

AG215 BUSINESS FINANCE COURSEWORK ASSIGNMENT

LEWIS BRITTON

ACADEMIC YEAR 2018/2019

Investment Project Appraisal

Capital Budgets

1.1 Project A

Monetary Declarations

	Numerical Value	Monetary Value
Machinery & Equipment	7500000	£7,500,000.00
Year 5 Scrap Value of Such	500000	£500,000.00
Initial Working Capital	500000	£500,000.00
Initial Revenue	7500000	£7,500,000.00
Initial Expense	4500000	£4,500,000.00

Additional Unit Information

	Rate	Year 0 (Now)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Bag Price	4.00%		750	780	811.2	843.648	877.39392	
Expense Per Bag	5.00%		450	472.5	496.125	520.93125	546.977813	
Number of Bag Sales	-10.00%		10000	9000	8100	7290	6561	

Capital Allowances

	Rate	Year 0 (Now)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Machinery & Equipment Value		7500000	5625000	4218750	3164062.5	2373046.875		
Scrap Value of Such							500000	
Capital Allowances	25.00%		1875000	1406250	1054687.5	791015.625	1873046.88	

Tax Payments

	Rate	Year 0 (Now)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Revenue	-6.40%		7500000	7020000	6570720	6150193.92	5756581.51	
Expenses	-5.50%		4500000	4252500	4018612.5	3797588.813	3588721.43	
Pre-Capital Allowance Profit			3000000	2767500	2552107.5	2352605.108	2167860.08	
Capital Allowance			1875000	1406250	1054687.5	791015.625	1873046.88	
Taxable Profit			1125000	1361250	1497420	1561589.483	294813.206	
Tax	35.00%		393750	476437.5	524097	546556.3189	103184.622	

Cash Flows

	Rate	Year 0 (Now)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Machinery & Equipment		-7500000					500000	
Working Capital	5.00%	-500000	-25000	-26250	-27562.5	-28940.625	607753.125	
Pre-Capital Allowance Profit			3000000	2767500	2552107.5	2352605.108	2167860.08	
Tax				-393750	-476437.5	-524097	-546556.319	-103184.622
Final Cash Flows		-8000000	2975000	2347500	2048107.5	1799567.483	2729056.89	-103184.622

Net Present Value

	Rate	NPV	Monetary Value of NPV	Result
For Original Cost of Capital	10.00%	1048814.966	£1,048,814.97	Accept

1.2 Project B

Monetary Declarations

	Numerical Value	Monetary Value
Machinery & Equipment	8000000	£8,000,000.00
Year 5 Scrap Value of Such	1000000	£1,000,000.00
Initial Working Capital	750000	£750,000.00
Initial Revenue	5000000	£5,000,000.00
Initial Expense	3750000	£3,750,000.00

Additional Unit Information

	Rate	Year 0 (Now)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Bag Price	7.00%		1000	1070	1144.9	1225.043	1310.79601	
Expense Per Bag	5.00%		650	682.5	716.625	752.45625	790.079063	
Marketing Expenses			500000	250000	250000	250000	250000	
Number of Bag Sales	20.00%		5000	6000	7200	8640	10368	

Capital Allowances

	Rate	Year 0 (Now)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Machinery & Equipment Value		8000000	6000000	4500000	3375000	2531250		
Scrap Value of Such							1000000	
Capital Allowances	25.00%		2000000	1500000	1125000	843750	1531250	

Tax Payments

	Rate	Year 0 (Now)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Revenue	28.40%		5000000	6420000	8243280	10584371.52	13590333.03	
Expenses			3750000	4345000	5409700	6751222	8441539.72	
Pre-Capital Allowance Profit			1250000	2075000	2833580	3833149.52	5148793.312	
Capital Allowance			2000000	1500000	1125000	843750	1531250	
Taxable Profit			-750000	575000	1708580	2989399.52	3617543.312	
Tax	35.00%		-262500	201250	598003	1046289.832	1266140.159	

Cash Flows

	Rate	Year 0 (Now)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Machinery & Equipment		-8000000					1000000	
Working Capital	3.00%	-750000	-22500	-23175	-23870.25	-24586.3575	844131.6075	
Pre-Capital Allowance Profit			1250000	2075000	2833580	3833149.52	5148793.312	
Tax				262500	-201250	-598003	-1046289.83	-1266140.16
Final Cash Flows		-8750000	1227500	2314325	2608459.75	3210560.163	5946635.087	-1266140.16

