Ch.3

Cost -Volume- Profit Analysis
(CVP)

→ what is CVP? → تعطي لنا أي ان الشركات ← إختيار أحد فرعين (Q)

تعرف خسارة ← خسارة ← تضيع

Operating Income ≠ Total Revenue ← جميع ما تحصل عليه الشركة من مبيعات
(الدخل التشغيلي) = Total Cost

Total Revenue (TR) − Total Cost (TC) = Operating Income (OI)

$$TR - TC = OI$$

Total Cost = Variable Cost + Fixed Cost

$$TC = VC + FC$$

> ❋ Selling price → P
> Number of unit sold → Q

Variable Cost = [Direct Material + Direct Labor + Variable Manufacturing overhead] +

other variable costs

Variable manufacturing Cost

$$VC = DM + DL + V. MOH + other VC.$$

↳ تتغير بتغير الانتاج

①

Fixed Cost = Fixed Manufacturing overhed + other Fixed Costs

$$FC = F.MOH + other\ FC$$

↳ withen Relevant النشاط حجم ضمن
    Range

Example: Bookstore - selling GMAT textbooks

$$P = \$200$$

$$Vc/unit = \$120$$

$$FC = \$\ 2,000$$

$$Q = \quad 40\ units$$

* Full apsorption costing Income statement (الطريقة الي بنحفظها)
    External users الـ فيها نحضر و GAAP ب مقبولة ↲

(CM. IS)
Contribution margin Income statement: لنحرف التقارير داخل الشركة بنحضر ←
   (Variable Costing)

    Maching Principle تطبق ب في GAAP ب مقبولة غير ↵

CM. IS

Sales	$200 \times 40 \rightarrow$	8,000
(Variable Costs)	$(120 \times 40) \rightarrow$	(4,800)
Contribution margin	$3,200 \rightarrow (80 \times 4)$	$[200 - 120 = 80]$
(Fixed Costs)	(2,000)	
operating Income	1,200	

②

$$\therefore CM = Sales - VC \quad [\$3,200 = 8,000 - 4,800]$$

$$CM/unit = \frac{CM}{Q} \quad \left[\frac{3,200}{4Q} = 80\right]$$

or

$$CM/unit = P - VC/unit \quad [200 - 120 = 80]$$

← عند زيادة Q بمقدار 1 يصبح قيمة $80 سلبي ولكن في تنقص FC

$$CM_\% = \frac{CM}{Sales} \times 100\% \quad \left[\frac{3,200}{8,000} \times 100\% = 40\%\right]$$

or

$$CM_\% = \frac{CM/unit}{P} \times 100\% \quad \left[\frac{80}{200} \times 100\% = 40\%\right]$$

يعني كل $1 من Sales بحيب CM يساوي $0.4 و تنقص $0.6

FC

→ CUP Equation:

$$Rev. - VC - FC = OI$$

$$(P \cdot Q) - (VC/unit \cdot Q) - FC = OI$$

$$Q(P - VC/unit) - FC = OI \quad \cdots \text{①}$$

$$Q \cdot CM/unit - FC = OI \quad \cdots \text{②}$$

$$\therefore CM - FC = OI \quad \cdots 3$$

③

Breakeven point (BEP)

لنقطة التعادل (%ر,%ج وق.م)

$$Q(P - VC/unit) - FC = OI$$

$$Q(P - VC/unit) - FC = 0$$

$$Q(P - VC/unit) = FC$$

$$\therefore BEP = \frac{FC}{CM/unit} \longrightarrow \left[\frac{200}{80} = 25 \ unit \right]$$

عند بيع 25 وحدة يتعادل الايراد وق.ثابتة

$$BEP(\$) = \frac{BEP}{Q} \times P \quad \left[25 \times 200 = \$5,000 \right]$$

or

$$BEP(\$) = \frac{FC}{CM\%} \quad \left[\frac{2,000}{40\%} = \$5,000 \right]$$

* Target OI

$$Target(Q) = \frac{FC + target \ OI}{CM/unit} \quad \left[\frac{2,000 + 2,800}{80} = 60 \ unit \right]$$

$$Target \ Revenue(\$) = Target(Q) \times P \quad \left[60 \times 200 = \$12,000 \right]$$

or

$$Target \ Revenue(\$) = \frac{FC + Target \ OI}{CM\%} \quad \left[\frac{2,000 + 2,800}{40\%} = \$12,000 \right]$$

