

### 附錄三

由(4.17)式以及(4.18)式可知 $r_2^{NE}$ 、 $r_1^{NE}$ 為：

$$r_2^{NE} = \frac{1}{3} \left\{ \frac{A+B+2E+2F}{[(x_2-x_1)(1-\gamma hp - (1-\gamma)p) - z_2+z_1]} \right\} + \frac{1}{3} b_1 z_1 + \frac{2}{3} b_2 z_2 + \frac{1}{3} c_1 + \frac{2}{3} c_2 \quad \text{-----(4.17)}$$

$$r_1^{NE} = -\frac{1}{3} \left\{ \frac{A+B+2E+2F}{[(x_2-x_1)(1-\gamma hp - (1-\gamma)p) - z_2+z_1]} \right\} + \frac{A+B+E+F}{[(x_2-x_1)(1-\gamma hp - (1-\gamma)p) - z_2+z_1]} + \frac{2}{3} b_1 z_1 + \frac{1}{3} b_2 z_2 + \frac{2}{3} c_1 + \frac{1}{3} c_2 \quad \text{-----(4.18)}$$

其中：

A=

$$(x_2 - x_1) \left\{ (a_1 x_1 + K_1) \left[ (1-\gamma)(1-hp)^2 + (1-p) \right] - (K_2 - K_1) \left[ (1-p) - hp(1-hp) \right] \right\}$$

B=

$$(-z_2 + z_1) \left\{ a_1 x_1 \left[ (1-hp) - \gamma p(1-h) \right] + (K_2 - K_1) \left[ -(1-hp) + \gamma p(1+h) \right] \right\}$$

E=

$$(x_2 - x_1) \left\{ \left[ (1-p)(1+\gamma-hp) \right] \left[ (a_2 x_2 + K_2) + (K_2 - K_1) \right] + \gamma (x_2 - x_1) \left[ -\bar{y}p + \bar{y}hp \right] + [(x_2 - x_1)((\bar{y} - \bar{y}p) - z_2 + z_1)] \left[ 1 - \gamma hp \right] \right\}$$

F=

$$(-z_2 + z_1) \left\{ \left[ -\gamma p + \gamma hp + 1 - hp \right] \left[ (a_2 x_2 + K_2) + (K_2 - K_1) \right] + \gamma (x_2 - x_1) \left[ -\bar{y}p + \bar{y}hp \right] + [(x_2 - x_1)((\bar{y} - \bar{y}hp) - z_2 + z_1)] \right\}$$

$\therefore \frac{\partial r_1}{\partial x_2} =$

$$\begin{aligned} & (6pK_1 - 4\gamma pK_2 - 12\gamma pK_1 - 10hp^2K_1 - 2\gamma h^3p^3K_2 + 15\gamma hp^2K_1 - 6\gamma h^2p^3K_1 \\ & + 8h^2p^3K_1 - 4h^2p^3K_2 - 2p^2K_1 - 4\gamma p^2K_2 + \gamma p^2K_1 - 2hp^3K_1 + 9\gamma^2 pK_1 \\ & + 4\gamma^2 h^2p^2K_1 - 4\gamma^2 pK_2 + 4\gamma^2 p^2K_1 - 6\gamma hp^3K_2 + 4\gamma hp^3K_1 + 6hp^2K_2 \\ & + (3\gamma hp^2K_1 - 2hp^3K_2 - 2\gamma^2 p^2K_2) x_1 \\ & + (-6pK_1 + 4\gamma pK_2 + 12\gamma pK_1 + 10hp^2K_1 + 2\gamma h^3p^3K_2 - 15\gamma hp^2K_1 \\ & + 6\gamma h^2p^3K_1 - 8h^2p^3K_2 + 4h^2p^3K_2 + 2p^2K_1 + 4\gamma p^2K_2 - \gamma p^2K_1 + 2hp^3K_1 \\ & - 9\gamma^2 pK_1 - 4\gamma^2 h^2p^2K_1 + 4\gamma^2 pK_2 - 4\gamma^2 p^2K_1 + 6\gamma hp^3K_2 - 4\gamma hp^3K_1 - 6hp^2K_2 \\ & - 3\gamma hp^2K_1 + 2hp^3K_2 + 2\gamma^2 p^2K_2) x_2 \end{aligned}$$