Net Present Value

	Rate	NPV	Monetary Value of NPV	Result
For Original Cost of Capital	10.00%	1408894.003	£1,408,894.00	Accept

1.3 Project A Analysis

The *Monetary Declaration* section is self-explanatory as it simply contains given data from the brief in addition to Initial Revenue being calculated by multiplying the initial Bag Price by the initial Number of Bag Sales. And, Initial Expense being calculated by multiplying initial Expense Per Bag by the initial Number of Bag Sales. Hence, respectively:

$$BP_{y1} * NoBS_{y1}$$

$$EPB_{y1} * NoBS_{y1}$$

The *Additional Unit Information* section shows the next year's Bag Price by multiplying the

current one's by the given rate of 4%. As follows:

$$BP_{yx+1} = (BP_{yx} * (1 + 0.04))$$

Next, the calculating of the Expense Per Bag in the same manner at 5% follows:

$$EPB_{yx+1} = (EPB_{yx} * (1 + 0.05))$$

Finally, the Number of Bag Sales in the same manner again is calculated to observe the decrease in sales due to the negative rate, at 10%. Hence:

$$NoBS_{yx+1} = (NoBS_{yx} * (1 + (-0.10)))$$

The *Capital Allowances* section shows first, calculating the Capital Allowance on Year x 's Machinery & Equipment Value by multiplying this value by the rate, as follows:

$$CA_{yx+1} = (MEV_{yx} * 0.25)$$

Second, by subtracting this number from Year x 's Machinery & Equipment Value to find Year $(x + 1)$'s Machinery & Equipment Value. This follows:

$$MEV_{yx+1} = (MEV_{y4} - SVoS_{y5})$$

Repeating until Year 4, resulting in Year 5's Capital Allowances being equal to Year 4's Machinery & Equipment Value minus its Scrap Value in Year 5. That is:

$$CA_{y5} = (MEV_{y4} - SVoS_{y5})$$

The *Tax Payments* section refers to first, finding the Revenue and Expenses by multiplying the Number of Bag Sales values by the Bag Price and Expense Per Bag values, respectively for Years 2-5:

$$R = (BP * NoBS)$$

$$E = EPB * NoBS$$

With Year 1's values being carried from earlier. Both R & E decrease due to decreasing sales and increasing expenses therefore, have negative rates as shown. Next, Pre-Capital Allowance Profit is calculated by subtracting the Expenses from the Revenue for Years 1-5, as follows:

$$PCAB = (R - E)$$

After the Capital Allowances have been carried, the Taxable Profit is calculated by subtracting the Capital Allowances from the Pre-Capital Allowances Profit as this tax does not apply to Capital Allowance, as follows:

$$TP = (PCAB - CA)$$

Therefore, Tax is calculated by multiplying the Tax Rate by the Taxable Profit, as follows:

$$T = (TP * (0.35))$$

Finally, the *Cash Flows* section shows that by carrying the Taxes, carrying the Working Capital Rate and amending outflows to be negative, the Working Capital is calculated by multiplying its Rate by the sum of all previous years' Working Capital, as follows:

$$WC = (SUM(WC_{y0} : WC_{yx}) * (0.05))$$

All eligible flows are treated with regards to $(*(-1))$ for an outflow adjustment. The respective sums for flows of Machinery & Equipment, Working Capital, Pre-Capital Allowance Profit and Tax lead to the Final Cash Flows which are increasing meaning overall profit increase, displayed as follows:

$$FCF = (ME + WC + PCAP + T)$$

Hence, final Net Present Value (NPV) is as follows, relative to the first Cost of Capital rate:

$$\begin{aligned} NPV &= (0.10(SUM(FCF_{y1-6})) + (FCF_{y0})) \\ NPV &= 0.10, 2975000 + 2347500 + 204107.5 + 1799567.483 + 2729056.887 \\ &\quad - 103184.6222) - 8000000 = 1048814.97 \end{aligned}$$

This equates to £1,048,814.97 which is greater than zero and therefore profitable. A *Result* cell has been added based on an IF function, to reflect this.

