> $utility\_left := (1-r) \cdot H \cdot (s \cdot (1-r) + (1-s) \cdot ((thetar-1) \cdot r + 1))^{-\text{alpha}} - R1 \cdot (1-r)^{-\text{beta}}$
$- (1-r) \cdot F \cdot (1-r \cdot s)^{-\text{gamma}}$

$utility\_left := (1-r) H (s (1-r) + (1-s) ((thetar-1) r + 1))^{-\alpha} - R1 (1-r)^{-\beta} - (1$

$- r) F (-r s + 1)^{-\gamma}$ 　　　　　　　　　　　(1)

> $utility\_right := ((thetar-1) \cdot r + 1) \cdot H \cdot (s \cdot (1-r) + (1-s) \cdot ((thetar-1) \cdot r + 1))^{-\text{alpha}}$
$- R2 \cdot (1-r)^{-\text{beta}} - F \cdot (1-r \cdot s)^{-\text{gamma}}$

$utility\_right := ((thetar-1) r + 1) H (s (1-r) + (1-s) ((thetar-1) r + 1))^{-\alpha} - (1$

$- r)^{-\beta} R2 - F (-r s + 1)^{-\gamma}$ 　　　　　　　　　(2)

> $utility := s \cdot utility\_left + (1-s) \cdot utility\_right$

$utility := s \Big((1-r) H (s (1-r) + (1-s) ((thetar-1) r + 1))^{-\alpha} - R1 (1-r)^{-\beta} - (1$

$- r) F (-r s + 1)^{-\gamma}\Big) + (1-s) \Big(((thetar-1) r + 1) H (s (1-r) + (1$

$- s) ((thetar-1) r + 1))^{-\alpha} - (1-r)^{-\beta} R2 - F (-r s + 1)^{-\gamma}\Big)$ 　(3)

> $simplify(utility)$

$-H (-1 + r (s\, thetar - thetar + 1)) (-r (s-1) thetar - r + 1)^{-\alpha} + F (r s - 1) (-r s + 1)^{-\gamma}$ 　(4)

$- ((R1 - R2) s + R2) (1-r)^{-\beta}$

> $DS := simplify(diff(utility, s))$

$DS := -H \alpha r (-1 + (1 + (s-1) thetar) r) thetar (-r (s-1) thetar - r + 1)^{-\alpha-1} - H ($ 　(5)

$-r (s-1) thetar - r + 1)^{-\alpha} r\, thetar + F r \gamma (r s - 1) (-r s + 1)^{-\gamma-1} + F (-r s + 1)^{-\gamma} r$

$- (1-r)^{-\beta} (R1 - R2)$

> $maximize(utility, s = 0..1)$

$maximize\Big(s \Big((1-r) H (s (1-r) + (1-s) ((thetar-1) r + 1))^{-\alpha} - R1 (1-r)^{-\beta} - (1$ 　(6)

$- r) F (-r s + 1)^{-\gamma}\Big) + (1-s) \Big(((thetar-1) r + 1) H (s (1-r) + (1$

$- s) ((thetar-1) r + 1))^{-\alpha} - R2 (1-r)^{-\beta} - F (-r s + 1)^{-\gamma}\Big), s = 0..1\Big)$

> $utility\_test := H \cdot (s \cdot (1-r) + (1-s) \cdot ((thetar-1) \cdot r + 1))^{-\text{alpha}} \cdot (thetar \cdot r \cdot (s + 1) - 2 \cdot r \cdot s$
$- r + 1) - (1-r)^{-\text{beta}} \cdot (s \cdot R1 + (1-s) \cdot R2) - F \cdot (1-rs)^{-\text{gamma}} \cdot (1-rs)$

$utility\_test := H (s (1-r) + (1-s) ((thetar-1) r + 1))^{-\alpha} (thetar\, r (s + 1) - 2 r s - r$ 　(7)

$+ 1) - (1-r)^{-\beta} (s R1 + (1-s) R2) - F (1-rs)^{-\gamma} (1-rs)$

> $simplify(utility\_test)$

$(-r (s-1) thetar - r + 1)^{-\alpha} H (1 + ((thetar-2) s + thetar - 1) r) - F (1-rs)^{-\gamma+1} - (1$ 　(8)

$- r)^{-\beta} ((R1 - R2) s + R2)$

> $simplify(utility\_test - utility)$

$2 H r s (thetar-1) (-r (s-1) thetar - r + 1)^{-\alpha} - \Big((1-rs)^{-\gamma+1} + (-r s + 1)^{-\gamma} (r s$ 　(9)

$- 1)\Big) F$

> # -

> $utility\_left2 := H \cdot (1-r) \cdot A^{-\text{alpha}} - R1 \cdot (1-r)^{-\text{beta}} - F \cdot (1-r) \cdot (1-r \cdot s)^{-\text{gamma}}$

$utility\_left2 := H (1-r) A^{-\alpha} - R1 (1-r)^{-\beta} - (1-r) F (-r s + 1)^{-\gamma}$ 　(10)

> $utility\_right2 := H \cdot ((thetar - 1) \cdot r + 1) \cdot A^{-\text{alpha}} - R2 \cdot (1 - r)^{-\text{beta}} - F \cdot (1 - r \cdot s)^{-\text{gamma}}$

$$utility\_right2 := H((thetar - 1)\, r + 1)\, A^{-\alpha} - (1 - r)^{-\beta} R2 - F(-r\, s + 1)^{-\gamma} \qquad \textbf{(11)}$$

> $utility2 := simplify(s \cdot utility\_left2 + (1 - s) \cdot utility\_right2)$

$$utility2 := F(r\, s - 1)(-r\, s + 1)^{-\gamma} + ((-R1 + R2)\, s - R2)(1 - r)^{-\beta} - A^{-\alpha}(-1 + r(s\, thetar \qquad \textbf{(12)}$$
$$- thetar + 1))\, H$$

>