Prisoner's Dilemma

1 Charness-Rabin utility

$$u(x_i, x_j) = (1 - \beta r - \alpha s)x_i + (\beta r + \alpha s)x_j$$

where $r = 1_{\{x_i<x_j\}}$ and $s = 1_{\{x_i>x_j\}}$. So,

$$u(x_i, x_j) = \begin{cases} (1-\beta)x_i + \beta x_j & x_i < x_j \\ x_i & x_i = x_j \\ (1-\alpha)x_i + \alpha x_j & x_i > x_j \end{cases}$$

2 PD payoff matrix

P1\P2	Corporate	Defect
Corporate	R	S
Defect	T	P

Table 1: Table 1

Where, $T > R > P > S$

3 CR transformed PD payoff matrix

The payoff matrix need not be symmetric anymore.

P1\P2	Corporate	Defect
Corporate	R, R	$\alpha_1 T + (1-\alpha_1)S$, $\beta_2 S + (1-\beta_2)T$
Defect	$\beta_1 S + (1-\beta_1)T$, $\alpha_2 T + (1-\alpha_2)S$	P, P

Table 2: Table 2

4 Level 0 players

Players assume partner's $\alpha = \beta = 0$. So the payoff matrix is

P1\P2	Corporate	Defect
Corporate	R, R	$\alpha_1 T + (1-\alpha_1)S$, T
Defect	$\beta_1 S + (1-\beta_1)T$, S	P, P

Table 3: Table 3

At level 0, players believe that the partner's dominant strategy is Defect. So the best response will be:

$$\text{best response} = \begin{cases} Cooperate & \alpha > \frac{P-S}{T-S} \\ Defect & \alpha < \frac{P-S}{T-S} \\ \{Defect, Cooperate\} & \alpha = \frac{P-S}{T-S} \end{cases}$$