Mini Lesson: Break-Even Analysis

Revised August 2016

The **Break Even Analysis** is an analysis that determines the point where generated revenue is equal to expenses. A firm is at its break-even point when total sales or revenues are equal to total expenses. The purpose of calculating a firm's break-even point is to determine the point where sales reaches a volume at which producing them becomes profitable.

Definitions of Important Terms

A break-even analysis contains two components, a break-even point in units and a break-even point in sales dollar. The **break-even point in units** refers to the volume of sales a firm will need to reach in order to begin turning a profit. The **break-even point in sales dollar** refers to the dollar amount a firm needs in order to make a profit.

- Break Even Point (in units) = Fixed Costs/(Unit Selling Price - Unit Cost)
- Break Even Point (in sales dollar) = Fixed Costs/Profit Rate

Revenue is the income generated from the sale of goods or services.

Revenue = Units Sold x Price per Unit

Fixed costs are costs that do not change with the quantity of output. Examples of fixed costs include rent, insurance premiums, or loan payments. If firm XYZ fixed costs were $2500, regardless of whether the firm sells 0, 20, 50, or even 1000 products, the fixed costs will still be $2500. On the other hand, **fixed costs per unit** will change as the quantity of output increases or decreases. If firm XYZ fixed costs were $2500, sales of 20 products will be $125 per unit, sales of 50 products will be $50 per unit, and sales of 1000 products will be $2.50 per unit. In economics, this is known as **economies of scale**, as the quantity of output increases, the price of producing *each* product decreases.

Variable costs are costs that change with the quantity of output. Examples of variable costs include wages, utilities, or raw materials. As specified in the previous activity, **Cost of Goods Sold (COGS)** are costs associated with creating products that a firm sells. For the purpose of this activity, the COGS is the only variable cost.

Selling Price per Unit is the price a firm charges to sell the good or service they provide.

Cost of Goods Sold per Unit refers to the cost of producing one unit of the good or service.

Cost of Goods Sold per Unit = Selling Price per Unit - (Selling Price per unit x Profit Rate)

Click on the tab with the worksheet titled Activity 1 to begin.

Activity 1: Linking the Income Statement to the Break-Even Analysis

Calculate the Net Sales, Gross Profit, Total Expenses, Net Income, and Profit Ratio in the Income Statement. Then using the Income Statement, determine the Cost of Goods Sold per Unit, the Profit Rate, and the Annual Fixed Cost. Refer to the Mini Lesson for help.

Directions:
   a. Copy current worksheet to new worksheet and title it "Activity 1 Solution."
   b. Enter formula in cell G10 to calculate Net Sales.
   c. Enter formula in cell G14 to calculate Gross Profit.
   d. Enter formula in cell G15 to calculate the Gross Profit Rate.
   e. Use AutoSum in cell G29 to calculate Total Expenses.
   f. Enter formula in cell G31 to calculate Net Income. If there is a net loss, use red font in cell G31.
   g. Enter formula in cell G32 to calculate Profit Ratio.
   h. Change cells G10, G14, and G29 to Bold Font.
   i. Set cell M7 equal to the contents of cell G15.
   j. Enter formula in cell M6 to calculate Cost of Goods Sold per Unit.
   k. Set cell M8 equal to the contents of cell G29.
   l. Save file as Break-Even XX, where XX are your initials.
   m. Click on the tab for the worksheet titled Activity 2 to continue.

Activity 2: Introducing a Break-Even Table

Based on the Income Statement from Activity 1, Sam's Furniture sold roughly 715 units ($250,000/$350). Even with these sales, the firm still experienced a net loss. This suggests that the break-even point should be greater than 715. Using the Income Statement from Activity 1, complete the Break Even Table.

Directions:
   a. Copy current worksheet to new worksheet and title it "Activity 2 Solution."
   b. Link the amounts that you calculated from the previous activity to cells E3:E6.
   c. Use the Fill Handle for cells B11:B31 to set Units Sold in intervals of 50 from 0 to 1000.
   d. Enter formula in cell C11 to calculate Revenue using an absolute cell reference to the Selling Price per Unit. Use the Fill Handle on cell C11 to apply to cells C12:C31.
   e. Enter formula in cell D11 to calculate Variable Cost using an absolute cell reference to the Cost of Goods Sold per Unit. Use the Fill Handle on cell D11 to apply to cells D12:D31.
   f. Link the value of the Annual Fixed Cost (cell E6) as an absolute cell reference to cell E11. Use the Fill Handle on cell E11 to apply to cells E12:E31.
   g. Enter formula in cell F11 to calculate Total Cost. Use the Fill Handle on cell F11 to apply to cells F12:F31.
   h. Select cells B8:F31 and use all borders.

