# Reciprocity in Teams

Richard Fairchild[†]

*School of Management, University of Bath*

Hanke Wickhorst[‡]

*Münster School of Business and Economics*

This Version: February 3, 2011

**Abstract.** In this paper, we show that reciprocity in a joint venture may combine to prevent project switching, mitigate effort shirking, and enhance venture performance.

Keywords: Reciprocity, Joint Venture, Team Production.
JEL classification: D21, D62, L23, L24.

[†]School of Management, University of Bath, Bath, BA2 7AY, United Kingdom; e-mail: mnsrf@bath.ac.uk.

[‡]Institute for Organisational Economics, University of Münster, Scharnhorststr. 100, D-48151 Münster, Germany; e-mail: hanke.wickhorst@uni-muenster.de.

# 1 Introduction

Much existing research into reciprocity in teamwork focuses on Fehr and Schmidt's (1999) inequity aversion approach. We develop the research agenda by considering the effects of positive (empathy) and negative (relationship souring) reciprocity on team incentives and performance. We consider two moral hazard problems affecting team performance: ex ante double sided effort shirking and ex post conflicts over control (specifically project switching). We contribute to Hart and Moore's (2008) and Hart's (2009) analysis of contracts as fair reference points, with conflict leading to souring of relationships. Hart and Moore's (2008) model can be thought of as an ex ante model, with souring affecting initial investment, while Hart's (2009) model can be thought of as an ex post model, with souring being affected by potential ex post hold-up/renegotiation. We draw these two approaches together by considering a dynamic model of souring, incorporating both ex ante and ex post souring. Finally, Hart and Moore (2008) focus on contractual negotiations over cashflow rights, while we consider negotiations over both cashflow rights and venture direction.

# 2 The Model

We consider a team of two risk-neutral players, $i \in \{1, 2\}$, who are jointly running a venture. They invest in a project, and negotiate a contract which determines their equity stakes, and the venture's course of action. We focus on the effects of relationship souring, as in Hart and Moore (2008) and Hart (2009). Each player benefits not only from his but also his partner's payoff due to his empathy[1]. That is, player $i$ initially has a utility function $U_i = \Pi_i + \theta\Pi_{-i}$, where $\Pi_i$ represents a player's payoff and $\theta \in [0, 1)$ is the empathy parameter. If the relationship is soured, empathy is destroyed, and $\theta = 0$.

The timing of the model is as follows: At date 1, the players negotiate the contract. The contract determines a) their relative cash flow rights, and b) the direction of the venture (in terms of project choice). We assume that negotiations take the form of Nash-bargaining with equal outside options. For our purpose it is sufficient to assume the agents to have equal abilities, such that they equally

[1] Sally (2001) first developed the empathy game. In his model, empathy is an endogenously derived weight attached by a player to his opponent's payoff. In our model, we take this weighting as exogenously given, although there is some endogeneity in the model, as empathy is destroyed when the relationship is soured by project switching.

share the profit. At date 1 there is a menu of available projects, each requiring the investment of $I > 0$. More specific: there are $N > 1$ projects available, with $N-1$ of them having a negative NPV. The remaining project (project $G$) has the following characteristics: It is risky[2], with a binomial distribution of outcomes, as follows. In the case of a success, project $G$ realises income of $R > 0$. In the case of failure, the project realises zero income. The project succeeds with probability $p$ and fails with probability $1-p$. We assume that $pR > I$ that is, $G$ has a positive NPV.

Since the players are concerned with maximising their monetary payoffs, they both agree on investing in the only positive NPV project available: Project $G$. In our model, we are interested in considering the initial contract as a fair, reference point contract, following Hart and Moore (2008) and Hart (2009).[3]

At date 2, an alternative project, $B$, becomes available. It provides zero income for certain. However, player 2 may be tempted to force the team to switch projects anyway as it provides her with private benefits, $b > 0$. Whereas player 1 receives zero benefit. Player 1 and 2 receive zero private benefit from project $G$. Either player can wait until date 4 (after they have exerted effort) to force the team into project $B$. If the players anticipate date 4 project switching, and they disagree over this course of action, the relationship is soured from date 2. At this stage, player 2 can insert a self-control clause into the contract that prevents her from switching projects at date 4.

The players exert simultaneous, unobservable efforts (with cost of effort: $\beta e_i^2$) in creating the business (hence, we consider double sided moral hazard in the form of double sided effort shirking) at date 3. Their effort levels affect the date 4 success probability of the venture as follows: $p = \lambda(e_1 + e_2)$. Hence, project $G$'s expected value is $V_G = pR = [\lambda(e_1 + e_2)]R$, whereas project $B$'s expected value is $V_B = 0$.

