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On the Social Efficiency of Conflict

Santiago Sánchez-Pagés*

Abstract

In sharp contrast with the economic literature on conflict, this paper shows that confrontation may be efficiency enhancing. Conditions are derived under which a contest over the exclusive control of a resource Pareto dominates open access. When the population size is big enough or production exhibits strong decreasing returns to scale, agents unanimously prefer to engage in conflict.

JEL classification: D23, D74.

1 Introduction

Conflict is increasingly gaining recognition among economists as a powerful force driving human interactions. Rational agents not only engage in purely "economic" activities like production or exchange. They also employ coercion to different degrees in order to appropriate what others have produced or to secure certain rents.

Tracing back to Bush and Meyer (1974), a strand of the economic literature has taken into account the possibility of conflict. Skaperdas (1992), Hirshleifer (1995) and Neary (1997) have explored models where agents fight over a common pool of output. Because they model conflict as a socially wasteful activity, these works focus on the extent of the inefficiency generated by this "dark side" of self-interest, along with its allocative implications. But they rather leave open the question of why agents do not agree to peacefully share the output they have jointly produced.

Alternatively, the papers by Grossman and Kim (1995) and Muthoo (2004) have argued that contests happen to be mainly over *rights* rather than over *objects* and that this distinction can help us to understand why conflict occurs at all. Specifically, these works apply economic models of conflict to the study of the origin of different types of property rights. The present paper follows this line of research and is able to obtain a novel result in the economic literature on conflict: When weak governance, the impossibility of informal agreements or uncertainty preclude the efficient

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joint exploitation of a resource, a confrontation over its exclusive use should be expected to arise. And contrary to the received wisdom, that conflict can be *efficiency enhancing* compared to a peaceful settlement.

2 The model

Consider a population of agents indexed by $i = 1, 2, ..., n$ who own T units of initial endowments each that can be transformed into labor, denoted by l_i, into arms, denoted by r_i, or devoted to leisure, h_i. Hence, $r_i + l_i + h_i \leq T$.

In this economy there is a resource agents can extract output from. But before any production can take place, they have to decide whether to establish an open access regime or to initiate an *exclusion contest* whose winner will obtain exclusive property rights.[1]

If all agents agree to make access to the resource fully open, no conflict erupts and the resource is exploited *non-cooperatively.* The amount of output produced only depends on the total labor input according to the function $F(\cdot)$ that satisfies $F' > 0$ and $F'' < 0$. Following the standard formulation of the "commons" problem (see for instance Cornes and Sandler, 1983), an agent's share over output under open access is defined to be proportional to his labor input. Hence, when agents' utilities are additively separable in output and leisure, payoffs become simply

$$u_i^F = \frac{l_i}{L} F(L) + h_i, \tag{1}$$

$$= \frac{l_i}{L} F(L) + (T - l_i), \tag{2}$$

where $L = \sum_{j=1}^{n} l_j$. Let us assume that the production function takes the iso-elastic form $F(L) = L^\alpha$ with $\alpha \in (0, 1)$. Then, the payoff function (2) can be rewritten as

$$u_i^F = \frac{l_i}{L} L^\alpha + (T - l_i). \tag{3}$$

But if at least one agent decides to challenge open access, the exclusion contest takes place and agents can invest in arms too. These investments aim to alter in their favor the probability of winning the contest. We will assume that agent's i winning probability takes the following functional form axiomatized by Skaperdas (1996):

$$p_i = \frac{r_i^m}{\sum_{j=1}^{n} r_j^m},$$

where the parameter $m > 0$ represents the returns to scale of conflict effort. If an agent wins the contest, she obtains exclusive property rights and gains

[1] How these decisions are taken, either simultaneously or sequentially, is immaterial to our results

the monopolistic control of the resource. If not, the agent is excluded and she can only derive utility from leisure. Payoffs in this case are thus:

$$u_i^E = \frac{r_i^m}{\sum_{j=1}^n r_j^m} l_i^\alpha + (T - l_i - r_i). \tag{4}$$

3 Open vs. monopolistic access

Let us now analyze the two scenarios that can arise after agents are called to decide on the property regime that will be established over the resource.

First, if open access is established, the "tragedy of the commons" ensues and labor is oversupplied with respect to the efficient level, leading to lower individual payoffs than under cooperative production.

Proposition 1 *In the interior symmetric Nash equilibrium under open access, the total level of labor input and individual payoffs are:*

$$L^F = (\frac{n-1+\alpha}{n})^{\frac{1}{1-\alpha}}, \tag{5}$$

$$u^F = T + \frac{1-\alpha}{n^2}(\frac{n-1+\alpha}{n})^{\frac{\alpha}{1-\alpha}}. \tag{6}$$

Proof. The first order condition of an agent's problem under open access is

$$\frac{\partial u_i^F}{\partial l_i} = (L - l_i)L^{\alpha-2} + \alpha l_i L^{\alpha-2} - 1 = 0,$$

so under symmetry this condition boils down to

$$(n - 1 + \alpha)L^{\alpha-1} = n,$$

that after some manipulation yields L^F in the text of the Proposition. Finally, by plugging it into (3) one can get the equilibrium payoff (6). ■

Note that individual payoffs are decreasing in the population size because overexploitation intensifies as n increases and go down to zero $n \to \infty$.

Alternatively, agents can decide to challenge open access and initiate the exclusion contest. Victory grants monopolistic access to the resource but defeat implies getting totally excluded.