i. Change cells B10:F10 to Bold Font.
j. Select cells B11:B31 and center align.
k. Take a look at the Revenue and Total Cost columns. Fill color to Yellow across columns B through F for the first row where Revenue exceeds Total Cost, then Fill color to Yellow for the row above it too. These two rows represent the range in which the break-even point in units and break-even point in sales dollar is located.
l. Save file.
m. Click on the tab for the worksheet titled Activity 3 to continue.

Activity 3: Finding the Break-Even Point

Complete the two break-even tables.

Directions:
a. Copy current worksheet to new worksheet and title it "Activity 3 Solution."
b. Copy the values from Activity 2 Solution (cells E3:E6) to cells E3:E6 of this worksheet.
c. Based on the range that you highlighted from Activity 2, use the Fill Handle for cells B11:B21 to set Units Sold in intervals of 5.
d. Enter formula in cell C11 to calculate Revenue using an absolute cell reference to the Selling Price per Unit. Use the Fill Handle on cell C11 to apply to cells C12:C21.
e. Enter formula in cell D11 to calculate Variable Cost using an absolute cell reference to the Cost of Goods Sold per Unit. Use the Fill Handle on cell D11 to apply to cells D12:D21.
f. Link the value of the Annual Fixed Cost (cell E6) as an absolute cell reference to cell E11. Use the Fill Handle on cell E10 to apply to cells E12:E21.
g. Enter formula in cell F11 to calculate Total Cost. Use the Fill Handle on cell F11 to apply to cells F12:F21.
h. Format cells C11:F21 to Currency with 2 decimal places, comma separator, and $ symbol.
i. Select cells B8:F21 and use all borders.
j. Change cells B10:F10 to Bold Font.
k. Select cells B11:B21 and center align.
l. Take a look at the Revenue and Total Cost columns again. Fill color to Yellow across columns B through F for the first row where Revenue exceeds Total Cost, then Fill color to Yellow for the row above it too. These two rows represent the range in which the break-even point in units and break-even point in sales dollar is located.
m. Based on the range that you highlighted from the step above, use the Fill Handle for cells B26:B31 to set Units Sold in intervals of 1.
n. Enter formula in cell C26 to calculate Revenue using an absolute cell reference to the Selling Price per Unit. Use the Fill Handle on cell C26 to apply to cells C27:C31.
o. Enter formula in cell D26 to calculate Variable Cost using an absolute cell reference to the Cost of Goods Sold per Unit. Use the Fill Handle on cell D26 to apply to cells D27:D31.
p. Link the value of the Annual Fixed Cost (cell E6) as an absolute cell reference to cell E26. Use the Fill Handle on cell E26 to apply to cells E27:E31.

q. Enter formula in cell F26 to calculate Total Cost. Use the Fill Handle on cell F26 to apply to cells F27:F31.
r. Format cells C26:F31 to Currency with 2 decimal places, comma separator, and $ symbol.
s. Select cells B23:F31 and use all borders.
t. Change cells B25:F25 to Bold Font.
u. Select cells B26:B31 and center align.
v. Take a look at the Revenue and Total Cost columns again. Fill color to Yellow for the two rows that you believe closely represents the break-even point.
w. Save file.
x. Click on the tab for the worksheet titled Activity 3 to continue.

Activity 4: Break-Even in Sales Dollars and # of Sales

Calculate the break-even point in sales dollars and the break-even point in number of sales. Then, create a line graph with 4 lines, one for Revenue, Variable Cost, Fixed Cost, and Total Cost.

