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Abstract

Consider a non-governmental organization (NGO) that can invest in a public good. Should the government or the NGO own the public project? In an incomplete contracting framework with *split-the-difference* bargaining, Besley and Ghatak (2001) argue that the party who values the public good most should be the owner. We demonstrate the robustness of their insight when the split-the-difference rule is replaced by the *deal-me-out* solution. Our finding is in contrast to the private good results of Chiu (1998) and De Meza and Lockwood (1998), who show that the optimal ownership structure crucially depends on whether the split-the-difference rule or the deal-me-out solution is used.

Keywords: ownership; incomplete contracts; investment incentives; public goods; bargaining

JEL Classification: D23; D86; C78; H41; L31

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1 Introduction

Should governments or private organizations be the owners of public projects? This question might be one of the most fundamental problems in economics. As has been emphasized in a seminal paper by Besley and Ghatak (2001), many states now delegate the responsibility for providing public goods to non-governmental organizations (NGOs).[1] The question then naturally arises: Should the state maintain ownership, or should the NGO become the owner, in particular when the NGO is also the key investor?

Our analysis of the optimal ownership structure is rooted in the property rights approach based on incomplete contracting (Grossman and Hart, 1986; Hart and Moore, 1990; Hart, 1995), which has become the leading paradigm in the modern theory of the firm.[2] In a nutshell, the simplest version of the basic property rights model works as follows. Consider two parties who can generate a surplus when they collaborate tomorrow. If the parties will not agree on collaboration, the party who owns the relevant assets will still be able to generate a surplus, albeit smaller than the collaboration surplus. Suppose that today one of the two parties has to make an important investment decision. The central result of the property rights theory is that this party should be the owner. The reason is that tomorrow the parties will agree to collaborate and divide the collaboration surplus according to the *split-the-difference* rule. Hence, each party gets its disagreement payoff plus half of the additional surplus that is generated by collaboration. Ownership thus increases the share of the total surplus that a party will get tomorrow, so the investing party should be the owner in order to improve its incentives to invest.

In the present paper, we further broaden the property rights approach by

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[1] See also the recent books by Donahue and Zeckhauser (2011), Grimsey and Lewis (2004), and Yescombe (2011) for numerous practical examples.

[2] Hart (2011) describes in a very concise way the state of the art of the theory of the firm. See also Segal and Whinston (2013) for a comprehensive survey of the related literature.

bringing together two important variants of the basic incomplete contracting model (see Table 1).

First, Chiu (1998) and De Meza and Lockwood (1998) have shown that the conclusions of the basic property rights model crucially rely on whether the ex post negotiations between the parties are modelled using the split-the-difference rule or the *deal-me-out solution*.[3] According to the deal-me-out solution, each party gets half of the collaboration surplus, except when one party's disagreement payoff is larger than half of the collaboration surplus. In the latter case, the party with the large disagreement payoff gets its disagreement payoff, while the other party is residual claimant. If the bargaining solution is given by the deal-me-out rule, then it may be optimal to make the non-investing party the owner of the relevant assets, which is never the case in the standard property rights model.[4] In particular, if the non-investing party is the owner, then the investing party can become residual claimant, so it may even have first-best investment incentives.

Second, Besley and Ghatak (2001) have applied the property rights approach to a public goods setting.[5] In this setting, even the non-owner gets a surplus in case of disagreement, since the owner provides a public good. Besley and Ghatak (2001) follow the standard property rights approach in assuming that the bargaining outcome is given by the split-the-difference rule. It turns

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[3]We follow the wording of Binmore et al. (1989), which is also used by De Meza and Lockwood (1998).

[4]Giving ownership to a non-investing party may also be optimal in property rights models in which the investing party has private information about its disagreement payoff (see Schmitz, 2006, and Goldlücke and Schmitz, 2014).