At date 4, the project either succeeds or fails. If it fails, it provides zero income, and the game ends. If it succeeds, the players can stick with this project, in which case it provides income of $R > 0$ or either player can force the team to switch projects to project $B$.

Finally, the game ends and the players receive their payoffs. We solve the game by backward induction.

[2]Since both players are risk-neutral, they are not concerned with the risk (variance) of the project.

[3]Note that Hart and Moore (2008) and Hart (2009) focus on the cashflow rights in the initial reference point contract. We consider both cashflow- and decision rights.

In equilibrium the players correctly anticipate the date 4 project switching, and this will affect their date 2 empathy. In a circular argument their date 2 empathy will affect their date 4 project switching. Hence, there is no trivial solution. However, in the case of player 1, he receives zero private benefits from project $B$, and hence zero profit. Furthermore, he obtains positive payoff from project $G$, whether empathy has been destroyed at date 2, in which case income is $\frac{R}{2}$ or empathy has been retained, in which case income is $\frac{R}{2}(1+\theta)$. Therefore, it is trivial to state that player 1 will never switch projects at date 4. Hence, we need to focus on player 2's project switching decision. First, consider the case where the players anticipate no project switching. Therefore, empathy is retained through date 4 and player 2 will switch projects, if:

$$b \geq b'' := \frac{R}{2}(1+\theta) \Leftrightarrow \theta \leq \theta'' := \frac{2b}{R} - 1, \tag{1}$$

where $b''$ (and $\theta''$) represents the critical level of private benefits (empathy) at which player 2 switches projects, given that empathy has been retained through date 4.

Next, consider the case where the players anticipate project switching, so that empathy is destroyed at date 2. Now, player 2's date 4 success payoff from switching/not switching is $b$ or $\frac{R}{2}$ respectively. Therefore, in this case, player 2 will switch projects, if:

$$b \geq b' := \frac{R}{2}, \tag{2}$$

where $b'$ represents the critical level of private benefits at which player 2 switches projects, given that empathy has been destroyed at date 2. we see that $b' < b''$, and thus:

**Lemma 1** *Player* 2*'s date* 4 *project switching decision is affected by her private benefits as follows:*

- *If $b < b'$, player* 2 *does not switch projects.*
- *If $b \in [b', b'']$, we have multiple equilibria. By a focal point argument (see Schelling, 1960), we assume that the players coordinate on the superior, non-switching equilibrium.*
- *If $b > b''$, player* 2 *switches projects.*

Clearly, player 2's decision to switch projects depends crucially on her private benefits. Since we assume the players to coordinate in the case of $b \in [b', b'']$, we can focus on two different situations: $b \in [0, b'']$, where there is no project switching, and $b > b''$, where there is project switching by player 2.

**Lemma 2** *Considering (1), we state:*

- *If* $\theta \in [0, \theta'']$, *player* 2 *switches projects.*
- *If* $\theta > \theta''$, *player* 2 *does not switch projects.*

We now move back to date 3 to solve for the players' optimal effort levels. First, we assume: $\theta > \theta''$. Therefore, from Lemma 2, player 2 does not switch projects at date 4. Correctly anticipating this, the players choose their optimal effort levels to maximise their respective payoffs:

$$U_i = [\lambda(e_i + e_{-i})]\frac{R}{2}(1+\theta) - \beta e_i^2. \tag{3}$$

Solving for the according Nash-equilibrium, we obtain:

$$e_i^* = \frac{\lambda\Delta}{2\beta}, \text{ with } \Delta := \frac{R}{2}(1+\theta), \tag{4}$$

accordingly, the resulting firm value and the agents' payoffs are given by:

$$V^* = \frac{\lambda^2\Delta R}{\beta} \tag{5}$$

and

$$U_i^* = \frac{3\lambda^2\Delta^2}{4\beta}. \tag{6}$$

It is easy to show that the players suffer from an effort-implementation problem, since they have the tendency to free-ride. Hence, the players would benefit from an increased effort, which could be induced by various instruments like monitoring or peer-pressure. Empathy as well has an effort-enhancing effect and therefore could be to the players' advantage. We compare the Nash-equilibria with empathy to a benchmark scenario without empathic players ($\theta = 0$) and see that:

$$e_i^* - e_i^{BM} = \frac{\theta\lambda R}{4\beta} > 0. \tag{7}$$

Clearly, the players exert more effort due to their empathy, compared to the benchmark scenario. Hence, the project value will be increased as well:

$$V^* - V^{BM} = \frac{\theta\lambda^2 R^2}{2\beta}. \tag{8}$$

Since we are focusing on a behavioural trait it is interesting to analyse the welfare-effects of this trait. Since empathy is such a prevailing phenomenon of human behaviour, it should lead to an enhanced utility, as it would be eliminated by learning-mechanisms otherwise. It is easy to show that not only does empathy increase a players effort and therefore the firm-value but also the players utility, which gives a theoretical rationale for its prevalence:

$$U_i^* - U_i^{BM} = \frac{3\lambda^2 R^2(2\theta + \theta^2)}{16\beta} > 0. \tag{9}$$

