LISBOA SCHOOL OF ECONOMICS & MANAGEMENT

Corporate Investment Appraisal

Masters in Finance

2014-2015

Fall Semester

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 | 10 | 10 | 10 | 10 | 10 |

| | |
|---|---|
| Total Depreciation | 50 |
| BV at t=0 | 100 |
| BV at t=5 | 50 |
| MV at t=5 | 70 |
| Capital Gain at t=5 | 20 |

(b) Earnings Forecast

| t | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Sales | 0 | 100 | 105 | 110,25 | 115,7625 | 121,550625 |
| Cost of Goods Sold | 0 | 40 | 42 | 44,1 | 46,305 | 48,62025 |
| Selling Expenses | 0 | 10 | 10,5 | 11,025 | 11,57625 | 12,1550625 |
| Administrative Expenses | 0 | 5 | 5,25 | 5,5125 | 5,788125 | 6,07753125 |
| EBITDA | 0 | 45 | 47,25 | 49,6125 | 52,093125 | 54,69778125 |
| Annual Depreciation | 0 | 10 | 10 | 10 | 10 | 10 |
| EBIT | 0 | 35 | 37,25 | 39,6125 | 42,093125 | 44,69778125 |

(c) Determine Operating CF

| t | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| EBIT | 0 | 35 | 37,25 | 39,6125 | 42,093125 | 44,69778125 |
| EBIT(1-Tc) | 0 | 21 | 22,35 | 23,7675 | 25,255875 | 26,81866875 |
| Annual Depreciation | 0 | 10 | 10 | 10 | 10 | 10 |
| Operating CF | 0 | 31 | 32,35 | 33,7675 | 35,255875 | 36,81866875 |

(d) Analyse the Net Working Capital

| t | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| NWC | 0 | 10 | 10,5 | 11,025 | 11,57625 | 12,1550625 | 0 |
| Change of NWC | 0 | 10 | 0,5 | 0,525 | 0,55125 | 0,5788125 | |
| NWC "recovery" | | | | | | | 12,1550625 |

(e) FCFF

| t | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Operating CF | 0 | 31 | 32,35 | 33,7675 | 35,255875 | 36,81866875 | 0 |
| Capital Expenditure | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| Selling of Fixed Asset | 0 | 0 | 0 | 0 | 0 | 70 | 0 |
| Capital Gain Tax | 0 | 0 | 0 | 0 | 0 | 8 | 0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Change in NWC | 0 | 10 | 0,5 | 0,525 | 0,55125 | 0,5788125 | 0 |
| Residual Value of the NWC | 0 | 0 | 0 | 0 | 0 | 0 | 12,1550625 |
| FCFF | -100 | 21 | 31,85 | 33,2425 | 34,704625 | 98,23985625 | 12,1550625 |

2. Calculate Discounted Payback

| t | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| FCFF | -100 | 21 | 31,85 | 33,2425 | 34,704625 | 98,23985625 | 12,1550625 |
| Discounted FCFF | -100 | 19,09090909 | 26,32231405 | 24,97558227 | 23,70372584 | 60,99922152 | 6,861215899 |
| Accumulated Discounted FCFF | -100 | -80,90909091 | -54,58677686 | -29,61119459 | -5,907468752 | 55,09175277 | 61,95296867 |

| | | |
|---|---|---|
| Discounted Payback | 4,096844986 | years |

3. Compute NPV

| t | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| FCFF | -100 | 21 | 31,85 | 33,2425 | 34,704625 | 98,23985625 | 12,1550625 |

| | |
|---|---|
| NPV | $61,95 |

4. Calculate IRR

| t | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| FCFF | -100 | 21 | 31,85 | 33,2425 | 34,704625 | 98,23985625 | 12,1550625 |