[5]For variants of Besley and Ghatak's (2001) model, see e.g. Halonen-Akatwijuka and Pafilis (2009 and 2014) on repeated games and location choice, Grosjean (2010) on maintenance costs, Francesconi and Muthoo (2011) on impure public goods, and Halonen-Akatwijuka (2012) on indispensable agents. On optimal ownership structures in models where the private party does not directly care about the public good, see also Hart et al. (1997) and Hoppe and Schmitz (2010).

out that in Besley and Ghatak's (2001) model the party who has a larger valuation of the public good should always be the owner, even when the other party is the key investor.

	private goods	public goods
split-the-difference	Grossman and Hart (1986), Hart and Moore (1990)	Besley and Ghatak (2001)
deal-me-out	Chiu (1998), De Meza and Lockwood (1998)	this paper

Table 1. Relation to the literature.

The goal of the present contribution is to investigate whether Besley and Ghatak's (2001) important insights are robust when the split-the-difference rule is replaced by the deal-me-out rule. Is it still true that the party who values the public good most should always be the owner, or does the optimal ownership structure crucially depend on whether the split-the-difference rule or the deal-me-out solution is applied, as it is the case in a private goods framework? Moreover, may the deal-me-out solution even yield first-best investment incentives for a party as in the case of private goods?

These questions are important, since the deal-me-out solution may be at least as plausible as the split-the-difference rule.[6] In laboratory experiments, the deal-me-out solution predicts well, as has been emphasized by Binmore et al. (1989, 1991). Both rules may be appealing as fairness norms. Moreover, Binmore et al. (1991) point out that what people perceive as fair may actually be influenced by strategic considerations. There are indeed convincing non-cooperative bargaining games in support of each of the two sharing rules. For

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[6]Moreover, the questions are also interesting as De Meza and Lockwood (2004) have shown that even in the case of the deal-me-out solution the investing party should always be the owner when there are sufficiently strong spillovers in a private good setting. One might hence suspect that this result carries over to the case of public goods. Yet, we will show that this is not the case.

instance, in Chiu and Yang's (1999) infinite horizon bargaining game, the choice between the two approaches depends on the length of time that taking an outside option restricts a party from reverting to collaboration with the other party.[7]

We find that Besley and Ghatak's (2001) central insights are indeed robust when we replace the split-the difference rule by the deal-me-out solution. Specifically, we focus on the case in which the NGO is the key investor. Due to the public-good nature of the project, the party who cares more about the project has by definition a larger disagreement payoff. Thus, only the high-valuation party's outside option may be binding in the deal-me-out solution. Suppose first that the NGO cares more about the public good. When the NGO's outside option is binding, the NGO's investment incentives are maximized if the NGO is the owner (since in the case of disagreement the NGO is in a better position to make use of its own investment than the government). Now suppose the government cares more about the public good. When the government's outside option is binding, the NGO is residual claimant. In this case, the NGO's incentives are maximized if the NGO's investment has only a minimal effect on the government's outside option, so the government should be the owner. The latter finding is in stark contrast to the standard property rights model and thus strengthens the conclusions of Besley and Ghatak (2001).

Finally, in contrast to the private goods framework, we find that even when the NGO is residual claimant due to the deal-me-out rule, it does not have first-best investment incentives, because in the case of public goods by investing the NGO also increases the government's disagreement payoff.

The remainder of the paper is organized as follows. In the next section,

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[7]See also Muthoo (1999), who provides comprehensive discussions of non-cooperative bargaining games with alternating offers that may lead to the split-the-difference or the deal-me-out division.

we introduce the formal model. In Section 3, we briefly consider the split-the-difference rule, while our main results regarding the deal-me-out solution are derived in Section 4. Concluding remarks follow in Section 5.