Proposition 2 *In the interior symmetric Nash equilibrium of the exclusion contest, the individual labor input, conflict investment and individual payoffs are:*

$$l^E = (\frac{\alpha}{n})^{\frac{1}{1-\alpha}}, \tag{7}$$

$$r^E = m\frac{n-1}{n^2}(\alpha n)^{\frac{\alpha}{1-\alpha}}, \tag{8}$$

$$u^E = T + (\frac{1-\alpha}{n} - m\frac{n-1}{n^2})(\frac{\alpha}{n})^{\frac{\alpha}{1-\alpha}}. \tag{9}$$

Proof. The first order conditions of the problem faced by an agent can be written as:

$$\begin{aligned}\frac{\partial u_i^E}{\partial r_i} &= m\frac{p_i(1-p_i)}{r_i}l_i^{\alpha} - 1 = 0\\ \frac{\partial u_i^E}{\partial l_i} &= \alpha p_i l_i^{\alpha-1} - 1 = 0.\end{aligned}$$

In any interior symmetric Nash equilibrium of this game, agent's investments in conflict and labor must satisfy the following condition

$$m\frac{n-1}{n} = \alpha\frac{r}{l},$$

that finally yields the equilibrium choices l^E and r^E stated in the text of the Proposition, provided that $T \geq l^E + r^E$. Finally, by plugging them into (4) the equilibrium payoff (9) can be derived. ■

Note that the intensity of conflict, measured by the investment in arms, r^E, increases with m and that this leads in turn to lower individual payoffs.

4 The social efficiency of conflict

We have so far derived the outcomes of the two possible property regimes that can arise in our model. Agents will compare them and decide whether to establish open access or to initiate conflict depending on which of the two offers the highest (expected) payoff.

Although the investments in the contest are not directly productive, exclusion reduces the inefficiency associated with open access: Only one agent access to the resource so it cannot be overexploited. The huge rents that exclusion generates can thus induce agents to trigger conflict. The next Proposition derives conditions on the population size and on the conflict and production technologies under which the exclusion contest *ex-ante* Pareto dominates peaceful access.

Proposition 3 *There exists a threshold $\overline{m}(n,\alpha)$ such that if $m \leq \overline{m}(n,\alpha)$ agents unanimously prefer the exclusion contest to open access, that is $u^F \leq u^E$. Moreover, this threshold is increasing in the population size, n, and decreasing in the labor elasticity of output, α.*

Proof. Given expressions (6) and (9), straightforward algebra shows that

$$u^F \leq u^E \;\Leftrightarrow\; m \leq \frac{1-\alpha}{n-1}(n - (\frac{n-1}{\alpha}+1)^{\frac{\alpha}{1-\alpha}}) \equiv \overline{m}.$$

The derivative of $\overline{m}(n,\alpha)$ is

$$\frac{\partial \overline{m}}{\partial n} = \frac{1-\alpha}{(n-1)^2}(-1 + (\frac{n-1}{\alpha(1-\alpha)}+1)(\frac{n-1}{\alpha}+1)^{\frac{\alpha}{1-\alpha}-1}) > 0,$$

where the inequality comes from the fact that

$$(\frac{n-1}{\alpha}+1)^{\frac{\alpha}{1-\alpha}} > 1 > \frac{\frac{n-1}{\alpha}+1}{\frac{n-1}{\alpha(1-\alpha)}+1}.$$

On the other hand, the derivative of the threshold with respect to α is

$$\frac{\partial \overline{m}}{\partial \alpha} = -\frac{\overline{m}}{1-\alpha} - \frac{1}{n-1}\left(\frac{n-1}{\alpha}+1\right)^{\frac{\alpha}{1-\alpha}} (\frac{\ln\left(\frac{n-1}{\alpha}+1\right)}{1-\alpha} - \frac{n-1}{n-1+\alpha}) < -\frac{\overline{m}}{1-\alpha} < 0.$$

where the first inequality follows again from straightforward calculus and the second from the fact that we restrict our attention to $\overline{m} > 0$. ■

This Proposition shows that as long as the contest is not too resource consuming, *all* agents will have an incentive to contest open access and initiate conflict. Therefore, a conflict over the resource *ex-ante* Pareto dominates open access. Moreover, the room for an exclusion contest increases as the population becomes bigger and the production technology deteriorates: These two factors worsen the tragedy of the commons making thus relatively more profitable to trigger hostilities.

5 Conclusion

We have presented a model where agents can fight a conflict awarding exclusive control over a resource otherwise of open access. We have shown that, in sharp contrast with the economic literature on conflicts and contests, the allocation of (expected) payoffs emerging from confrontation can Pareto dominate the one generated by peaceful, open access. Agents unanimously prefer to engage in confrontation when the population size is big enough or the labor elasticity of output is not too high. This result generalizes to alternative specifications of the basic model presented here.

Two qualifications must be nonetheless noted: First, we have assumed away the possibility of agents contracting their labor inputs under open access. Our result mainly applies thus to those (not infrequent) scenarios where the absence of strong formal institutions or the lack of trust or communication render such agreements not binding.

Second, we stress the distinction between *ex-ante* and *ex-post* Pareto efficiency. We are not claiming here that conflict is more efficient than peace. The distribution of payoffs after the contest is resolved cannot Pareto dominate open access because it is too unequal; the winning agent obtains exclusive rights over the output whereas the rest only enjoy leisure. However, at the beginning of the game, agents know that victory in the contest awards a very valuable prize. So in expected terms all of them can prefer the contest to open access and hence unanimously choose to open conflict.

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