$$\begin{aligned}
& + (6K_1 - 12hpK_1 + 12(hp)^2K_1 - 9\gamma K_1 + 24\gamma hpK_1 - 9\gamma h^2p^2K_1 - 6(hp)^2K_2 \\
& - 2pK_1 + 6\gamma K_2 - 6\gamma pK_2 + 5\gamma pK_1 + 6hp^2K_2 - 4hp^2K_1 - 12\gamma hpK_2 \\
& + 12\gamma^2 h^2p^2K_2 - 9\gamma^2 h^2p^2K_1 + 4\gamma hp^2K_2 - \gamma p^2K_1 - 3\gamma hp^2K_1 - 4\gamma^2 hp^2K_2 \\
& + \gamma hp^2K_1 + \gamma^2 p^2K_1) z_1 \\
& + (-6K_1 + 12hpK_1 - 12(hp)^2K_1 + 9\gamma K_1 - 24\gamma hpK_1 + 9\gamma h^2p^2K_1 + 6(hp)^2K_2 \\
& + 2pK_1 - 6\gamma K_2 + 6\gamma pK_2 - 5\gamma pK_1 - 6hp^2K_2 + 4hp^2K_1 + 12\gamma hpK_2 \\
& - 12\gamma^2 h^2p^2K_2 + 9\gamma^2 h^2p^2K_1 - 4\gamma hp^2K_2 + \gamma p^2K_1 + 3\gamma hp^2K_1 + 4\gamma^2 hp^2K_2 \\
& - \gamma hp^2K_1 - \gamma^2 p^2K_1) z_2 \\
& + (-3\gamma \bar{y}hp + 3\bar{y} - 8\bar{y}p + 12\gamma hp^2\bar{y} + 3a_2 + 3\gamma a_2 - 3hpa_2 - 6pa_2 - 3\gamma hpa_2 \\
& - 3\gamma^2 hpa_2 + 3\gamma h^2p^2a_2 + 3\gamma^2 hp^2a_2 - 3\gamma h^2p^3a_2 + 4pa_1 - 8hp^2a_1 + 4h^2p^3a_1 \\
& - 2\gamma pa_1 + 16\gamma hp^2a_1 - 8\gamma h^2p^3a_1 - \gamma \bar{y}p^2 - 6\gamma \bar{y}hp^2 + 5\bar{y}p^2 - 5\gamma hp^3\bar{y} - 3\gamma pa_2 \\
& + 3hp^2a_2 + 3p^2a_2 - 6\gamma pa_1 + 6\gamma^2 pa_1 - 8\gamma^2 hp^2a_1 + 4\gamma^2 h^2p^3a_1 - 5\gamma^2 \bar{y}p^2 \\
& + 5\gamma^2 hp^3\bar{y} + \gamma^2 pa_2 - 3\gamma^2 p^2a_2 + 3\gamma hp^3a_2 + 2\gamma \bar{y}p + 3\gamma^2 \bar{y}hp^2 - 3\gamma^2 h^2p^3\bar{y} \\
& + \gamma \bar{y}p^2) x_1^2 \\
& + (3a_2 + 3\gamma a_2 - 3hpa_2 - 8pa_2 - 3\gamma pa_2 + 8hp^2a_2 + 3\bar{y} - 8\bar{y}p + 6\gamma hp^2\bar{y} + 9\gamma hpa_2 \\
& - 3\gamma^2 hpa_2 + 3\gamma h^2p^2a_2 + 3\gamma^2 hp^2a_2 - 3\gamma h^2p^3a_2 + 3\gamma^2 \bar{y}hp^2 - 3\gamma \bar{y}hp \\
& - 3\gamma^2 h^2p^3\bar{y} + 5p^2a_2 - 5hp^3a_2 + 5\bar{y}p^2 - 5\gamma hp^3\bar{y} + 5\gamma^2 pa_2 - 5\gamma^2 p^2a_2 \\
& + 5\gamma hp^3a_2 - 6\gamma \bar{y}p^2 + 5\gamma^2 hp^3\bar{y} + 2\gamma \bar{y}p - 3\gamma hp^2a_2 + \gamma hp^2a_2 + \gamma^2 \bar{y}p^2) x_2^2 \\
& + (6 - 6\gamma hp - 3\gamma pa_2 + 3\gamma hpa_2 + 3a_2 - 3hpa_2 - 3\gamma \bar{y}p + 3\gamma \bar{y}hp + 3\bar{y} - 3\bar{y}hp - p \\
& + \gamma p) z_1^2 \\
& + (6 - 6\gamma hp - 3\gamma pa_2 + 3\gamma hpa_2 + 3a_2 - 3hpa_2 - 3\gamma \bar{y}p + 3\gamma \bar{y}hp + 3\bar{y} - 3\bar{y}hp - p \\
& + \gamma p) z_2^2 \\
& + (6\gamma \bar{y}hp + 16\bar{y}p - 6\gamma hp^2\bar{y} + 15pa_2 - 4\gamma^2 h^3p^3a_1 + 6\gamma^2 \bar{y}hp^2 - 6\gamma h^2p^2a_2 \\
& - 4pa_1 + 8hp^2a_1 - 4h^2p^3a_1 + 8\gamma pa_1 - 16\gamma hp^2a_1 + 8\gamma h^2p^3a_1 + 6\gamma \bar{y}hp^2 - 4\bar{y}p^2 \\
& + 4\gamma hp^3\bar{y} + 3\gamma pa_2 - 2hp^2a_2 - 2p^2a_2 - 3\gamma p^2a_2 - 4\gamma^2 pa_1 + 8\gamma^2 hp^2a_1 \\
& - 6\gamma^2 h^2p^3a_1 + 4\gamma^2 \bar{y}p^2 + 6\gamma \bar{y}p^2 - 12\gamma^2 hp^3\bar{y} - 8\gamma^2 pa_2 + 2\gamma hp^2a_2 + 3\gamma p^2a_2
\end{aligned}$$