2 The model

There are two parties, G (the government) and N (a non-governmental organization, NGO). At an initial date 0, the parties agree on an ownership structure $o \in \{G, N\}$. At date 1, the NGO chooses an observable but non-contractible investment level $i \geq 0$. In line with the incomplete contracting approach (Grossman and Hart, 1986; Hart and Moore, 1990; Hart, 1995), it is assumed that ex ante it is not possible to write a contract that specifies ex post collaboration of the parties.[8]

At date 2, the parties can write a contract specifying collaboration to provide a public good. If the two parties agree to collaborate, they together provide the quantity $y(i)$ of the public good, where $y(0) = 0$, $y'(0) = \infty$, $y'(\infty) = 0$, and $y'' < 0$. If the parties do not collaborate at date 2, the provided quantity of the public good depends on the ownership structure. In particular, in case of disagreement the quantity of the public good is $\lambda_N y(i)$ if $o = N$ and $\lambda_G y(i)$ if $o = G$, where $0 < \lambda_G < \lambda_N \leq 1$. Note that collaboration is always ex post efficient. Moreover, since the NGO is the investing party, in case of disagreement a larger fraction of the NGO's investments can be used when the NGO is the owner.

Let the government's valuation of the public good be denoted by $\theta_G > 0$, while the non-governmental organization's valuation is denoted by $\theta_N > 0$. Thus, the parties' payoffs are as depicted in Table 2, where t is a transfer payment from the government to the NGO.

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[8]For detailed discussions of the incomplete contracting paradigm, see Hart and Moore (1999), Maskin and Tirole (1999), and Tirole (1999).

	payoff of party G	payoff of party N
collaboration	$\theta_G y(i) - t$	$\theta_N y(i) + t$
default, $o = G$	$\theta_G \lambda_G y(i)$	$\theta_N \lambda_G y(i)$
default, $o = N$	$\theta_G \lambda_N y(i)$	$\theta_N \lambda_N y(i)$

Table 2. The parties' payoffs.

The first best-benchmark. Note that the total surplus $(\theta_G + \theta_N)y(i) - i$ is maximized by the investment level i^{FB}, which is implicitly characterized by the first-order condition $(\theta_G + \theta_N)y'(i^{FB}) = 1$.

3   Split-the-difference

Besley and Ghatak (2001) follow the standard property rights approach and apply the split-the-difference rule to model the date-2 negotiations. Hence, under ownership structure $o \in \{G, N\}$, at date 2 the parties agree on a transfer payment t such that each party gets its default payoff plus half of the renegotiation surplus $(\theta_G + \theta_N)y(i) - (\theta_G + \theta_N)\lambda_o y(i)$.

Thus, given ownership structure $o \in \{G, N\}$, the NGO's ex ante payoff is given by

$$\theta_N \lambda_o y(i) + \frac{1}{2}(\theta_G + \theta_N)(1 - \lambda_o)y(i) - i.$$

and the government's payoff is given by

$$\theta_G \lambda_o y(i) + \frac{1}{2}(\theta_G + \theta_N)(1 - \lambda_o)y(i).$$

As a consequence, at date 1 the NGO chooses the investment level i^o, which is implicitly characterized by

$$\frac{1}{2}[\theta_G + \theta_N + \lambda_o(\theta_N - \theta_G)]y'(i^o) = 1.$$

Note that there is always underinvestment compared to the first-best solution, because the NGO's marginal return $\frac{1}{2}[\theta_G + \theta_N + \lambda_o(\theta_N - \theta_G)]$ is smaller

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than the social marginal return $\theta_G + \theta_N$. Moreover, observe that $i^G \geq i^N$ whenever $\theta_G \geq \theta_N$, because

$$
\begin{aligned}
\frac{1}{2}[\theta_G + \theta_N + \lambda_G(\theta_N - \theta_G)] &\geq \frac{1}{2}[\theta_G + \theta_N + \lambda_N(\theta_N - \theta_G)] \\
\Longleftrightarrow 0 &\geq (\lambda_N - \lambda_G)(\theta_N - \theta_G) \\
\Longleftrightarrow \theta_G &\geq \theta_N.
\end{aligned}
$$

Due to concavity of the total surplus, this means that it is always optimal for the party who has a larger valuation of the public good to be the owner. In particular, even though the NGO is the investing party, ownership by the government can be optimal, which is in contrast to the standard property rights theory with private goods.[9] Intuitively, when party G has a larger valuation of the public good, then N's investment improves the default payoff and thus the bargaining position of party G more than its own bargaining position, so making party G the owner is optimal as this reduces the impact of the default payoffs on the bargaining outcome.

