附錄一－CVCS 模型推導

已知銷貨收入(S_t)減成本(C_t)等於淨利(E_t)：

$$E_t = S_t - C_t \tag{1}$$

又成本可以按其是否會隨著銷貨收入變動而等比例變動而分類成變動成本(V_t)與固定成本(F_t)：

$$\begin{aligned} C_t &= V_t + F_t \\ &= \upsilon S_t + F_t \end{aligned} \tag{2}$$

其中，$\upsilon = \frac{\triangle V_t}{\triangle S_t}$ 。

將(2)式帶入(1)式，可得到(3)式：

$$E_t = (1-\upsilon)S_t - F_t \tag{3}$$

令銷貨收入(S_t)為一階自我相關：

$$S_t = \alpha_0 + \alpha_1 S_{t-1} + \varepsilon_s \tag{4}$$

令固定成本(F_t)為一階自我相關，並將成本僵固性反應於其中：

$$F_t = \beta_0 + \beta_1 F_{t-1} + \beta_2 \upsilon (S_{t-1} - S_t) D_t + \varepsilon_F \tag{5}$$

其中，D_t 為啞變數(dummy variable)，當 $S_{t-1} - S_t > 0$ ，則 D=1，當 $S_{t-1} - S_t < 0$ ，則 D=0。

將(4)式與(5)式帶入(3)式，可得到(6)式：

$$
\begin{aligned}
E_t &= (1-\upsilon)S_t - F_t \\
&= (1-\upsilon)(\alpha_0 + \alpha_1 S_{t-1} + \varepsilon_S) - (\beta_0 + \beta_1 F_{t-1} + \upsilon\beta_2(S_{t-1} - S_t)D_t + \varepsilon_F) \\
&= (1-\upsilon)(\alpha_0 + \alpha_1 S_{t-1} + \varepsilon_S) - \beta_0 - \beta_1\left((1-\upsilon)S_{t-1} - E_{t-1}\right) \\
&\quad -\upsilon\beta_2(-\alpha_0 + (1-\alpha_1)S_{t-1} - \varepsilon_s)D_t - \varepsilon_F \\
&= (1-\upsilon)\alpha_0 - \beta_0 + \upsilon\alpha_0\beta_2 D_t + \beta_1 E_{t-1} + (1-\upsilon)(\alpha_1 - \beta_1)S_{t-1} - \upsilon\beta_2(1-\alpha_1)S_{t-1}D_t \\
&\quad +\upsilon\beta_2 D_t\varepsilon_S + (1-\upsilon)\varepsilon_S - \varepsilon_F \\
&= \gamma_0 + \gamma_1 D_t + \gamma_2 E_{t-1} + \gamma_3 S_{t-1} + \gamma_4 S_{t-1}D_t + \eta
\end{aligned} \tag{6}
$$

其中，

$$
\begin{aligned}
&\gamma_0 = (1-\upsilon)\alpha_0 - \beta_0; \\
&\gamma_1 = \upsilon\alpha_0\beta_2; \\
&\gamma_2 = \beta_1; \\
&\gamma_3 = (1-\upsilon)(\alpha_1 - \beta_1); \\
&\gamma_4 = \upsilon(\alpha_1 - 1)\beta_2; \\
&\eta = \upsilon\beta_2 D_t\varepsilon_S + (1-\upsilon)\varepsilon_S - \varepsilon_F
\end{aligned}
$$

CVCS 模型：

$$
ROE_t = \gamma_{d0} + \gamma_{d1}\cdot D_t + \gamma_{d2}\cdot ROE_{t-1} + \gamma_{d3}\cdot S_{t-1} + \gamma_{d4}\cdot S_{t-1}\cdot D_t + \varepsilon_{dt} \tag{7}
$$

附錄二－CVCS'模型推導

已知銷貨收入(S_t)減成本(C_t)等於淨利(E_t)：

$$E_t = S_t - C_t \tag{1}$$

又成本可以按其是否會隨著銷貨收入變動而等比例變動而分類成變動成本(V_t)與固定成本(F_t)：

$$\begin{aligned} C_t &= V_t + F_t \\ &= \upsilon S_t + F_t \end{aligned} \tag{2}$$

其中，$\upsilon = \frac{V_t}{S_t}$。

將(2)式帶入(1)式，可得到(3)式：

$$E_t = (1-\upsilon)S_t - F_t \tag{3}$$

令銷貨收入(S_t)為一階自我相關：

$$S_t = \alpha_0 + \alpha_1 S_{t-1} + \varepsilon_s \tag{4}$$

令固定成本(F_t)為一階自我相關，並將成本僵固性與影響成本僵固性程度之因素反應於其中：

$$F_t = \beta_0 + \beta_1 \cdot F_{t-1} + \beta_2 \upsilon \cdot (S_{t-1} - S_t) \cdot D_t + \sum_{i=3}^{7} \beta_i \upsilon \cdot (S_{t-1} - S_t) \cdot D_t \cdot controls + \varepsilon_F \tag{5}$$