Next, we consider: $\theta \in [0, \theta'']$. In this case, from lemma 2, player 2 switches projects at date 4. Correctly anticipating this, the players maximise:

$$\hat{U}_1^* = 0 - \beta e_1^2 \tag{10}$$

and

$$\hat{U}_2^* = [\lambda(e_1 + e_2)]b - \beta e_2^2. \tag{11}$$

Solving for the according Nash-equilibria, we obtain:

$$\hat{e}_1^* = 0 \text{ and } \hat{e}_2^* = \frac{\lambda b}{2\beta}, \tag{12}$$

accordingly, the resulting firm value and the agents' payoffs are given by:

$$V^* = 0 \tag{13}$$

and

$$\hat{U}_1^* = 0 \text{ and } \hat{U}_2^* = \frac{\lambda^2 b^2}{4\beta}. \tag{14}$$

At date 2, player 2 can insert a self-control clause into the contract committing not to switch projects at date 4. She makes this decision by comparing $U_2^*$ and $\hat{U}_2^*$.

**Lemma 3** *For $\theta \in [0, \theta'']$, player 2 incorporates a self-control clause into the con-*

*tract at date* 2*, if:*

$$\Delta\sqrt{3} > b := b_c. \tag{15}$$

Therefore, player 2's date 2 self-control clause decision and date 4 switching decision is driven by the size of the private benefits from the alternative project and the additional effect of empathy on (12).

**Proposition 1** *With $b_c > b''$ as the critical ex ante level of private benefits that equates player 2's expected utility in project-switching and non-switching cases, we note that:*

- *If $b \in [0, b'']$, player 2 does not switch the project ex post following success and therefore has no need to implement a self-control clause. Firm value is maximised and is unaffected by the level of private benefits.*
- *If $b \in [b'', b_c]$, player 2 switches the project ex post and therefore inserts the self-control clause. This maximises firm value, which is unaffected by the level of private benefits.*
- *If $b > b_c$, player 2 switches the project ex post and does not insert the self-control clause ec ante and therefore firm value is minimised.*

In order to get a intuition for the effects of empathy in this matter, we re-write proposition 1 in terms of a critical $\theta$.

**Proposition 2** *With $\theta_c > \theta''$ as the critical level of empathy that equates player 2's expected utility in project-switching and non-switching cases, we note that:*

- *If $\theta > \theta''$, player 2 does not switch the project ex post following a success and therefore has no need to insert a self-control clause. Firm value is maximised, and increasing in empathy.*
- *If $\theta \in [\theta_c, \theta'']$, player 2 switches the project ex post and therefore, he inserts a self-control clause. This maximises firm value, which is increasing in empathy.*
- *If $\theta \in [0, \theta_c]$, player 2 switches the project ex post and does not insert the self-control clause ex ante and therefore firm value is minimised.*

# 3 Conclusion

Our model provides the basis for future research. Firstly, we should develop the behavioural aspects of teamwork further, considering the effects of other forms of positive reciprocity (fairness, trust), and negative reciprocity (e.g. anger). It may be fruitful to consider the combined effects of fairness and overconfidence. Secondly, it would be interesting to test this work experimentally. Finally, we should attempt to use our model to address real-world issues, such as venture capital and partnerships. This will enable us to provide practical policy implications. For instance, scholars are increasingly conceptualising about the desire for fairness in venture capital contracts and performance. Our model provides rigorous formal support for this prescription.

# References


Fehr, E., and Schmidt, K. (1999): A Theory of Fairness, Competition and Cooperation. Quarterly Journal of Economics, 817-868.

Hart, O., and Moore, J. (2008): Contracts as Reference Points. Quarterly Jourtnal of Economics, 1-48.

Hart, O. (2009): Hold-up, Asset Ownership, and Reference Points. Quarterly Journal of Economics, 267-300.

Sally, D. (2001): On Sympathy and Games. Journal of Economic Behavior and Organization, 1-30.

Schelling, T. C. (1960): The Strategy of Conflict. Cambridge, Massachusetts: Harvard University Press.