1.4 Project B Analysis

All calculations in Project B are executed in the same manner as Project A's, relative to Project B's data with a few minor changes. The first being the Initial Expenses in Year 1, adjusted by the addition of 500000 for marketing expenses and 250000 added to each subsequent year's Expenses, also for marketing, that is:

$$E_{y2-5} = (EPB * NoBS) + ME_{y2-5}$$

$$ME = \text{Marketing Expenses} = 2.5 * 10^5$$

The second note is, the Number of Bag Sales Rate is positive this time at 20%; (1+0.20) and therefore results in increasing Revenues and Expenses, as rates of change for the Bag Price and Expense Per Bag are also positive. Despite the increased Expenses, this gives higher Pre-Capital Allowance Profit than Project A. Next, the Capital Allowance Rate changes to 3% which simply alters the before seen formula to calculate the Working Capital, to multiply by 0.03. Giving smaller out flows here even with the higher initial Working Capital of -750000 being used as the multiplier rather than -500000 like before. Tax Rate remains the same and due to the higher Pre-Capital Allowance Profit, Taxable Profit is higher. All of these factors put together however, amount to far greater Final Cash Flows for Project B. Meaning there is proportionately enough marginal Revenue to make up for some higher Expenses. After the NPV calculation of:

$$NPV = (0.10, 1227400 + 2314325 + 2608459.75 + 3210560.163 + 5946635.087 - 1266140.159) - 8750000 = 1408894.000$$

Therefore, an NPV of £1,408,894.00 is given. This again, is greater than zero and thus, profitable.

1.5 Comparison, Conclusions & Assumptions

In conclusion, this NPV is greater than Project A's. As they are both above the breakeven point (NPV = 0), or Internal Rate of Return, both therefore are profitable. However, with no immediate complications or alterations, Project B offers a greater Net Present Value by £360,079.04 and so, is more profitable. This most potently due to the, before described, positive increase in Number of Bag Sales per year, the higher increase rate of 7%, rather than 4%, in Bag Price and, the lowered Working Capital Rate. As these are multipliers, they can have a vital effect. Even though the overall Expenses are increasing in Project B, rather than decreasing, as in A and, Year 0 and Year 6 outflows were greater, the marginal increased Revenue is proportionately enough to bring Project B out on top. Making the Final Cash Flows for Project B not only higher than Project A's but also, increasing by a greater amount. Thus, making Project B the most desirable project to proceed with.

As for assumptions made regarding Project A, some existing required adaptation with a £1,500,000 expense and therefore must be included as it is incremental to the project. Next, The Head Office charge for rental of the production grounds of £500,000 is a Corporate Overhead and should therefore not be included. Initial Investments are taken as given. There were no apparent Sunk Costs, Opportunity Costs or Incidental Effects on the project. Working Capital is taken as given, the project suffers no Abandonment Costs. Taxes are paid at a constant rate of 35% and, Tax Depreciation should be included to account for the Scrap Value of the machinery.

Assumptions made in Project B include: a Sunk Cost of £1,500,000 due to the money spent “to date” and therefore is not incremental to the project and is not included. Again, Initial Investments are taken as given. There were no apparent Opportunity Costs, Incidental Effects or Corporate Overheads. Working Capital is taken as given, the project suffers no Abandonment Costs. Taxes are paid at a constant rate of 35% and, Tax Depreciation should be included to account for the Scrap Value of the machinery. Finally, for both projects, some “Rates” in the Spreadsheets are rates of change and some are simply applicable rates however, were both collected under the same column for form purposes.

Data Tables

2.1 Project A

Net Present Value				
	Rate	NPV	Monetary Value of NPV	Result
For Original Cost of Capital	10.00%	1048814.966	£1,048,814.97	Accept
For Adjusted Cost of Capital	0.00%	3796047.248		
	1.00%	3463410.877		
	2.00%	3145675.922		
	3.00%	2841987.255		
	4.00%	2551548.095		
	5.00%	2273615.447		
	6.00%	2007495.943		
	7.00%	1752542.04		
	8.00%	1508148.545		
	9.00%	1273749.44		
	10.00%	1048814.966		
	11.00%	832848.9565		
	12.00%	625386.3878		
	13.00%	425991.1318		
	14.00%	234253.8895		
	15.00%	49790.2906	£49,790.29	
	16.00%	-127760.855		
	17.00%	-298739.169		
	18.00%	-463464.189		
	19.00%	-622236.74		
	20.00%	-775340.197		