④

CUP and Income tax

Net Income = Operating Income $\cdot$ (1- tax Rate)

$$NI = OI \cdot (1- \text{tax Rate})$$

$$OI = \frac{NI}{1- \text{tax Rate}}$$

Tax Rate = 40% ولدينا $\$1,200 \leftarrow NI$ وهو قيمة أكبر نريد أن نصل على

$$OI = \frac{1,200}{60\%} = \$2,000$$

$$\text{Target } Q = \frac{FC + \text{target } OI}{CM/unit} \qquad \left[\frac{2,000 + 2,000}{80} = 50 \text{ unit} \right]$$

$$\text{Target Revenue } (\$) = \text{Target } Q \cdot P \qquad \left[50 \cdot 200 = \$10,000 \right]$$

$$\text{or} \qquad \left[\frac{2,000 + 2,000}{CM/unit \cdot P} \rightarrow \frac{4,000}{80/200} = 10,000 \right]$$

Status Que   الوضع الحالي   حالة أخرى

P = $200   P = $200

VC/unit = $120   VC/unit = $120

CM/unit = $80   CM = $80

FC = $2,000   FC ┌→ $2,000
                                                         └→ $500
Q = 40 unit

            ↓   Q ↑ 10%

OI = 80·40 + ⁻2,000   ∴ Q = 10% × 40 + 40

OI = $1,200   Q = 44 unit
                                                             ↓
                                                      OI = 80 × 44 − 2,500

                                                      OI = $1,020

∴ Status Que   أفضل

1,200 < OI لأن و $115 سعرنها إذا اشترينا 50 وحدة بسعر الشركة تخطيط سعر أي عند *

$$OI = (P - VC/unit)\, Q - FC$$

$$1,200 = (P - 115)\, 50 - 2000$$
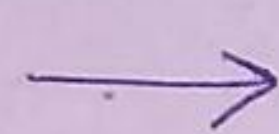
$$\frac{3,200}{50} = P - 115 \quad \longrightarrow \quad \boxed{P = \$179}$$

→ Sensitivity Analysis: تحليل الحساسية
    ↳ what if analysis   [ماذا تكون تأثير ايش إذا ؟]

$$MOS_Q = Sales_Q - BEP_Q \qquad [15 = 40 - 25]$$

$$MOS_\$ = Sales_\$ - BEP_\$ \qquad [3,000 = 8,000 - 5,000]$$

$$MOS_\% = \frac{MOS_\$}{Sales_\$} \quad ^{\times 100\%} \qquad \left[\frac{3,000}{8,000} = \underline{37.5\%}\right]$$

Sales can drop by 37.5
before we start losing

Cost Structure:

TC / VC / FC

العلاقات بيه

$$\left. \begin{array}{l} VC/TC \\ FC/TC \end{array} \right\} \text{نسبة}$$

سمي كل ما زادت بزيد الجبد علي كأنو إذا قلت

المبيعات بتكون الخسارة كبيرة

Degree of Operating laverage (DOL)

OI ← يوضح أثر FC على

$$DOL = \frac{CM}{OI} \implies$$
تغير المبيعات زيادة أو نقصان يؤثر على OI اعتماداً

على مجم FC (البسط والمقام الفرق بينهم) FC

⑦

مثلاً زادت المبيعات 10%

$$DOL \times 10\% = \uparrow OI$$

زيادة في OI

وبيجي OI الجديد = $\underset{old}{OI} + \uparrow OI$

Multiple Product ← بأكثر من منتج

$$OI = (P - VC/unit)Q_1 + (P - VC/unit)Q_2 \cdots - FC$$

$$OI = \underset{Product_1}{CM/unit} + \underset{Product_2}{CM/unit} \cdots - FC$$

Sales mix   يحرجوا عن بعض   Bundle   حزمة

Example:

	Product₁	Product₂	
Sales Q	60	40	→ Sales mix 3 : 2 نسبة الـ q
P	$200	$100	CM/unit Product₁ = $80, Product₂ = $30
VC/unit	$120	$70	
FC	$4,500		

$$OI = 80 \times 60 + 30 \times 40 - 4,500$$

$$OI = \$1,500$$

⑧

$$CM/_{bundle} = CM_{Product_1} + CM_{Product_2}$$

$$= (Q \cdot CM/_{unit}) + (Q \cdot CM/_{unit})$$

$$= 3 \times 80 + 2 \times 30$$

$$= \$300$$

$$BEP_{Q/_{bundle}} = \frac{FC}{CM/_{bundle}} = \frac{4,500}{300} = 15 \text{ bundle}$$

