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Partnership, reciprocity and team design

Giuseppe De Marco [a,c], Giovanni Immordino [b,c,*]

[a] Dipartimento di Statistica e Matematica per la Ricerca Economica, University of Naples Parthenope, Via Medina 40, 80133 Naples, Italy
[b] Dipartimento di Scienze Economiche e Statistiche, University of Salerno, Via Ponte Don Melillo, 84084 Fisciano (SA), Italy
[c] CSEF, Italy

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ABSTRACT

This paper studies the effect of intention-based reciprocity preferences on the free-riding problem arising in partnerships. Our results suggest a tendency of efficient partnerships to consist of members whose sensitivity to reciprocity is – individually or jointly – sufficiently high. Sufficient conditions for the implementation of the efficient strategy profile require a reciprocity-based sharing rule so that each partner gets a fraction of the output, which is a percentage of his own sensitivity to reciprocity with respect to the overall sensitivity in the team. Finally, we introduce the concept of psychological strong Nash equilibrium and show that it allows for the unique and collusion-proof implementation of the efficient strategy profile.

1. Introduction

It is widely believed, and has been suggested by experimental evidence, that agents' preferences often exhibit an important intention-based component.[1] In this paper, we examine the role played by intention-based reciprocity preferences in the partnership framework, which appears to be one of the most natural environments for reciprocity to play a central role. In particular, we study a classical model of partnership where partners jointly produce according to a non-stochastic technology, and share the resulting output among themselves.

It is generally accepted that partnerships are inefficient if the partners' actions are not verifiable, i.e. neither the identity of a free-rider nor the one of a non-free-rider is revealed after a deviation. In fact, in this case a partner could shirk because he must share the marginal benefit of his effort, but he alone bears its cost. Holmstrom (1982) formalizes this argument showing that in certain differentiable, monotonic partnerships, no sharing rule can elicit an efficient set of actions; that is, the efficient action profile cannot be implemented as a Nash equilibrium of the corresponding partnership game.

If a player is sufficiently sensitive to reciprocity, he will have incentives to work harder if he believes that his partners' intentions are good, in the sense that they plan to exert a level of effort which is higher than the one they expect from him. Conversely, he will have incentives to free ride if he believes that the other players' intentions are bad. In other words, the player will have incentives to match the other agents' intentions to avoid experiencing a disutility from his anti-reciprocal behavior. Building on this simple intuition, we construct a class of intention-based preferences and design teams of reciprocity-driven partners. It turns out that symmetric efficient strategy profiles can be sustained (in equilibrium) by reciprocity-driven partners even when, in case of self-interested partners, they are not.[2] Conversely, we show that

* Corresponding author at: Dipartimento di Scienze Economiche e Statistiche, University of Salerno, Via Ponte Don Melillo, 84084 Fisciano (SA), Italy.
E-mail address: giimmo@tin.it (G. Immordino).

[1] See for instance Charness and Rabin (2002); Falk et al. (2003a,b) and Falk and Fischbacher (2006).

[2] Symmetric efficient strategy profiles arise naturally in partnerships with symmetric production functions which are the classical example of partnerships with unverifiable actions.

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reciprocity motives incentivize partners to deviate, destroying asymmetric equilibria; therefore, asymmetric efficient profiles can no longer be implemented as an equilibrium if agents are sufficiently sensitive to reciprocity. In particular, our first result gives useful insights for the optimal design of the team by describing the psychological attitudes of the team members required to sustain the symmetric efficient strategy profile as a psychological Nash equilibrium—for any given sharing rule. The second result, on the other hand, takes a psychological characteristic of the partners (namely the minimal level of individual sensitivity to reciprocity) as given, and finds a condition on the overall level of reciprocity and a sharing rule which implement the symmetric strategy profile as a psychological equilibrium. This reciprocity based sharing rule is such that each partner gets a fraction of the output, which is a percentage of his own sensitivity to reciprocity with respect to the overall sensitivity in the team. However, even if the efficient strategy profile is sustained, there could be other (inefficient) strategy profiles which are sustained as a Nash equilibrium or as a psychological Nash equilibrium for the same set of sharing rules. Moreover, the conditions used to prove the previous results are not sufficient to sustain efficiency if some partners can collude. We introduce the concept of psychological strong Nash equilibrium and show that it solves both problems allowing for the unique and collusion-proof implementation of the efficient strategy profile.