2.2 Project B

Net Present Value				
	Rate	NPV	Monetary Value of NPV	Result
For Original Cost of Capital	10.00%	1408894	£1,408,894.00	Accept
For Adjusted Cost of Capital	0.00%	5291339.84		
	1.00%	4816358.67		
	2.00%	4363713.9		
	3.00%	3932119.37		
	4.00%	3520375.13		
	5.00%	3127360.93		
	6.00%	2752030.16		
	7.00%	2393404.46		
	8.00%	2050568.6		
	9.00%	1722665.91		
	10.00%	1408894		
	11.00%	1108500.91		
	12.00%	820781.457		
	13.00%	545073.963		
	14.00%	280757.206		
	15.00%	27247.6051	£27,247.61	
	16.00%	-216003.37		
	17.00%	-449511.59		
	18.00%	-673762.479		
	19.00%	-889213.058		
	20.00%	-1096293.84		

2.3 Analysis

Using Data Tables, it can be seen in Project A, increasing the Cost of Capital rate to 15% gives an NPV of £49,790.29. A 15% Rate gives Project B an NPV of £27,247.61. As we know, risk in Capital Budgeting can involve fluctuations and uncertainties in the market, tax, costs of manufacturing etc. and of course time. Examples include: accounting errors leading to unaccounted expenses and thus, higher Expenses; market demand of new features to the project hence, increasing the Expense increase rate; general forecasting being inaccurate leading to reduced Sales etc.; machinery/other unexpected failures leading to replacement/repair costs i.e. higher Expenses; possible macro-financial problems causing Abandonment mid-project; unpredicted Tax alterations, etc. These play a part in the uncertainty of projects and thus, determining an appropriate Cost of Capital rate. Therefore, these results show that even though Project B is more profitable, it is more sensitive to change as seen by the higher deviance in Project B's results when the Cost of Capital rate is raised. Therefore, bringing the overall NPV down faster. Making Project B riskier and far more unreliable. Therefore, based on this analysis, this would change any immediate recommendations of Project B until further contemplation as Project A can be considered 'safer'.

Sensitivity Analysis

3.1 Project A

Scenario Summary		Current Values:	Project A Pessimistic	Project A Neutral	Project A Optimistic
Changing Cells (Rate)	\$B\$15	5.00%	6.50%	5.00%	2.00%
Result Cells (NPV)	\$C\$52	1048814.966 £1,048,814.97	789770.1813 £789,770.18	1048814.966 £1,048,814.97	1546861.156 £1,546,861.16

3.2 Project B (I)

Scenario Summary		Current Values:	Project B Pessimistic	Project B Neutral	Project B Optimistic
Changing Cells (Rate)	\$B\$15	5.00%	6.50%	5.00%	2.00%
Result Cells (NPV)	\$C\$53	1408894.003 £1,408,894.00	965803.6108 £965,803.61	1408894.003 £1,408,894.00	2255531 £2,255,531.00

3.3 Project B (II)

Scenario Summary		Current Values:	Project B Pessimistic 2	Project B Neutral 2	Project B Optimistic 2
Changing Cells (Rate)	\$B\$15	5.00%	8.00%	5.00%	4.50%
Result Cells (NPV)	\$C\$53	1408894.003 £1,408,894.00	509136.6486 £509,136.65	1408894.003 £1,408,894.00	1553625.278 £1,553,625.28

3.4 Analysis

First, Project A varies by roughly £200,000 negatively when altered to 6.5% and positively by roughly £500,000 when altered to 2%. In terms of Project B, there is a decrease of roughly £450,000 but an increase of around £800,000, respectively. This again shows Project B is far more sensitive to the risk factors and uncertainty associated with the project as seen by the proportionately larger reaction to change. If it was realistic to reduce the Expense Per Bag rate to 2% it would be a clear recommendation of Project B however, that is not reality and its most likely that the company, will over spend and increase the rate of growth in their Expense Per Bag. Therefore, Project A is safer in the worst possible event, making more of a profit when the rate is increased.

Project B's secondary suggested rates have simply put even more of a constraint on the best expected rate (4.5%) to an increase in NPV of roughly £150,000 but a decrease of almost £1,000,000 when adjusted for the worst outcome of 8%. This is more negatively impacting than both of the other projections and thus, solidifies the fact that Project B is far too unreliable.

Project A appears to be the safest option in this scenario as even though its worst expected NPV lies below the, primary, worst expected NPV for B, it also lies above the, secondary, worst expected NPV for B. And, it contains a best possible NPV of £1,546,861.16 which is very close to the, secondary, best expected NPV for B, £1,553,625.28. Meaning, better results for A in a negative outcome and reasonably equal results in a positive outcome. Thus, A is more reliable.