1 bundle $\longrightarrow$ 3 product$_1$

$\quad\quad\quad\quad \longrightarrow$ 2 product$_2$

$$\therefore \quad 3 \times 15 = 45 \text{ unit (product1)}$$

$$2 \times 15 = 30 \text{ unit (product}_2\text{)}$$

$$BEP_{\$/_{bundle}} = 45 \times 200 + 30 \times 100 \longrightarrow \$12,000$$

$$CM^{or}_{\% /_{bundle}} = \frac{CM/_{bundle}}{Sales/_{bundle}} = \frac{300}{3 \times 200 + 2 \times 100} = 37.5\%$$

$$\therefore BEP = \frac{FC}{CM_{\%/_{bundle}}} = \frac{4,500}{37.5\%} = \$12,000$$

⑨

Ch. 3
CUP Analysis   قوانين

① TR - TC = OI

② TC = FC + VC

③ VC = DM + DL + Variable MOH + other VC.

④ FC = Fixed MOH + other FC

⑤ CM/unit = P - VC/unit   or   CM/Q

⑥ CM = (P - VC/unit) Q   or   Sales - VC

⑦ $CM_{\%}$ = CM/sales . 100%   or $\dfrac{CM/unit}{P}$. 100%

⑧ CUP Equation:

※ Q (P - VC/unit) - FC = OI

※ Q . CM/unit - FC = OI

※ CM - FC = OI

⑨ Breakeven point (BEP)

※ BEP_Q = $\dfrac{FC}{CM/unit}$

※ $BEP_{(\$)}$ = BEP_Q . P   or $\dfrac{FC}{CM\%}$

10 Target Operating Income

$$\text{Target (Q)} = \frac{FC + \text{target OI}}{CM/\text{unit}}$$

$$\text{Target Revenue ($\$$)} = \text{Target} \times P$$
$$\qquad\qquad\qquad Q$$

$$\text{or} \qquad \frac{FC + \text{target OI}}{CM\%}$$

11 CUP and Income tax

$$OI = \frac{NI}{1 - \text{tax Rate}}$$

12 Margin of Safty (MOS)

* $$\text{MOS (Q)} = \text{Sales (Q)} - \text{BEP (Q)}$$

* $$\text{MOS ($\$$)} = \text{Sales ($\$$)} - \text{BEP ($\$$)}$$

* $$\text{MOS (\%)} = \frac{\text{MOS ($\$$)}}{\text{Sales ($\$$)}} \cdot 100\% \qquad \text{or} \qquad \frac{\text{MOS (Q)}}{\text{Sales (Q)}}$$

11

⑬ Degree of Operating laverage (DOL)

∗ $DOL = \dfrac{CM}{OI}$

$\begin{pmatrix} OI\uparrow \\ sales\uparrow \end{pmatrix}$ OI خذ الزيادة ←

  Sales خذ الزيادة ←

∗ $OI\uparrow = sales\uparrow\% \cdot DOL$

∗ $New\ OI = old\ OI + OI\uparrow$

⑭ Sales mix
[نسبة توزيع] $A:B:C$ لي يُحتّر عنه بالسبه

Bundle   حزمة

$OI = (CM/unit \cdot Q)_{Product_1} + (CM/unit \cdot Q)_{Product_2} \ldots - FC$

↳ for more 1 product

$CM/bundle = CM_{Product_1} + CM_{Product_2} \ldots CM_{Product_n}$

wher every $CM = CM/unit \cdot Q$

⑮ BEP /bundle

∗ $BEP/bundle\ (Q) = \dfrac{FC}{CM/bundle}$ → يوجد Q لكل product بـ

  Sales mix

$$BEP_{[\$] / bundle} = \begin{cases} BEP_{(Q) / bundle}^{Product} \cdot P \end{cases}$$

or $\dfrac{FC}{CM}$
$[\%] / bundle$

$$BEP_{(\%)} = \frac{CM / bundle}{(Q_1 \cdot P_1) + (Q_2 \cdot P_2) \cdots + (Q_n \cdot P_n)}$$

لكل منتج كاك وتغيره →

* Contribution margin Income Statement

Sales

(VC)
_____
CM

(FC)
_____
OI

RUBA
MTOOR

⑬