

TEACHING NOTES

GEZ PETROL STATION: SPREADSHEET MODELLING FOR CAPITAL BUDGETING¹

Case Synopsis

After retiring from the army, Mr Haris was looking into the opportunity of becoming a GEZ Petrol service station dealer in Selangor, Malaysia. In order to decide whether he should apply and embark on the business, he sought the assistance of Mr Rizal, an accounting lecturer who was also an expert in building financial models for decision making. Capital budgeting is one of the important analyses to be performed in order to make the decision. Using Excel in performing the analysis, various sensitivity analyses could be conducted. Mr Rizal then gathered the relevant operational and financial data from Baron Service Station, a typical petrol station under GEZ stable. The model should be flexible enough to allow the petrol station operator to anticipate, for example, (1) what will happen to overall cash flow of the petrol station if the fuel prices go up? And (2) how much cash flow can be generated if credit card sales is reduced?

Intended Courses

Management Accounting at the undergraduate and postgraduate levels

Financial Modelling at the undergraduate and post-graduate levels

Integrated Case Study at the undergraduate level

Financial Management at the undergraduate level

Executive development programme on Entrepreneurship for business entrepreneurs and sole proprietors.

¹This is an extension of the case GEZ PETROL STATION: CVP ANALYSIS AND SPREADSHEET MODELLING FOR PLANNING AND DECISION MAKING, to be published in Emerging Economy Markets Case Studies. While the previous case concentrates on building a financial model to perform cost-volume-profit-analysis, this case focuses on building a model for capital budgeting. Information gathered on sales and expenses are the same.

Research Methodology and Data Sources

The operational and financial data are obtained from the owner of Baron Service Station. Other data are obtained through interviews with the area manager of GEZ Berhad and websites of the relevant institutions.

Case Objectives

The case discussion is intended to achieve the following learning outcomes:

1. Students are able to prepare a good financial model to make the decision.
2. Students are able to prepare a cash flow statement by business segment in order to prepare the capital budget
3. Students are able to prepare a capital budget and find the net present value of the business.
4. Students are able to build a financial model that is sufficiently flexible to allow various what if analysis to be performed;
5. Students are able to use what if analysis tools in Excel such as Goal Seek and Data Tables.

In order to come up with the capital budget and solve for the net present value (NPV) of the project, knowledge in Accounting is very important. Students need to prepare a cash flow statement to determine the annual cash flow from the business. Since sales are constant throughout the period, accruals and inventories are the same at the beginning and at the end of the period, payments are made when incurred, and no non-cash expenses such as depreciation are involved, the net cash flow is the same as the net income.

The case can be covered in a 2-hour discussion class. Students have to read the case in advance, and develop the financial model using Excel spreadsheet prior to class discussion. Students are recommended to look for instructions on how to use Excel Goal Seek and Data Table.

Suggested Discussion Questions

1. Using financial modelling techniques, produce a cash flow statement for each segment of the business as well as the overall business.
2. Find the NPV for the project.
3. Should Mr. Haris enter the business? Why?
4. If the government raised the fuel prices by RM0.30 for all types of fuel in order to cut its fuel subsidy, do you anticipate the cash flow of the petrol station business would be eroded?
5. If credit card sales are increased from 40% to 70%, what is the effect on the overall cash flow?
6. Determine the minimum annual cash flow in order for Mr. Haris to enter into the business?
7. Prepare a Data Table to show the NPV for various rates of return.
8. What are some of the qualitative factors Mr. Haris should consider in making the decision whether to enter into the business or not?

Net Present Value

In simple term, NPV (the acronym for net present value) is the difference between what something costs and what it is worth: $NPV = Value - Cost$. The NPV investment rule says invest in something which is worth more than its cost. In the standard finance textbook, Value is expressed as the discounted value of expected future cash flows, and Cost is replaced by investment. In other words, NPV is a calculation that compares the amount invested today to the present value of the future cash receipts from the investment. The future cash amounts are discounted by a specified rate of return.

