## Money II

Many times the cost of an operation is due to a fixed cost and some incremental cost that varies with the amount of work done or the number of items produced. One way to analyze these costs is with a breakeven analysis.

As an example, consider an airline flying between New York and Washington DC. There is a fixed cost of \$10,000 to fly the airplane between these cities plus a variable cost of \$25 per passenger. The airline charges \$150 for each ticket. How many do they need to sell to be profitable?

We can plot a graph showing the costs of operating the airline on one curve and the revenue generated from ticket sales on another curve.



From the graph we can see that approximately 80 passengers must purchase tickets for the airline to break even. This is called a breakeven analysis.

We can compute the actual breakeven point easily enough since both curves are linear. The costs can be written as:

$$C_T = C_F + C_I X \tag{1}$$

Where:

 $C_T$  = the total cost  $C_F$  = fixed costs  $C_I$  = incremental costs

X = the number of passengers

For Income, we have

 $I_T = I_F + I_I X$ 

Where  $I_T$ ,  $I_F$ , and  $I_I$  represent total income, fixed income, and incremental income respectively.

We can solve these two equations for the number of passengers

$$\begin{split} C_T &= C_F + C_I X = I_T = I_F + I_I X \\ C_F - I_F &= (I_I - C_I) X \\ X &= (C_F - I_F) / (I_I - C_I) \\ X &= (10,000 - 0) / (150 - 25) = 80 \end{split}$$

The breakeven point is 80 passengers. The airline will loose money if fewer than 80 people fly and will make money if more than 80 people fly. This type of analysis can be used for many different problems.

## **Cash Flow**

Cash flow is more or less a break even analysis used to show how much cash a company has on hand. This is a very important analysis because many companies that are making money are so cash poor they cannot continue business. This is especially true of startup businesses.

## Example

You and two friends decide to start a business and you decide that you will pay yourselves \$50,000 per year until the company becomes profitable. Your business plan calls for 4 months of product development with sales starting in the fifth month. You plan to sell the following number of items each month.

Month	1	2	3	4	5	6
Sales (Units)	0	0	0	0	300	475
Month	7	8	9	10	11	12
Sales (Units)	600	700	775	845	903	1000

You decide to borrow money to get started and the bank offers you a loan at 6% interest. You will pay the loan back in 12 equal monthly payments.

Month	1	2	3	4	5	6	7	8	9	10	11	12
Salaries	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500
Loan Payment	\$10,328	\$10,328	\$10,328	\$10,328	\$10,328	\$10,328	\$10,328	\$10,328	\$10,328	\$10,328	\$10,328	\$10,328
Sales (Units)	-	-	-	-	300	475	600	700	775	845	903	1,000
Revenue	\$-	\$-	\$-	\$-	\$9,000	\$14,250	\$18,000	\$21,000	\$23,250	\$25,350	\$27,090	\$30,000
Last Month	\$120,000	\$97,172	\$74,344	\$51,516	\$28,688	\$14,860	\$6,282	\$1,454	\$(374)	\$48	\$2,570	\$6,832
Cash	\$97,172	\$74,344	\$51,516	\$28,688	\$14,860	\$6,282	\$1,454	\$(374)	\$48	\$2,570	\$6,832	\$14,004
Salary	\$50,000											
Item Price	\$30.00											
Loan	\$120,000											
Interest	6%	0.005										
Sales Rate	1.0											

The table on the previous page shows each month for the first year, the amount of money spent, the amount of money made, and the cash on hand at the end of each month. This type of table can be easily setup in a spreadsheet program and various questions can be quickly answered.

Each row in the table defines a different item. The rows are:

- 1. The first row lists the months from the start of the company. All accounting is done at the end of the month.
- 2. The next row lists the salaries of you and your partners. You are each making \$50,000 per year or \$4166.67 per month.
- 3. This row lists the loan payment due each month. It is calculated from the loan amount and the interest rate shown at the bottom of the table. The loan is for 12 months and is repaid in 12 equal payments.
- 4. The Sales row lists the projected number of units you sell each month.
- 5. The Revenue row lists the amount of money you make from these sales. The unit cost is \$30 which is shown below.
- 6. The Last Month row lists the cash on hand at the end of the previous month. We start this row with the amount of the loan then in subsequent months; enter the Cash value from the previous month.
- 7. The Cash row list the cash the company has at the end of the month. It is calculated with:

Cash = Cash Last Month + Revenue – Salaries – Loan Payment

The table shows that with the project sales, the company will turn the corner and become profitable in month 9. Month 8 is very tight and you may need to take home a reduced salary but it seems to turn around in month 9. This is exactly the type of information a bank might want before loaning you the money. You can see very easily that if you do not make your sales projections, the results can be very different. A small cash shortage can be tolerated by temporarily reducing your salary but a large cash shortage will kill the company. Cash flow problems are the largest reason for failure of startup businesses.

Using a spreadsheet like the one shown above, you can change various values and see what the results will be. Using a similar spreadsheet, answer the following questions.

- 1. How much money will you need to borrow if the loan rate is 12%? Round your answer to the next greater \$1,000.
- 2. If you can only sell 450 items in month 6, what impact will this have on your company? Which month will you run out of money (negative balance at the end of the month)? Use the original loan rate.
- 3. Using the data from question 2, how many will you have to sell in month 7 to compensate for the diminished sales in month 6?
- 4. If you need to buy \$30,000 worth of equipment at the start of business. Can borrowing more money initially help? What loan amount produces the minimum shortfall of cash the 12<sup>th</sup> month? Round your answer to the nearest \$1000. Use the original problem to investigate this possibility.
- 5. Using the data in problem 4, could you borrow the original \$120,000 and make up for the difference by selling more product. If so, how much more would you have to sell (i.e. 10%, 20%, 50%, ...)? Assume that the percent increase applies to all months.
- 6. If your actual sales are 10% less each month than that projected. When will you run out of money? Can borrowing more money initially help? If so, how much? Can reducing your salary help? If so, how much of a salary cut will the three of you have to take?