ACRONYMS (ABBREVIATIONS) FOR USE WITH MANAGERIAL ACCOUNTING RELATING TO COST-VOLUME-PROFIT ANALYSIS.

CM Contribution Margin in total dollars
UCM Unit Contribution Margin
CMR Contribution Margin Ratio
S Sales Revenue in total dollars
USP Unit Sales Price
FC Fixed Costs/Expenses in total
VC Variable Costs in total
UVC Unit Variable Cost
BEP Break-Even Point (non-specific as to dollars or unit)
BEP$ Break-Even Point in dollars
BEP# Break-Even Point in number of units
NI Net Income
TC Total Cost (TC = FC + VC ; TC = COGS + SELL + ADM ; TC = Period + Product)
TP Target Profit (desired net income)
MS Margin of Safety in dollars
MS% Margin of Safety as a percentage of sales
OP LEV Operating Leverage

# number of items, as in number of units
C 6 - COST-VOLUME-PROFIT RELATIONSHIPS

Written by Professor Gregory M. Burbage, MBA, CPA, CMA, CFM ©

CHAPTER LEARNING OBJECTIVES:
MAJOR:
- Be able to calculate: cmr, ucm, cm, bep#, bep$, tp#, tp$, op lev, ms, ms%
- Identify limiting assumptions of CVP analysis.
MINOR:
- CVP graph
- Sales mix

LIMITING ASSUMPTIONS IN CVP ANALYSIS:
- Linear revenues and costs
- Cost behavior is either F or V, and MC can be divided into F or V.
- Sales mix is constant
- No change in inventories (i.e., production = sales)
- No change in worker/machine productivity and efficiency.
- Time value of money concept ignored.

The following is simply a demonstration to show how the BEP formulas were determined and how certain terms/concepts relate to each other. You do not need to commit this to memory!

Given: USP x # Units = S
UVC x # Units = VC
UCM x # Units = CM

S - EXPENSES = NET INCOME
S - (VC + FC) = NET
(USP x #) - ((UVC x #) + FC ) = NET
USP x # - UVC x # - FC = NET
# x (USP - UVC) - FC = NET
# x (UCM) - FC = NET
# x UCM = FC + NET
# = (FC + NET) / UCM

Therefore, when net income is zero ($-0-) that is the BEP. So using the previous equation if net income is set to zero, then the following formula is the BEP#:

$$\text{BEP#} = \frac{\text{FC} + 0}{\text{UCM}}$$

Remember Variable Costs DO NOT EXIST without Sales (i.e., production).
Therefore, as one unit is produced/sold, a little expense is incurred (variable cost) and what is left over is used to pay off the FC.
Finally, when enough sales are made, all FC are paid, that's the BEP.
Any sales above the BEP would add to Profits at the rate of the UCM for each sale.
CMR is the percentage of CM to S. E.g.,

<table>
<thead>
<tr>
<th>Units</th>
<th>S</th>
<th>VC</th>
<th>CM</th>
<th>FC</th>
<th>NET</th>
</tr>
</thead>
<tbody>
<tr>
<td>USP</td>
<td>20</td>
<td>12</td>
<td>8</td>
<td>500</td>
<td>1500</td>
</tr>
<tr>
<td>UVC</td>
<td>12</td>
<td>16</td>
<td>12</td>
<td>1000</td>
<td>1500</td>
</tr>
<tr>
<td>UCM</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>500</td>
<td>1500</td>
</tr>
</tbody>
</table>

Large CMR vs small CMR, and when Net for two companies are the same. I.e., FC differ and VC differ but TC is equal so as to make net income the same.

OPERATING LEVERAGE (OP LEV) is the measure of the extent to which fixed costs are utilized in a company. I.e., usually the larger the fixed cost the smaller the variable cost percentage.

Formula for Operating Leverage is \[ \frac{CMR}{NET} \]. The resulting number when multiplied times the anticipated percentage change in sales, will result in the anticipated percentage change in net income.