$$\begin{aligned}
& +2\gamma^2 p^2 a_2 - 2\gamma hp^3 a_2 - 6a_2 - 6\gamma a_2 + 6hpa_2 + 12\gamma pa_2 - 12hp^2 a_2 - 6\bar{y} \\
& - 12\gamma hp^2 \bar{y} - 6\gamma hpa_2 + 6\gamma^2 hpa_2 - 6\gamma h^2 p^2 a_2 - 6\gamma^2 hp^2 a_2 + 6\gamma h^2 p^3 a_2 \\
& - 6\gamma^2 \bar{y} hp^2 + 6\gamma \bar{y} hp + 6\gamma^2 h^2 p^3 \bar{y} - 6p^2 a_2 + 6hp^3 a_2 - 6\bar{y} p^2 + 6\gamma hp^3 \bar{y} - 9\gamma pa_2 \\
& + 6\gamma^2 p^2 a_2 - 6\gamma hp^3 a_2 - 4\gamma \bar{y} p + 3hp^2 a_2 - 6\gamma \bar{y} hp - pa_2 - hp^3 a_2 + 2\gamma^2 hp^3 \bar{y} ) \\
& x_1 x_2 \\
& + ( -6hpa_1 + 6(hp)^2 a_1 - 6\gamma a_1 + 10\gamma hpa_1 - 12\gamma h^2 p^2 a_1 + 4\gamma \bar{y} p - 6\bar{y} + 8\bar{y} p - 6a_2 \\
& - 3\gamma a_2 + 6hpa_2 + 6pa_2 + 3\gamma pa_2 - 6hp^2 a_2 + 6\gamma hp - 3\gamma^2 h^2 p^2 - 6\gamma^2 hp^2 a_2 \\
& + 3\gamma^2 h^2 p^2 a_2 - 3\gamma h^2 p^2 a_2 - 7\gamma^2 \bar{y} p^2 + 3\gamma^2 \bar{y} h^2 p^2 + 2p - 2\gamma hp^2 - 3\gamma p^2 a_2 \\
& + 6\gamma hp^2 a_2 - 2\gamma \bar{y} p^2 - 2\bar{y} hp^2 - 2\gamma p + 2\gamma^2 hp^2 + 3\gamma^2 p^2 a_2 + 3\gamma^2 \bar{y} p^2 + 6\gamma pa_1 \\
& - 6\gamma hp - 8\gamma^2 hp^2 a_1 + 6\gamma^2 h^2 p^2 a_1 + 3\gamma^2 h^2 p^2 + 4\gamma^2 \bar{y} hp^2 - 3\gamma^2 \bar{y} h^2 p^2 + 2pa_1 \\
& - 2hp^2 a_1 - 2\gamma p^2 a_1 + 4\gamma hp^2 a_1 - 2\gamma \bar{y} hp^2 + 2\gamma^2 p^2 a_1 ) x_1 z_1 \\
& + ( 6hpa_1 - 6(hp)^2 a_1 + 6\gamma a_1 - 10\gamma hpa_1 + 12\gamma h^2 p^2 a_1 - 4\gamma \bar{y} p + 6\bar{y} - 8\bar{y} p + 6a_2 \\
& + 3\gamma a_2 - 6hpa_2 - 6pa_2 - 3\gamma pa_2 + 6hp^2 a_2 - 6\gamma hp + 3\gamma^2 h^2 p^2 + 6\gamma^2 hp^2 a_2 \\