For example, an investment of \$500,000 today is expected to return \$100,000 of cash each year for 10 years. The \$500,000 being spent today is already a present value, so no discounting is necessary for this amount. However, the future cash receipts of \$100,000 for 10 years need to be discounted to their present value. Let's assume that the receipts are discounted by 14% (the company's required return). This will mean that the present value of those future receipts will be approximately \$522,000. The \$522,000 of present value coming in is compared to the \$500,000 of present value going out. The result is a net present value of \$22,000 coming in.

Investments with a positive net present value would be acceptable. Investments with a negative net present value would be unacceptable.

The following is the formula for calculating NPV:

$$NPV = \sum_{t=1}^T \frac{C_t}{(1+r)^t} - C_0$$

where

C_t = net cash inflow during the period t

C_0 = total initial investment costs

r = discount rate, and

t = number of time periods

The Art of Spreadsheet Modelling

A spreadsheet model is an attempt to build a representation of reality using logical mathematical relationships. A spreadsheet can be used to show how changes in the external environment will impact the success of a business. In order to determine the net cash flow for Baron Petrol Station, a cash flow statement is needed for each business segment, where the fuel business is further divided into 3 segments (R95, R97 and Diesel). Thus, there are 4 segments in total.

A typical spreadsheet model has two building blocks; input and output. A model output is the ultimate quantity of interest that is computed by the model, in this case the cash flow generated by the different lines of business (fuel business i.e. R95, R97, diesel and *SelesaMart*), the discounted cash flow and the net present value. A model input is an assumption about the value of a key quantity of interest that is needed to compute a model output. Models often have many inputs. For example, all the data given in the case are inputs – sales in liters, sales proportion between the three types of fuel, unitcost, sales price, sales mix of fuel and *SelesaMart*, proportion of credit card sales, credit card charge, product loss, salary and all other expenses and data required in the decision making, required rate of return, the initial investment and so on (see Input Section of the model in Exhibit 1).

The Output Section in this case are i) Baron's Cash Flow Statement and ii) a schedule showing the cash flows generated in each year, the discounted cash flow and finally, the net present value of the project. Note that the value of the output cells should not contain raw numbers. They should contain cell numbers of the input section. Any formulae used would be referred to the cell number in the input section. For example, in cell C52 (Credit card sales for R95), “=C5*C6*\$C\$34” should be entered. The model will not work for other scenarios if for example “=15227287*0.4” is entered in the cell. In doing a sensitivity analysis, a decision maker will only need to change the input, for example from 60%:40% of cash sales to credit card sales ratio to 30%:70%. The output figure will automatically change. Exhibit 2 shows the formulae entered in each cell.

A spreadsheet model is easier to follow if we use different colors to denote each type of building block. The model in Exhibit 1 uses the following color-coding convention:

- Blue for Inputs
- Yellow for Output

The following steps will often help us build a model:

- **STEP 1:** What do we want to use the model to accomplish?

- **STEP 2:** To accomplish our goal, what output quantities must be computed?
- **STEP 3:** What inputs and decision variables need to be determined in order to compute the needed outputs?
- **STEP 4:** Identify the key logical relationships between our inputs and outputs. In essence, this requires us to determine the calculations or formulas that enable the model user to turn the inputs into output values.
- **STEP 5:** Set up a spreadsheet that uses the logical relationships to relate inputs and outputs.

Any assumptions we make about model inputs are bound to be in error, for example, if the credit card and cash sales mix is 30%:70% instead of 60%:40% or some other combinations. For this reason, a modeler should always do a sensitivity analysis to determine how sensitive model outputs are to changes in important model inputs. An intelligent model needs to be flexible so that it can easily incorporate changes.

Case Analysis

1. The model is as shown in Exhibits 1 (figures) and 2 (formulas).
2. Based on Exhibit 1 under the baseline scenario when liters of fuel sold is 10,671,252 (INPUT cell F5), it appears that for Baron petrol station, the whole business will give a net cash flow of RM820,994 (OUTPUT cell H67), and a net present value of RM2,912,213 (assuming a 5-year project).
3. Based on the above, Mr Haris should enter into the business because the net present value is positive. This shows that Mr Haris should be able to have a return higher than he required.
4. By increasing the sales price by RM0.30 for each type of fuel, and subsequently their costs, the net cash flow of the business increased from RM820,994 to RM828,058. Thus, the NPV also increases.
5. By changing the INPUT cell C34 (credit card sales) from 40% to 70%, overall cash flow decreased from RM820,994 to RM758,947 due to the increase in credit card charges of about RM62,000

(increased from RM82,729 to RM144,775). However, the NPV is still positive (RM2,677,008), showing that the business is still lucrative.