This paper demonstrates that, despite their apparent complexity, intention-based reciprocity models can be useful to study economically relevant settings like team-production in a novel and simple way. Our contribution builds on and extends three different literatures. First, after the seminal contribution by Holmstrom (1982) successive papers on partnership have shown that the efficiency or near efficiency can be obtained in partnerships with a random technology (Matsushima, 1989; Legros and Matsushima, 1991; Williams and Radner, 1995), with risk-averse partners and random-sharing rules (Rasmusen, 1987), with repeated play (Radner, 1986), or finally through the use of mixed strategies, provided the partners have unlimited liability (Legros and Matthews, 1993). More recently, Rahman and Obara (2010) employ a mediator who, by allocating private information differently across agents, provides the right incentives if after any unilateral deviation innocence is statistically attributable to someone. In this paper, without requiring any form of monitoring, we get equilibrium-implementation results for efficient action profiles in one-shot, non-stochastic partnerships with symmetric production functions.[3]

Second, the experimental evidence in Fehr et al. (1997) suggests that reciprocal motives contribute to the enforcement of contracts. In this vein, Dufwenberg and Kirchsteiger (2000), Englmaier and Leider (2008) and Netzer and Schmutzler (2010) all show that efficiency is generally increased when a materialistic principal interacts with a reciprocal agent.[4] We show that the efficiency-enhancing role of reciprocity, extends also to partnerships.[5]

Third, we contribute to the theoretical literature on psychological games (Geanakoplos et al., 1989; Rabin, 1993; Dufwenberg and Kirchsteiger, 2004; Falk and Fischbacher, 2006; Battigalli and Dufwenberg, 2009) by extending the definition of strong Nash equilibrium that has been introduced by Aumann (1959) to environments with reciprocal players.

The present paper is also related to a growing literature that studies the impact of inequity aversion on partnership (Li, 2009; Bartling and von Siemens, 2010) and on principal multiple agent models (Itoh, 2004; Demougin and Fluet, 2006; Rey Biel, 2008). These articles find that inequity aversion can improve incentives since agents work harder to avoid suffering from unfavourable inequality. However, as also recognized by Itoh (2004) "reciprocity and inequity aversion are distinct motives, and often intention matters more, in particular in the domain of punishing behaviour, as suggested by recent evidence." Moreover, the effects of inequity aversion on utilities depend substantially on differences in material payoffs between the partners in the team rather than differences in efforts. Therefore, the implementation results are strongly related to the choice of particular sharing rules. In particular, the equal sharing rule seems to be crucial to obtain the implementation results. More precisely, in Bartling and von Siemens (2010), the authors argue that equal sharing arises endogenously as an outcome of inequity aversion, since it is the unique sharing rule that maximizes the partners' incentives to exert effort. Instead, Li (2009) shows that if the sharing rule distributes the team output equally when the output is high and punishes some randomly chosen agents when the team output is low, then efficient actions can be implemented. In contrast, with reciprocity-driven partners also unequal sharing rules can maximize incentives.

Finally, in a companion paper (De Marco and Immordino, 2012), we study the impact of intention-based reciprocity preferences on the principal-multiple agents model. We show that hiring reciprocal agents to implement a first or a second-best contract will always benefit the principal if the strategy profile is symmetric. When, however, the profile (first or second-best) is asymmetric the principal's best interest might be better served by self-interested agents.

The paper is organized as follows. Section 2 introduces the general framework. In Section 3 we provide sufficient and necessary conditions to implement the efficient strategy profile as a psychological Nash equilibrium. Section 4 deals with multiplicity, collusion and unique implementation of the efficient strategy profile. In Section 5 we discuss where differences in results might lie between our approach to reciprocity and the standard one. Section 6 concludes. All proofs are relegated in Appendix A, some examples and calculations can be found in Appendix B.

[3] The assumption of symmetric production functions makes the problem interesting implying that neither the identity of a shirker nor the one of a non-shirker is revealed after a deviation.

[4] Even if, as shown by Netzer and Schmutzler (2010), firms may not want to employ reciprocal workers.

[5] That the free-riding problem could be mitigated by peer pressure, profit sharing, shame, guilt, norms, mutual monitoring, and empathy was already discussed in their seminal paper by Kandel and Lazear (1992).