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Agreements with reciprocity: Co-financing and MOUs ☆

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A B S T R A C T

Institutions for co-financing agreements often exist to encourage public good investment. Can such frameworks deliver maximal investment when agents are motivated by reciprocity? We demonstrate that indeed they can, but not how one might expect. If maximal investment is impossible in the absence of the institution and public good returns are high, then an agreement signed by all parties cannot lead to full investment. However, if all parties reject the agreement, then full investment is attainable via a gentlemen's agreement or memorandum of understanding (MOU). Agreement institutions may thus do more than just facilitate the signing of binding agreements; they may play a critical role in igniting informal cooperation underpinned by reciprocity.

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1. Introduction

Institutions play an important role in creating the conditions for investment in public goods. Among other things, they facilitate the negotiation and enforcement of binding agreements. One common type of agreement is a co-financing, or cost-sharing, agreement; signatories make a binding commitment to co-finance each other's future public good investments. The agreement does not commit a signatory to invest in public goods per se. However, should any signatory initiate a public good investment, its co-signatories are committed to share the cost.[1] Such agreements have been used to finance critical investment in public goods, ranging from disease eradication to climate change mitigation.[2]

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[1] These agreements are often politically more feasible than binding commitments to actually invest in public goods.

[2] In April 2016 The World Bank and The Asian Infrastructure Investment Bank signed a co-financing agreement focusing on water, transport and energy. Each party contributed $216 million to the first project, upgrading slums in Indonesia: www.brettonwoodsproject.org/2016/06/world-bank-and-aiib-signs-joint-co-financing-agreement. Such agreements are also signed by private companies. The Asian Development Bank, for instance, has an agreement

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Theoretically, co-financing agreements can increase public good investment (cf. Varian, 1994).[3] This is because a signatory can be pivotal in inducing other signatories to invest in public goods, as only with its participation would the private cost of a public good be less than the private benefit. However, full investment remains impossible. This is because when there are many signatories, an individual signatory is no longer pivotal, thus it deviates to not signing and not investing.

These insights rely on the assumption that agents care only about their material payoffs. Yet behaviour in public good contexts often exhibits conditional cooperation (e.g. Fischbacher et al., 2001), cooperating only if others do. Such behaviour can be rationalised using reciprocity theory (Rabin, 1993; Dufwenberg and Kirchsteiger, 2004 (D&K), Falk and Fischbacher, 2006). It describes agents as having a desire to be kind to those who are kind to them, and unkind to those who are unkind to them. For example, if agent A invests, agent B may view A as kind and invest himself.

The implications of reciprocity for public good provision are both well established (e.g. Sugden, 1984) and straightforward. If agents care enough about reciprocity, maximal investment is possible, otherwise it is not. Such investment is not due to a formal agreement to invest, but rather an informal one (referred to as a gentlemen's agreement, a tacit agreement or a memorandum of understanding (MOU), for example).[4] By contrast, little is known about the implications of reciprocity for formal agreements over public goods.

An obvious question follows: How does an opportunity to strike a formal co-financing agreement perform under reciprocity? More specifically, one may wonder: Can a co-financing mechanism deliver full investment? Does such investment follow if all players sign the formal agreement? Is it impossible if all players reject the formal agreement? To answer these questions, we apply D&K's model of reciprocity to an agreements game where players choose whether or not to sign a formal cost-sharing agreement, then play a public good game. We find that if in the absence of the mechanism, full investment via an informal MOU is impossible and the public good return is high, then such investment remains impossible if all players sign. However, if all players reject the formal agreement, then full investment becomes attainable via an informal MOU. Despite not being the unique equilibrium, this outcome is both stark and surprising.

For some intuition, consider the interaction of kindness and co-financing agreements. Roughly, D&K say that agent i is kind to agent j if i could have given j a much lower payoff by changing his behaviour. Agent i deviating from a situation where all players sign and invest does reduce j's payoff, but not by much, as the cost-sharing agreement still has many signatories thus provides large investment incentives. By contrast, if i deviates from a situation where no-one signs and all invest, j's payoff is reduced considerably as there is no such cost-sharing agreement. Kindness and hence reciprocity incentives to invest in public goods are thus larger when there are no signatories than when there are many.

Our results provide several important insights. First, the existence of an institution for making binding agreements is potentially critical for triggering informal cooperation via MOUs and other informal agreements. Second, since our main result exemplifies a more general point that "high investment is possible with few signatories and impossible with many", formal agreements with few signatories may achieve better outcomes than those with many. Third, and pointing to the more general feature underlying the previous insights, prior stages in games (here, an agreement stage) can increase a player's influence over others' payoffs, since others may condition their actions on his early choice. This increase in payoff influence can "amplify" psychological payoffs (in our case kindness) and make otherwise impossible outcomes attainable.

We add to the literature on agreements (e.g. Barrett, 2003; Battaglini and Harstad, 2016; Martimort and Sand-Zantman, 2016) and an emerging literature on mechanism design where players have reciprocity preferences (Netzer and Volk, 2014; Bierbrauer and Netzer, 2016; Bierbrauer et al., 2017; Dufwenberg and Patel, 2017).

Our particular mechanism, cost-sharing agreements, falls into a class of mechanisms where commitments on strategy-conditional side-payments are made before a game is played (Jackson and Wilkie, 2005; Ellingsen and Paltseva, 2016). Cost-sharing is an important case of models where agents make commitments to match others' public good investments (Guttman, 1978, 1987, Boadway et al., 2007) or to compensate others for their investment (Varian, 1994). Our game may also be relevant for agreements on R&D investment (Katz, 1986) and International Environmental Agreements (IEAs) (Barrett, 1994), if they involve binding co-financing.

Understanding the role of reciprocity in IEAs is important for environmental economists. Nyborg (forthcoming) concurrently developed a model that extends D&K to cooperative games in order to apply it to Barrett's IEAs model. She finds that reciprocity can create weakly larger stable coalitions that exhibit higher abatement. Less closely related are Hadjiyiannis et al. (2012) and Kolstad (2014). The former studies the effect of a different notion of reciprocity on abatement in a two-player game with no possibility to sign an agreement. The latter examines the effect of equity- and efficiency-concerns (Charness and Rabin, 2002) in an IEAs game.

We structure the paper as follows. Section 2 presents a set of preliminaries needed for our main result. Section 3 states and explains our main result on how full investment is impossible if all players sign, but is possible if no-one signs. Section 4 argues that our result illustrates a more general principle that high investment is possible with few signatories but not with many, examines comparative statics and identifies a zero-sign-zero-invest equilibrium. Section 5 offers reflections on alternative definitions of reciprocity and other game forms. Section 6 concludes.

with Chevron to invest in IT, construction and engineering education: www.adb.org/site/cofinancing/partners. One area where cost-sharing agreements are extensively used is in R&D investments (Katz, 1986).

[3] Indeed higher investment is observed in related experimental games (Andreoni and Varian, 1999; Falkinger et al., 2000 and Charness et al., 2007).

[4] We shall refer to informal agreements to invest as MOUs throughout.

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