6. The NPV has to be more than zero if Haris wants to join the business. By using Goal Seek, setting the NPV (cell C76) to zero, and “by changing”F5 (total fuel) the annual amount of cash flow would be RM52,759. This is the minimum amount of cash flow needed by Haris to be able to join the business.
7. Students should prepare a one-way data table to show the NPVs with various rates of return. See Exhibit 3.
8. Although the NPV shows that the petrol service station is a good business project, relevant qualitative factors should also be considered, for example the traffic flow, the location of the business, competition from other petrol stations in the area and other risks associated with the business.

Report on Preliminary Use in the Classroom

The case has been tested once in a Financial Modelling class in an ~~MBA-MSc~~ program ~~and twice in Integrated Case Study classes offered to final year Accounting students~~ by one of the case writers. ~~For the Financial Modelling class, the~~The case was used after students were taught on how to prepare financial models to solve ~~CVP problems with mixed products~~NPV problems. In analyzing the case, students worked in pairs.

~~In the Integrated Study classes, where students were not initially exposed to financial modelling, the lecturer made an attempt to teach them the techniques of financial modelling in a 3 hour~~

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~~class. All the students have prior knowledge on costing and CVP analysis. In solving the case, students are divided into groups of four to five people.~~

~~The case contributed 10% of their overall marks for both classes.~~ Students found the case challenging. The case sharpened their critical thinking and was able to achieve its intended objectives. A majority of the students were able to prepare a good model, and were able to use the model in sensitivity analysis. Based on the fruitful comments from the students, improvements have been made to the case.

~~It is also interesting to ask students whether product loss due to evaporation should be treated as cost of goods sold or selling and administrative expenses in preparing the income statement for external financial reporting. Students' opinion may be divided between the two.~~

~~In finding the loss due to evaporations, a majority of students would merely multiply the loss percentage by the litres sold and the cost per litre (litres sold X product loss percentage X cost per litre), while a good student will calculate the loss as follows:~~

~~Product loss = litres sold X [product loss percentage/(1 - product loss percentage)] X cost per litre.~~

Other Comments

The case can also be used in preparing a model to forecast the sales and operating profit of the petrol station, particularly for the years 2011 and 2012, given the statistics on the number of vehicles according to states in the Exhibits and in the text. To be able to prepare the forecast, assumptions about the cost and price of fuel, and other expenses should also be given to students.