& - 3\gamma^2 h^2 p^2 a_2 + 3\gamma h^2 p^2 a_2 + 7\gamma^2 \bar{y} p^2 - 3\gamma^2 \bar{y} h^2 p^2 - 2p + 2\gamma hp^2 + 3\gamma p^2 a_2 \\
& - 6\gamma hp^2 a_2 + 2\gamma \bar{y} p^2 + 2\bar{y} hp^2 + 2\gamma p - 2\gamma^2 hp^2 - 3\gamma^2 p^2 a_2 - 3\gamma^2 \bar{y} p^2 - 6\gamma pa_1 \\
& + 6\gamma hp + 8\gamma^2 hp^2 a_1 - 6\gamma^2 h^2 p^2 a_1 - 3\gamma^2 h^2 p^2 - 4\gamma^2 \bar{y} hp^2 + 3\gamma^2 \bar{y} h^2 p^2 - 2pa_1 \\
& + 2hp^2 a_1 + 2\gamma p^2 a_1 - 4\gamma hp^2 a_1 + 2\gamma \bar{y} hp^2 - 2\gamma^2 p^2 a_1 ) x_1 z_2 \\
& + ( 6a_2 + 6\gamma a_2 - 6hpa_2 - 8pa_2 - 4\gamma pa_2 + 8hp^2 a_2 - 4\gamma \bar{y} p + 6\bar{y} - 8\bar{y} p + 2\gamma \bar{y} hp^2 \\
& + 4\gamma^2 hp^2 a_2 - 2p + 2\gamma hp^2 + 2\gamma p^2 a_2 - 4\gamma hp^2 a_2 + 2\gamma \bar{y} p^2 + 2\bar{y} hp^2 + 2\gamma p \\
& - 2\gamma^2 hp^2 - 2\gamma^2 p^2 a_2 - 2\gamma^2 \bar{y} p^2 + 2\gamma^2 \bar{y} hp^2 ) x_2 z_1 \\
& + ( -6a_2 - 6\gamma a_2 + 6hpa_2 + 8pa_2 + 4\gamma pa_2 - 8hp^2 a_2 + 4\gamma \bar{y} p - 6\bar{y} + 8\bar{y} p - 2\gamma \bar{y} hp^2 \\
& - 4\gamma^2 hp^2 a_2 + 2p - 2\gamma hp^2 - 2\gamma p^2 a_2 + 4\gamma hp^2 a_2 - 2\gamma \bar{y} p^2 - 2\bar{y} hp^2 - 2\gamma p
\end{aligned}$$

$$\begin{aligned}
& +2\gamma^2 hp^2 + 2\gamma^2 p^2 a_2 + 2\gamma^2 \bar{y}p^2 - 2\gamma^2 \bar{y}hp^2) x_2 z_2 \\
& + (-12 + 12\gamma hp + 6\gamma pa_2 - 6\gamma hpa_2 - 6a_2 + 6hpa_2 + 6\gamma \bar{y}p - 6\gamma \bar{y}hp - 6\bar{y} + 6\bar{y}hp \\
& + 2p - 2\gamma p) z_1 z_2 = 0 \text{-----}(4.22)
\end{aligned}$$

