

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 the 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 evaporation, 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
Baron Service Station: Capital Budgeting								
INPUT								
1	Fuel Business	R95	R97	Diesel	Total fuel			
2	Sales proportion	79.274710%	1.635947%	19.08934%				
3	Annual sales (Litres)	8,459,604	174,576	2,037,072	10,671,252			
4	Price per litre	RM1.80	RM2.05	RM1.80				
5	Cost per litre	RM1.69	RM1.94	RM1.74				
6	Product loss	0.50%	0.50%	0.30%				
7	Profit margin per litre	RM0.11	RM0.11	RM0.06				
8	Cost to Price per litre	94%	94%	97%				
9	Selesa Mart							
10	Sales as a % of fuel sales	7.429356%						
11	Sales	1,430,292						
12	Gross profit margin	20%						
13	Royalty	5% of sales						
14	Annual rental of equipment	7380						
15								
16								
17								
18	Salary	Monthly salary per person	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 diesel	1						
41	Pumps for petro	4						
42	Required rate of return	10%						
43	Initial investmet	200000						
44								
45	OUTPUT							
46	CASH FLOW STATEMENT FOR THE YEAR 2010							
47		R95	R97	Diesel	Total fuel	Selesa	Total	
48	Cash Inflow							
49	Cash	9,136,372	214,728	2,200,037	11,551,138	858,175	12,409,313	
50	Credit card	6,090,915	143,152	1,466,692	7,700,759	572,117	8,272,876	
51	Total Cash Inflow	15,227,287	357,881	3,666,729	19,251,897	1,430,292	20,682,189	
52	Cash outflow							
53	Purchases							
54	COGS	14,259,509	337,909	3,542,060	18,139,478	1,144,234	19,283,712	
55	Product loss	71,656	1,698	10,658	84,012	-	84,012	
56	Credit card fee	60,909.15	1,432	14,667	77,008	5,721	82,729	
57	Royalty - selesa					71,515	71,515	
58	Salary allocated	92,694	1,913	22,321	116,928	54,288	171,216	
59	Utilities				45,000	30,000	75,000	
60	Rent of equipment					7,380	7,380	
61	Salary - unallocated						81,312	
62	Insurance						1,920	
63	Stationaries						2,400	
64	Total Cash Outflow	14,484,768	342,952	3,589,706	18,462,426	1,313,137	19,861,195	
65	Net Cash Flow from operation	742,519	14,929	77,023	789,471	117,155	820,994	
66		Year	Year	Year	Year	Year	Year	
67	Net Cash Flow from operation	0	1	2	3	4	5	
68	Present Value	-RM200,000	RM820,994	RM820,994	RM820,994	RM820,994	RM820,994	
69	NPV if 5 years	RM2,912,213 Yes, Mr Haris should enter the business because the NPV is positive						
70								
71								
72								
73								
74								
75								

Exhibit 2

A	B	C	D	E	F	G	Formula Bar	H	I
1	Baron Service Station: Capital Budgeting								
2	INPUT								
3	Fuel Business	R95	R97	Diesel	Total fuel				
4	Sales proportion	0.7927471	0.016359467	0.1908934					
5	Annual sales (litres)	=\\$F\\$3*C4	=\\$F\\$3*104	=\\$F\\$3*E4	10671252				
6	Price per litre	=1.8	=2.05	=1.8					
7	Cost per litre	=1.6856	=1.9356	=1.7388					
8	Product loss	0.005	0.005	0.003					
9	Profit margin per litre	=C6-C7	=D6-D7	=E6-E7					
10	Cost to Price per litre	=1.6856/1.8	=1.9356/2.05	=1.7388/1.8					
11	Selesa Mart								
12	Sales as a % of fuel sales	0.07429356							
13	Sales	=C12*((C5*C6)+(D5*D6)+(I							
14	Gross profit margin	0.2							
15	Royalty	0.05	of sales						
16	Annual rental of equipment	7380							
17									
18		Monthly salary per person	Annual salaries	No.of staff	Fuel	Selesa	General		
19	Salary								
20	Station manager	3206	=C19*12	1			1		
21	Supervisors	1674	=C20*12	2	1	1			
22	Cashiers	950	=C21*12	6	3	3			
23	Crew	812	=C22*12	12	12	0			
24	Clerk	960	=C23*12	1			1		
25	General worker	805	=C24*12	2			2		
26	Security guard	1000	=C25*12	1			1		
27	Other expenses								
28	Utilities	75000							
29	Insurance	1920							
30	Stationaries	2400							
31									
32	Other information								
33	Cash sales	0.6							
34	Credit card sales	0.4	of total sales						
35	Credit card fee	0.01	of credit card transactio						
36	Allocation of utilities:								
37	Fuel business	0.6							
38	Selesa Mart	0.4							
39	No of pumps	5							
40	Pumps for diesel	1							
41	Pumps for petro	4							
42	Required rate of return	0.1							
43	Initial investmet	200000							
44									
45	OUTPUT								
46									
47									
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67									
68									
69		Year	Year	Year	Year	Year	Year		
70		0	1	2	3	4	5		
71	Net Cash Flow from operation	-200000	=\\$H\\$67	=\\$H\\$67	=\\$H\\$67	=\\$H\\$67	=\\$H\\$67		
72	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)		
73									
74	NPV if 5 years	=C72+NPV(C42,D71:H71)	=IF(C74>0,"Yes, Mr Haris should enter the business because the NPV is positive", "No, Mr Haris should not enter the business because the NP						
75									

Exhibit 3

A	B	C	D	E	F	G	H	I	J
75	One-way Data Table - NPV at various required rate of return								
76									
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									