Exhibit 1

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	A	B	C	D	E	F	G	H	I
1		Baron Service Station: Capital Budgeting							
2		INPUT							
3		Fuel Business	R95	R97	Diesel	Total fuel			
4		Sales proportion	79.274710%	1.635947%	19.08934%				
5		Annual sales (Litres)	8,459,604	174,576	2,037,072	10,671,252			
6		Price per litre	RM1.80	RM2.05	RM1.80				
7		Cost per litre	RM1.69	RM1.94	RM1.74				
8		Product loss	0.50%	0.50%	0.30%				
9		Profit margin per litre	RM0.11	RM0.11	RM0.06				
10		Cost to Price per litre	94%	94%	97%				
11		Selesa Mart							
12		Sales as a % of fuel sales	7.429356%						
13		Sales	1,430,292						
14		Gross profit margin	20%						
15		Royalty	5% of sales						
16		Annual rental of equipment	7380						
17									
18		Salary	Monthly salary	Annual salaries	No.of staff	Fuel	Selesa	General	
19		Station manager	RM3,206	RM38,472	1			1	
20		Supervisors	1,674	20,088	2	1	1		
21		Cashiers	950	11,400	6	3	3		
22		Crew	812	9,744	12	12	0		
23		Clerk	960	11,520	1			1	
24		General worker	805	9,660	2			2	
25		Security guard	1,000	12,000	1			1	
26									
27		Other expenses							
28		Utilities	RM75,000						
29		Insurance	RM1,920						
30		Stationaries	RM2,400						
31									
32		Other information							
33		Cash sales	60%						
34		Credit card sales	40% of total sales						
35		Credit card fee	1% of credit card transactions						
36		Allocation of utilities:							
37		Fuel business	60%						
38		Selesa Mart	40%						
39		No of pumps	5						
40		Pumps for diese1	1						
41		Pumps for petro	4						
42		Required rate of return	10%						
43		Initial investmet	200000						
44									
45		OUTPUT							
46									
47									
48									
49			R95	R97	Diesel	Total fuel	Selesa	Total	
50		Cash Inflow							
51		Cash	9,136,372	214,728	2,200,037	11,551,138	858,175	12,409,313	
52		Credit card	6,090,915	143,152	1,466,692	7,700,759	572,117	8,272,876	
53		Total Cash Inflow	15,227,287	357,881	3,666,729	19,251,897	1,430,292	20,682,189	
54		Cash outflow							
55		Purchases							
56		COGS	14,259,509	337,909	3,542,060	18,139,478	1,144,234	19,283,712	
57		Product loss	71,656	1,698	10,658	84,012	-	84,012	
58		Credit card fee	60,909.15	1,432	14,667	77,008	5,721	82,729	
59		Royalty - selesa					71,515	71,515	
60		Salary allocated	92,694	1,913	22,321	116,928	54,288	171,216	
61		Utilities				45,000	30,000	75,000	
62		Rent of equipment					7,380	7,380	
63		Salary - unallocated						81,312	
64		Insurance						1,920	
65		Stationeries						2,400	
66		Total Cash Outflow	14,484,768	342,952	3,589,706	18,462,426	1,313,137	19,861,195	
67		Net Cash Flow from operation	742,519	14,929	77,023	789,471	117,155	820,994	
68									
69			Year	Year	Year	Year	Year	Year	
70			0	1	2	3	4	5	
71		Net Cash Flow from operation	-RM200,000	RM820,994	RM820,994	RM820,994	RM820,994	RM820,994	
72		Present Value	(RM200,000)	RM746,358	RM678,507	RM616,825	RM560,750	RM509,773	
73									
74		NPV if 5 years	RM2,912,213	Yes, Mr Haris should enter the business because the NPV is positive					
75									