Using example above for Company B: \[ \frac{3000}{1500} = 2 \]

TARGET PROFIT (TP) formula is just an extension of the BEP Formula.

\[ TP# = \frac{FC + \text{desired profit in dollars}}{UCM}, \]
\[ TP$ = \frac{FC + \text{desired profit in dollars}}{CMR} \]

MARGIN OF SAFETY (MS) is the dollar amount of sales in excess of the Break Even Sales.

Formula: \[ S - \text{BEP}\$ = MS \]

Margin of Safety Percentage: \[ \frac{MS}{S} \]

CVP GRAPH will be demonstrated during class.
Using the information from the example on p. 249 of your text AND assuming we know the USP for the Le Louvre CD (A) and the Le Vin CD (B) we can determine the BEP# directly. (The USP for A and B are not given in the text, I have assumed $40 and $32, respectively, and therefore, we can calculate the UVC of each using the UVC ratio given.)

<table>
<thead>
<tr>
<th></th>
<th>Le Louvre</th>
<th>Le Vin</th>
</tr>
</thead>
<tbody>
<tr>
<td>USP</td>
<td>$40</td>
<td>$32</td>
</tr>
<tr>
<td>UVC</td>
<td>30</td>
<td>16</td>
</tr>
<tr>
<td>UCM</td>
<td>$10</td>
<td>$16</td>
</tr>
</tbody>
</table>

Based upon sales of $20,000 and $80,000, the ratio of units sold is 500 : 2,500. Reduced to the lowest common denominator it is a 1 : 5 ratio.

Calculating BEP#: Multiply the UCM of each Line, A and B, times the ratio of sales for each, 1 : 5, then add the contribution margins together to get what I call a COMBINED UCM.

- **Line A**: 1 x $10 = $10
- **Line B**: 5 x $16 = $80
- **COMBINED UCM** = $90

\[ \text{FC} \div \text{UCM} = \frac{27,000}{90} = 300 \text{ Combined Units, where each} \]

combined unit has 1 A and 5 Bs. Therefore, 300 Combined Units is equal to 300 x 1 As and 300 x 5 Bs. I.e., 300 As and 1,500 Bs.

**PROOF**: (300 x $10) + (1,500 x $16) = $27,000, the CM needed to cover the FC of $27,000.

If sales mix is not as anticipated then the BEP# and BEP$ will change. Using the example at the bottom of p. 255. Sales mix is now 2,000 units of A : 625 units of B or a ratio of 16 : 5. Recalculating we get:

- **Line A**: 16 x 10 = $160
- **Line B**: 5 x 16 = $80
- **COMBINED UCM** = $240

\[ \text{FC} \div \text{UCM} = \frac{27,000}{240} = 112.5 \text{ Combined Units, where each} \]

combined unit has 16 A and 5 Bs. Therefore, 112.5 Combined Units is equal to 112.5x 16 As and 112.5 x 5 Bs. I.e., 1,800 As and 562.5 Bs.

**PROOF**: (1,800 x $10) + (562.5 x $16) = $27,000, the CM needed to cover the FC of $27,000.
Put your answer to each of the following questions on the line provided. Round your numerical answers to 3 significant decimal places, if not even. Round monetary answers to the nearest whole dollar.

Assume the following: USP = 80; UVC = 60; FC = 5,000; Units sold = 365

Prepare a CM Income Statement including per unit and percentages. Use acronyms, this is for your use only in answering the following questions.

__________ How much is the Unit Contribution Margin (UCM)?

__________ How much is the Contribution Margin Ratio (CMR)?

__________ How much is the Break-Even Point in dollars (BEP$)?

__________ How much is the Break-Even Point in units (BEP#)?

__________ How much is the Margin of Safety in dollars?

__________ How much is the Margin of Safety percentage?

__________ How much is the Operating Leverage Factor?

__________ How much would net income change if sales decrease by $1,200? Use UCM or CMR approach.

__________ How many units would have to be sold to generate a net income of $1,740?

__________ How much would sales have to be to generate a net income of $1,740?