4 Deal-me-out

We now explore whether Besley and Ghatak's (2001) central insight is robust when we replace the split-the-difference rule by the deal-me-out solution.

Thus, we now suppose that at date 2 the parties split the collaboration surplus $(\theta_G + \theta_N)y(i)$ equally, except when one party's default payoff is larger than half of the collaboration surplus.[10] If party G's default payoff $\theta_G \lambda_o y(i)$ is

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[9]Schmitz (2013) has shown that when the regular Nash bargaining solution is replaced by the generalized Nash bargaining solution (i.e., if the renegotiation surplus is split unequally), then Besley and Ghatak's (2001) result that the party who values the public good most should always be the owner no longer holds. Yet, it is still true that only the relationship between θ_G and θ_N matters for the optimal ownership structure, while the investment technology is irrelevant (i.e., in contrast to the private good case, N-ownership is not always optimal, even though only party N has to make a relevant investment decision).

[10]Note that it is not possible that *both* parties' default payoffs are larger than half of the

larger than $\frac{1}{2}(\theta_G + \theta_N)y(i)$, then party G gets its default payoff $\theta_G \lambda_o y(i)$ and party N is residual claimant, i.e. it gets $(\theta_G + \theta_N)y(i) - \theta_G \lambda_o y(i)$. Analogously, if party N's default payoff $\theta_N \lambda_o y(i)$ is larger than $\frac{1}{2}(\theta_G + \theta_N)y(i)$, then party N gets $\theta_N \lambda_o y(i)$ and party G gets $(\theta_G + \theta_N)y(i) - \theta_N \lambda_o y(i)$.

Hence, given ownership structure $o \in \{G, N\}$, the NGO's ex ante payoff is given by

$$
u_o^N(i|\theta_G, \theta_N) = \begin{cases} \frac{1}{2}(\theta_G + \theta_N)y(i) - i & \text{if } \max\{\theta_N \lambda_o, \theta_G \lambda_o\} \le \frac{1}{2}(\theta_G + \theta_N), \\ \theta_N \lambda_o y(i) - i & \text{if } \theta_G \lambda_o < \frac{1}{2}(\theta_G + \theta_N) < \theta_N \lambda_o, \\ (\theta_G + \theta_N)y(i) - \theta_G \lambda_o y(i) - i & \text{if } \theta_N \lambda_o < \frac{1}{2}(\theta_G + \theta_N) < \theta_G \lambda_o, \end{cases}
$$

and the government's payoff is given by

$$
u_o^G(i|\theta_G, \theta_N) = \begin{cases} \frac{1}{2}(\theta_G + \theta_N)y(i) & \text{if } \max\{\theta_N \lambda_o, \theta_G \lambda_o\} \le \frac{1}{2}(\theta_G + \theta_N), \\ (\theta_G + \theta_N)y(i) - \theta_N \lambda_o y(i) & \text{if } \theta_G \lambda_o < \frac{1}{2}(\theta_G + \theta_N) < \theta_N \lambda_o, \\ \theta_G \lambda_o y(i) & \text{if } \theta_N \lambda_o < \frac{1}{2}(\theta_G + \theta_N) < \theta_G \lambda_o. \end{cases}
$$

We can now analyze the NGO's investment decision at date 1.