Exhibit 2

Baron Service Station: Capital Budgeting							
INPUT							
	R95	R97	Diesel	Total fuel			
Sales proportion	0.7927471	0.016359467	0.1908934				
Annual sales (Litres)	=F55*C4	=F55*D4	=F55*E4	10671252			
Price per litre	=1.8	=2.05	=1.8				
Cost per litre	=1.6856	=1.9356	=1.7388				
Product loss	0.005	0.005	0.003				
Profit margin per litre	=C6-C7	=D6-D7	=E6-E7				
Cost to Price per litre	=1.6856/1.8	=1.9356/2.05	=1.7388/1.8				
Selesa Mart							
Sales as a % of fuel sales	0.07429356						
Sales	=C12*((C5*C6)+(D5*D6)+I						
Gross profit margin	0.2						
Royalty	0.05	of sales					
Annual rental of equipment	7380						
Salary							
	Monthly salary per person	Annual salaries	No. of staff	Fuel	Selesa	General	
Station manager	3206	=C19*12	1			1	
Supervisors	1674	=C20*12	2	1	1		
Cashiers	950	=C21*12	6	3	3		
Crew	812	=C22*12	12	12	0		
Clerk	960	=C23*12	1			1	
General worker	805	=C24*12	2			2	
Security guard	1000	=C25*12	1			1	
Other expenses							
Utilities	75000						
Insurance	1920						
Stationeries	2400						
Other information							
Cash sales	0.6	of total sales					
Credit card sales	0.4	of total sales					
Credit card fee	0.01	of credit card transactio					
Allocation of utilities:							
Fuel business	0.6						
Selesa Mart	0.4						
No of pumps	5						
Pumps for diesel	1						
Pumps for petro	4						
Required rate of return	0.1						
Initial investmet	200000						
OUTPUT							
CASH FLOW STATEMENT FOR THE YEAR 2010							
	R95	R97	Diesel	Total fuel	Selesa	Total	
Cash Inflow							
Cash	=C5*C6*SC33	=D5*D6*SC33	=E5*E6*SC33	=SUM(C51:E51)	=C13*SC33	=F51+G51	
Credit card	=C5*C6*SC34	=D5*D6*SC34	=E5*E6*SC34	=SUM(C52:E52)	=C13*C34	=F52+G52	
Total Cash Inflow	=SUM(C51:C52)	=SUM(D51:D52)	=SUM(E51:E52)	=SUM(C53:E53)	=SUM(G51:G52)	=F53+G53	
Cash outflow							
Purchases							
COGS	=C5*C7	=D5*D7	=E5*E7	=SUM(C56:E56)	=G53*(1-C14)	=F56+G56	
Product loss	=(C5*C8)/(1-C8)*C7	=(D5*D8)/(1-D8)*D7	=(E5*E8)/(1-E8)*E7	=SUM(C57:E57)	0	=F57+G57	
Credit card fee	=C52*SC35	=D52*SC35	=E52*SC35	=SUM(C58:E58)	=G52*SC35	=F58+G58	
Royalty - selesa					=C13*G53	=F59+G59	
Salary allocated				=SUM(C60:E60)	=(G20*G20)+(G21*D21)	=F60+G60	
Utilities	=(C4*SD522*SF522)	=(D4*SD522*SF522)	=(E4*SD522*SF522)	=SUM(C60:E60)	=C38*C28	=F61+G61	
Rent of equipment					=C16	=G62	
Salary - unallocated						=(H19*D19)+(H23*D23)+(H24*D24)+(H25*D25)	
Insurance						=C29	
Stationeries						=C30	
Total Cash Outflow	=SUM(C56:C65)	=SUM(D56:D65)	=SUM(E56:E65)	=SUM(F56:F65)	=SUM(G56:G65)	=SUM(H56:H65)	
Net Cash Flow from operation	=C53-C66	=D53-D66	=E53-E66	=F53-F66	=G53-G66	=H53-H66	
NPV if 5 years							
	Year	Year	Year	Year	Year	Year	Year
	0	1	2	3	4	5	
Net Cash Flow from operation	-200000	=\$H\$67	=\$H\$67	=\$H\$67	=\$H\$67	=\$H\$67	=\$H\$67
Present Value	=PV(\$C\$42,C70,-C71)	=PV(\$C\$42,D70,-D71)	=PV(\$C\$42,E70,-E71)	=PV(\$C\$42,F70,-F71)	=PV(\$C\$42,G70,-G71)	=PV(\$C\$42,H70,-H71)	
NPV if 5 years	=C72+NPV(C42,D71:H71)	=F(C74>0,"Yes, Mr Harris should enter the business because the NPV is positive"," No, Mr Harris should not enter the business because the NP					

Exhibit 3

	A	B	C	D	E	F	G	H	I	J
75										
76		One-way Data Table - NPV at various required rate of return								
77										
78				RM2,912,213						
79			0%	RM3,904,970						
80			1%	RM3,784,638						
81			2%	RM3,669,722						
82			3%	RM3,559,912						
83			4%	RM3,454,919						
84			5%	RM3,354,474						
85			6%	RM3,258,325						
86			7%	RM3,166,238						
87			8%	RM3,077,991						
88			9%	RM2,993,380						
89			10%	RM2,912,213						
90			11%	RM2,834,309						
91			12%	RM2,759,500						
92			13%	RM2,687,626						
93			14%	RM2,618,539						
94			15%	RM2,552,099						
95			16%	2488175.475						
96			17%	2426644.034						
97			18%	2367388.675						
98			19%	2310299.928						
99			20%	2255274.652						
100										
101										
102										
103										