Solver

4.1 Project A

Objective Cell (Value Of)

Cell	Name	Original Value	Final Value
\$C\$41	For Original Cost of Capital NPV	1048814.966	2500000.182

Variable Cells

Cell	Name	Original Value	Final Value	Integer
\$D\$11	Bag Price Year 1	750	750	Contin
\$D\$13	Number of Bag Sales Year 1	10000	10793.77824	Contin
\$B\$13	Number of Bag Sales Rate	-10.00%	-7.50%	Contin
\$B\$12	Expense Per Bag Rate	5.00%	4.93%	Contin
\$E\$11	Bag Price Year 2	780	827.8130077	Contin
\$F\$11	Bag Price Year 3	811.2	854.6872331	Contin
\$G\$11	Bag Price Year 4	843.648	883.2008241	Contin
\$H\$11	Bag Price Year 5	877.39392	900	Contin

Constraints

Cell	Name	Cell Value	Formula	Status	Slack
\$C\$41	For Original Cost of Capital NPV	2500000.182	\$C\$41=2500000	Binding	0
\$B\$12	Expense Per Bag Rate	4.93%	\$B\$12>=0.03	Not Binding	1.93%
\$B\$13	Number of Bag Sales Rate	-7.50%	\$B\$13>=-0.075	Binding	0.00%
\$D\$11	Bag Price Year 1	750	\$D\$11<=900	Not Binding	150
\$E\$11	Bag Price Year 2	827.8130077	\$E\$11<=900	Not Binding	72.18699233
\$F\$11	Bag Price Year 3	854.6872331	\$F\$11<=900	Not Binding	45.31276686
\$G\$11	Bag Price Year 4	883.2008241	\$G\$11<=900	Not Binding	16.79917585
\$H\$11	Bag Price Year 5	900	\$H\$11<=900	Binding	0

4.2 Project B

Objective Cell (Value Of)

Cell	Name	Original Value	Final Value
\$C\$42	For Original Cost of Capital NPV	1408894.003	2500000.101

Variable Cells

Cell	Name	Original Value	Final Value	Integer
\$D\$11	Bag Price Year 1	1000	1000	Contin
\$D\$14	Number of Bag Sales Year 1	5000	6092.686872	Contin
\$B\$14	Number of Bag Sales Rate	20.00%	21.95%	Contin
\$B\$12	Expense Per Bag Rate	5.00%	4.73%	Contin
\$E\$11	Bag Price Year 2	1070	1150	Contin
\$F\$11	Bag Price Year 3	1144.9	1150	Contin
\$G\$11	Bag Price Year 4	1225.043	1150	Contin
\$H\$11	Bag Price Year 5	1310.79601	1150	Contin

Constraints

Cell	Name	Cell Value	Formula	Status	Slack
\$C\$42	For Original Cost of Capital NPV	2500000.101	\$C\$42=2500000	Binding	0
\$B\$12	Expense Per Bag Rate	4.73%	\$B\$12>=0.03	Not Binding	1.73%
\$B\$14	Number of Bag Sales Rate	21.95%	\$B\$14<=0.25	Not Binding	0.030512004
\$D\$11	Bag Price Year 1	1000	\$D\$11<=1150	Not Binding	150
\$E\$11	Bag Price Year 2	1150	\$E\$11<=1150	Binding	0
\$F\$11	Bag Price Year 3	1150	\$F\$11<=1150	Binding	0
\$G\$11	Bag Price Year 4	1150	\$G\$11<=1150	Binding	0
\$H\$11	Bag Price Year 5	1150	\$H\$11<=1150	Binding	0

4.3 Analysis

As can be seen, it is possible to achieve the desired £2.5m NPV, for both projects within an acceptable tolerance. By exhausting Solver, as it insisted on leaving Year 1 Bag Prices unchanged, it's shown that to achieve the desired NPV in Project A, the Years 2-5 Bag Prices must be increased (remaining below £900 as required), having reasonable slack. Number of Bag Sales Rate for growth increases by 1/4 with no slack, therefore pushing this to its allowable limit. Expense Per Bag Rate can also be decreased to a desirable value. And, Initial Bag Sales are increased by ~790, as desired. As for Project B, the same answer applies. Bag Prices for Years 2-5 must be increased and, stressed to the maximum possible value, i.e. no slack, making this risky. No. Bag Sales Rate for growth also increases but only by ~1/10 this time making this less desirable. Expense Per Bag Rate can also be decreased but, only by slightly more than Project A's and with the other factors in Project A's favour, this is essentially negligible.

Therefore, the slack on Project B, and minor increases, are less meaningful as they relate to less controllable/predictable factors and less considerable increases where desired.