Suppose first that $\theta_G \ge \theta_N$. In this case, the NGO maximizes

$$
u_o^N(i|\theta_G, \theta_N) = \begin{cases} \frac{1}{2}(\theta_G + \theta_N)y(i) - i & \text{if } \theta_G \lambda_o \le \frac{1}{2}(\theta_G + \theta_N), \\ (\theta_G + \theta_N)y(i) - \theta_G \lambda_o y(i) - i & \text{if } \frac{1}{2}(\theta_G + \theta_N) < \theta_G \lambda_o. \end{cases}
$$

Thus, the investment level is characterized by

$$
\frac{1}{2}(\theta_G + \theta_N)y'(i_o) = 1 \text{ if } \lambda_o \le \frac{1}{2}(1 + \theta_N/\theta_G)
$$

and

$$
[(1 - \lambda_o)\theta_G + \theta_N]y'(i_o) = 1 \text{ if } \lambda_o > \frac{1}{2}(1 + \theta_N/\theta_G).
$$

Observe that if $\lambda_N \le \frac{1}{2}(1 + \theta_N/\theta_G)$, then the investment level is given by $\frac{1}{2}(\theta_G + \theta_N)y'(i_o) = 1$ regardless of the ownership structure $o \in \{G, N\}$. If $\lambda_G > \frac{1}{2}(1 + \theta_N/\theta_G)$, then $o = G$ is the optimal ownership structure, since

$$
(1 - \lambda_N)\theta_G + \theta_N < (1 - \lambda_G)\theta_G + \theta_N < \theta_G + \theta_N.
$$

collaboration surplus, because the sum of the default payoffs $\theta_G \lambda_o y(i) + \theta_N \lambda_o y(i)$ cannot be larger than the collaboration surplus $(\theta_G + \theta_N)y(i)$.

Note that there is always underinvestment with regard to the first-best benchmark, so concavity of the total surplus implies that the ownership structure that leads to the larger investment level is optimal. Finally, $o = G$ is also optimal if $\lambda_G \leq \frac{1}{2}(1 + \theta_N/\theta_G) < \lambda_N$, because in this case

$$(1 - \lambda_N)\theta_G + \theta_N < \frac{1}{2}(\theta_G + \theta_N) < \theta_G + \theta_N$$

holds.

Recall that in the case of the split-the-difference rule, when $\theta_G \geq \theta_N$, then the investment level is characterized by $\frac{1}{2}[\theta_G + \theta_N + \lambda_G(\theta_N - \theta_G)]y'(i^G) = 1$. Note that the investment level is larger in the case of the deal-me-out solution, because both $\frac{1}{2}(\theta_G + \theta_N)$ and $(1 - \lambda_G)\theta_G + \theta_N$ are larger than $\frac{1}{2}[\theta_G + \theta_N + \lambda_G(\theta_N - \theta_G)]$.

Suppose next that $\theta_G < \theta_N$, so the NGO maximizes

$$u_o^N(i|\theta_G, \theta_N) = \begin{cases} \frac{1}{2}(\theta_G + \theta_N)y(i) - i & \text{if } \theta_N\lambda_o \leq \frac{1}{2}(\theta_G + \theta_N), \\ \theta_N\lambda_o y(i) - i & \text{if } \frac{1}{2}(\theta_G + \theta_N) < \theta_N\lambda_o. \end{cases}$$

In this case, the investment level is characterized by

$$\frac{1}{2}(\theta_G + \theta_N)y'(i_o) = 1 \text{ if } \lambda_o \leq \frac{1}{2}(1 + \theta_G/\theta_N)$$

and

$$\theta_N\lambda_o y'(i_o) = 1 \text{ if } \lambda_o > \frac{1}{2}(1 + \theta_G/\theta_N).$$