| | |
|---|---|
| IRR | 26% |

5. Compute Profitability Index

| t | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| FCFF | -100 | 21 | 31,85 | 33,2425 | 34,704625 | 98,23985625 | 12,1550625 |
| Capital Expenditure | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| Selling of Fixed Asset | 0 | 0 | 0 | 0 | 0 | 70 | 0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| FCFF+CapEx | | 0 | 21 | 31,85 | 33,2425 | 34,704625 | 28,23985625 | 12,1550625 |
| FCFF+CapEx | | 0 | 21 | 31,85 | 33,2425 | 34,704625 | 98,23985625 | 12,1550625 |

or

| | | |
|---|---|---|
| PI | 2,09582405 | note: considering the residual value of the fixed assets as "negative investment". |
| PI | 1,619529687 | 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 | -1000 | 500 | 500 | 500 |
| Equip B | -400 | 300 | 300 | |

a)

| | |
|---|---|
| R | 10% |

| | |
|---|---|
| NPV(A) | 243,425995492111 |
| NPV(B) | 120,661157024793 |

| | |
|---|---|
| EA(A) | 97,88519637 |
| EA(B) | 69,52380952 |

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 | 420000 | |
| Annual Depreciation | | in full, straight line |
| Unit Sale Price | 28 | |
| Unit Variable Cost | 19 | |
| Fixed Costs | 190000 | |
| Quantity | 110000 | |
| Tax rate | 34% | |
| Discount Rate | 12% | |

| t | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Sales | 0 | 3080000 | 3080000 | 3080000 | 3080000 |
| Variable Costs | 0 | 2090000 | 2090000 | 2090000 | 2090000 |
| Fixed Costs | 0 | 190000 | 190000 | 190000 | 190000 |
| Depreciation | 0 | 105000 | 105000 | 105000 | 105000 |
| EBIT | 0 | 695000 | 695000 | 695000 | 695000 |
| EBIT(1-Tc) | 0 | 458700 | 458700 | 458700 | 458700 |
| Operating CF | 0 | 563700 | 563700 | 563700 | 563700 |
| CapEx | 420000 | | | | |
| Res. Value Fixed Asset | | | | | 0 |
| Change NWC | | | | | |
| Res.Value NWC | | | | | |
| FCFFt | -420000 | 563700 | 563700 | 563700 | 563700 |

| | |
|---|---|
| NPV | 1292153,827 |

Project should go ahead, positive NPV.

b)
Sensistivity Analysis to variable "number of units sold"

| | NPV |
|---|---|
| Quantity | 1292153,827 |
| 0 | -692450,2364 |
| 20000 | -331613,134 |
| 40000 | 29223,96837 |
| 60000 | 390061,0707 |
| 80000 | 750898,1731 |
| 100000 | 1111735,276 |
| 120000 | 1472572,378 |
| 140000 | 1833409,48 |
| 160000 | 2194246,583 |
| 180000 | 2555083,685 |
| 200000 | 2915920,787 |

NPV is indeed sensitive to number of units sold.
As long as number of units is no lower than 40000 (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 | 13% | |
| Tax Rate | 40% | |

| | | Scenario | |
|---|---|---|---|
| | Pessimistic | Expected | Optimistic |
| Market Size | 110000 | 120000 | 130000 |
| Market Share | 22% | 25% | 27% |
| 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 | 399304,8812 |
| IRR | 23% |

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

b) Scenario Analysis:

| Scenario Summary | | | | |
|---|---|---|---|---|
| | | Current Values: | Pessimistic | Optimistic |
| Changing Cells: | | | | |
| | Size of Market | 120000 | 110000 | 130000 |
| | Market Share | 25% | 22% | 27% |
| | Unit Sale Price | 120 | 115 | 125 |
| | Unit Variable Cost | 70 | 72 | 68 |
| | Fixed Annual Costs | 800000 | 850000 | 750000 |
| | Initial Investment | 1500000 | 1500000 | 1500000 |
| Result Cells: | | | | |
| | NPV | 399304,8812 | -675701,6815 | 1561468,435 |
| | IRR | 23% | -8% | 51% |

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.