將(4)式與(5)式代入(3)式，可得到(6)式：

$$
\begin{aligned}
E_t &= (1-\upsilon)\cdot S_t - F_t \\
&= (1-\upsilon)(\alpha_0 + \alpha_1 \cdot S_{t-1} + \varepsilon_s) - (\beta_0 + \beta_1 \cdot F_{t-1} + \beta_2 \upsilon \cdot (S_{t-1} - S_t)\cdot D_t \\
&\quad + \sum_{i=3}^{7} \beta_i \upsilon \cdot (S_{t-1} - S_t)\cdot D_t \cdot controls + \varepsilon_F) \\
&= (1-\upsilon)(\alpha_0 + \alpha_1 \cdot S_{t-1} + \varepsilon_s) - [\beta_0 + \beta_1 \cdot ((1-\upsilon)\cdot S_{t-1} - E_{t-1}) \\
&\quad + \beta_2 \upsilon \cdot (-\alpha_0 + (1-\alpha_1)\cdot S_{t-1} - \varepsilon_s)\cdot D_t \\
&\quad + \sum_{i=3}^{7} \beta_i \upsilon \cdot (-\alpha_0 + (1-\alpha_1)\cdot S_{t-1} - \varepsilon_s)\cdot D_t \cdot controls + \varepsilon_F] \\
&= \left[\alpha_0 (1-\upsilon) - \beta_0\right] + (\alpha_1 - \beta_1)(1-\upsilon)\cdot S_{t-1} + \beta_1 \cdot E_{t-1} + \alpha_0 \beta_2 \upsilon \cdot D_t \\
&\quad - (1-\alpha_1)\beta_2 \upsilon \cdot S_{t-1}\cdot D_t + \sum_{i=3}^{7} \alpha_0 \beta_i \upsilon \cdot D_t \cdot controls \\
&\quad - \sum_{i=3}^{7} (1-\alpha_1)\beta_i \upsilon \cdot S_{t-1}\cdot D_t \cdot controls \\
&\quad + \left[\varepsilon_s (1-\upsilon) + \varepsilon_F + \beta_2 \upsilon \varepsilon_S \cdot D_t + \sum_{i=3}^{7} \beta_i \upsilon \varepsilon_S \cdot D_t \cdot controls\right] \\
&= \gamma_0 + \gamma_1 \cdot S_{t-1} + \gamma_2 \cdot E_{t-1} + \gamma_3 \cdot D_t + \gamma_4 \cdot S_{t-1}\cdot D_t + \sum_{i=5}^{9} \gamma_i \cdot D_t \cdot controls \\
&\quad + \sum_{i=10}^{14} \gamma_i \cdot S_{t-1}\cdot D_t \cdot controls + \eta
\end{aligned}
\tag{6}
$$

其中，

$$
\begin{aligned}
\gamma_0 &= \left[\alpha_0 (1-\upsilon) - \beta_0\right]; \\
\gamma_1 &= (\alpha_1 - \beta_1)(1-\upsilon); \\
\gamma_2 &= \beta_1; \\
\gamma_3 &= \alpha_0 \beta_2 \upsilon; \\
\gamma_4 &= -\beta_2 \upsilon (1-\alpha_1); \\
\gamma_5 \sim \gamma_9 &= \alpha_0 \beta_i \upsilon,\ i = 3 \sim 7; \\
\gamma_{10} \sim \gamma_{14} &= -\beta_i \upsilon (1-\alpha_1),\ i = 3 \sim 7; \\
\eta &= \varepsilon_s (1-\upsilon) + \varepsilon_F + \beta_2 \upsilon \varepsilon_S \cdot D_t + \sum_{i=3}^{7} \beta_i \upsilon \varepsilon_S \cdot D_t \cdot controls
\end{aligned}
$$

CVCS'模型：

$$
\begin{aligned}
ROE_t &= \gamma_{d'0} + \gamma_{d'1} \cdot S_{t-1} + \gamma_{d'2} \cdot ROE_{t-1} + \gamma_{d'3} \cdot D_t + \gamma_{d'4} \cdot S_{t-1} \cdot D_t \\
&\quad + \sum_{i=5}^{9} \gamma_{d'i} \cdot D_t \cdot Controls_{t-1} + \sum_{i=10}^{14} \gamma_{d'i} \cdot S_{t-1} \cdot D_t \cdot Controls_{t-1} + \varepsilon_{d't}
\end{aligned}
\tag{7}
$$