variable Cost	72	70	68
Fixed Cost	850000	800000	750000
CapEx	1500000	1500000	1500000

Analysis of the Expected Scenario

t	0	1	2	3	4	5
Sales		3600000	3600000	3600000	3600000	3600000
Variable Costs		2100000	2100000	2100000	2100000	2100000
Fixed Costs		800000	800000	800000	800000	800000
Depreciation		300000	300000	300000	300000	300000
EBIT	0	400000	400000	400000	400000	400000
EBIT(1-Tc)	0	240000	240000	240000	240000	240000
Operating CF	0	540000	540000	540000	540000	540000
CapEx	1500000					
Res. Value CapEX						0
Inv. Work.Capital						
Res. ValueWC						
FCFFt	-1500000	540000	540000	540000	540000	540000

NPV	446579.1493
IRR	23%

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

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

	Expected	Pessimistic	Optimistic
Changing Cells:			
Market Size	120000	110000	130000
Market Share	25%	20%	30%
Price	120	115	125
Variable Cost	70	72	68
Fixed Cost	800000	850000	750000
CapEx	1500000	1500000	1500000
Result Cells:			
NPV	446579.14	-859791.7465	2118474.352
IRR	23%	-15%	61%

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.