Directions:
a. Copy current worksheet into a new worksheet and title it "Activity 4 Solution."
b. Copy cells B3:F31 from Activity 2 Solution and paste it to cells B3:F31 in this worksheet.
c. Fill color for cells B9:B31 to Light Grey, cells C9:C31 to Light Olive Green, and cells D9:D31 to Light Red.
d. Using the formula in cell E35, create a text formula in cell E36 that will allow you to calculate the Total Sales at Break-Even.
e. Enter the formula in cell E37 using relative cell references to Fixed Costs and Profit Rate to calculate the Total Sales at Break-Even.
f. Using the formula in cell E40, enter the formula in cell E41 using relative cell references to Fixed Costs, Selling Price per Unit, and Variable Cost/COGS per Unit to calculate the Break-Even Point in Units.
g. Format cell E41 to Number with 2 decimal places.
h. Change cells B37:E37 and B41:E41 to Bold Font.
i. Take a look at the Total Sales at Break-Even and the Break-Even Point in Units. Make sure your answers from Activity 2 and 3 correspond with these amounts.
j. Highlight cells C10:C31 and create a Line Graph with Markers.
k. Right click on the graph and choose Select Data. Click on Edit Horizontal (X) Axis Series and select the range as cells B11:B31.
l. Right click on the graph and choose Select Data. Click on Add Legend Entries (Series), title the Series Variable Cost, and select cells D11:D31.
m. Right click on the graph and choose Select Data. Click on Add Legend Entries (Series), title the Series Fixed Cost, and select cells E11:E31.
n. Right click on the graph and choose Select Data. Click on Add Legend Entries (Series), title the Series Total Cost, and select cells F11:F31.

o. On the Layout tab, select Axis Titles ---> Primary Horizontal Axis Title ---> Title Below Axis and name it Units.

p. On the Layout tab, select Axis Titles ---> Primary Vertical Axis Title ---> Rotated Title and name it Dollars.

q. On the Layout tab, select Chart Title ---> Above Chart ---> and name it Break-Even Point.

r. Move this Text Box to the left corner of cell B43 and move the graph to the left corner of cell H8.

s. Drag the bottom right corner of the graph to enlarge it.

t. Save file.

u. Click on the tab with the worksheet titled Activity 5 to continue.

Activity 5: Graphing the Break-Even Point

Calculate the break-even point in sales dollars and the break-even point in number of sales. Then, create two line graphs; one line graph for Revenue and Total Cost and another for Variable Cost and Fixed Cost.

Directions:

a. Copy current worksheet into a new worksheet and title it "Activity 5 Solution."

b. Enter formula in cell E4 to calculate the Average Cost of Goods Sold per Sale.

c. Use the Fill Handle for cells B11:B31 to set Units Sold in intervals of 500 from 0 to 10,000.

d. Enter formula in cell C11 to calculate Revenue using an absolute cell reference to the Selling Price per Unit. Use the Fill Handle on cell C11 to apply to cells C12:C31.

e. Enter formula in cell D11 to calculate Variable Cost using an absolute cell reference to the Average Cost of Goods Sold per Sale. Use the Fill Handle on cell D11 to apply to cells D12:D31.

f. Link the value of the Annual Fixed Cost (cell E6) as an absolute cell reference to cell E11. Use the Fill Handle on cell E11 to apply to cells E12:E31.

g. Enter formula in cell F11 to calculate Total Cost. Use the Fill Handle on cell F11 to apply to cells F12:F31.

h. Format cells C11:F31 to Currency with 2 decimal places, comma separator, and $symbol.

i. Select cells B8:F31 and use all borders.

j. Change cells B10:F10 to Bold Font.

k. Select cells B11:B31 and center align.

l. Fill color for cells B9:B31 to Light Grey, cells C9:C31 to Light Olive Green, and cells D9:F31 to Light Red.

m. Using the formula in cell E35, create a text formula in cell E36 that will allow you to calculate the Total Sales at Break-Even.

n. Enter the formula in cell E37 using relative cell references to Fixed Costs and Profit Rate to calculate the Total Sales at Break-Even.

o. Using the formula in cell E40, enter the formula in cell E41 using relative cell references to Fixed Costs, Selling Price per Unit, and Variable Cost/COGS per Unit to calculate the Break-Even Point in Units.

p. Format cell E41 to Number with 2 decimal places.

q.   Change cells B37:E37 and B41:E41 to Bold Font.

r.   Highlight cells C10:F31 and create a Line Graph with Markers.

s.   Edit the Horizontal (X) Axis Series by selecting the range of cells for Units Sold (cells C10:F31).

t.   Select Primary Horizontal Axis Title, Title Below the Axis, and change the title to Units.

u.   Select Primary Vertical Axis Title, Rotated Title, and change the title to Dollars.

v.   Select Chart Title, Above Chart, and change the name to Break-Even Point.

w.   Move this Text Box to the left corner of cell B43, move the Break-Even graph to the left corner of cell H11.

x.   Save file.