Note that if $\lambda_N \leq \frac{1}{2}(1 + \theta_G/\theta_N)$, then the investment level is given by $\frac{1}{2}(\theta_G + \theta_N)y'(i_o) = 1$ regardless of the ownership structure. If $\lambda_G > \frac{1}{2}(1 + \theta_G/\theta_N)$, then $o = N$ is the optimal ownership structure, because

$$\theta_N\lambda_G < \theta_N\lambda_N < \theta_G + \theta_N.$$

Finally, if $\lambda_G \leq \frac{1}{2}(1 + \theta_G/\theta_N) < \lambda_N$, then again $o = N$ is optimal, since

$$\frac{1}{2}(\theta_G + \theta_N) < \theta_N\lambda_N < \theta_G + \theta_N.$$

In the case of the split-the-difference rule, if $\theta_G < \theta_N$, then the investment level is implicitly given by $\frac{1}{2}[\theta_G + \theta_N + \lambda_N(\theta_N - \theta_G)]y'(i^N) = 1$. Note that

the investment level is smaller in the case of the deal-me-out solution, because both $\frac{1}{2}(\theta_G + \theta_N)$ and $\theta_N \lambda_N$ are smaller than $\frac{1}{2}[\theta_G + \theta_N + \lambda_N(\theta_N - \theta_G)]$.

To summarize, the following results hold.

Proposition 1 *Suppose the outcome of the date-2 negotiations is given by the deal-me-out solution.*

(i) It is always optimal to let the party who values the public good most be the owner.

(ii) The NGO's investment level is larger than in the case of the split-the-difference rule if ownership by the government is optimal. Otherwise, the investment level is smaller than in the case of the split-the-difference rule.

(iii) The investment level is always strictly smaller than the first-best benchmark.

Intuitively, suppose first that party G's valuation θ_G is smaller than party N's valuation θ_N. Observe that in this case it can never happen that party G's outside option will be binding. If the NGO's outside option is binding, it gets its default payoff, so the NGO should be the owner, since then the NGO's default payoff is larger than when party G is the owner. If the NGO's outside option is not binding, each party gets half of the collaboration surplus regardless of the ownership structure, so it does not matter who is the owner. The investment level is smaller than in the split-the-difference scenario, where the NGO got more than half of the surplus when θ_N was larger than θ_G.

Next, suppose that party G has the larger valuation. In this case it can never happen that party N's outside option will be binding. If party G's outside option is binding, then the NGO is residual claimant, so its investment incentives are improved when party G's default payoff is made smaller, i.e. party G should be the owner. When party G's outside option is not binding, each party gets again half of the collaboration surplus, so the ownership structure does not matter. The investment level is larger than in the split-the-difference scenario, where the NGO got less than half of the surplus when θ_G

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was larger than θ_N.

Finally, note that due to the public good nature of the project, even when the NGO is residual claimant it does not have first-best investment incentives, because by investing it also increases party G's default payoff.

5   Conclusions

Besley and Ghatak (2001) have shown that in the case of public goods, ownership should reside with the party that cares most about the project, even if the other party is the key investor. However, their model might be considered to be restrictive in the sense that the outcome of the parties' negotiations was given by the split-the-difference rule.

In this paper, we have shown that Besley and Ghatak's (2001) central insight is indeed robust when the split-the-difference rule is replaced by the deal-me-out solution.[11] Our finding thus highlights another important difference between the public good and the private good settings, as Chiu (1998) and De Meza and Lockwood (1998) have shown that the central insights of the property rights theory are not robust with regard to the deal-me-out solution in the case of private goods. Moreover, it has turned out that in contrast to the case of private goods, with public goods it is not possible to provide first-best investment incentives, even when the bargaining outcome is given by the deal-me-out solution.

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[11] We have focused on the case of one-sided investments, which means that the technological asymmetry between the parties is as large as possible (so in the case of private goods the investing party should always be the owner), which is the most challenging case for Besley and Ghatak's (2001) findings. It can be shown that also in the more symmetric setting with two-sided investments Besley and Ghatak's (2001) central insight remains valid. Intuitively, the reason is again that the default payoff is always larger for the high-valuation party. Yet, the calculations with two-sided investments become much more tedious in the case of the deal-me-out solution.

Acknowledgements

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