Economics Letters 116 (2012) 504–507

Contents lists available at SciVerse ScienceDirect

Economics Letters

journal homepage: www.elsevier.com/locate/ecolet

On the inappropriateness of collective rent seeking analysis when agents exert within-group and between-group efforts

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ARTICLE INFO

Article history:
Received 14 April 2010
Received in revised form
30 March 2012
Accepted 20 April 2012
Available online 27 April 2012

JEL classification:
C72
D72
D74
L

Keywords:
Rent seeking
Production
Conflict
Two efforts

ABSTRACT

The ratio of within-group to between-group fighting is shown to be unrealistically high for the collective rent seeking model when agents exert two efforts i.e. within-group and between-group efforts. The ratio is more realistic for the production and conflict model. Six economics examples illustrate the unrealistic implications of rent seeking analysis.

1. Introduction

Rent seeking analysis, introduced by Tullock (1980) and others, has matured over the last decades. See Congleton et al. (2008) and the references therein. Examples of uses are lobbying, R&D races, and elections. Both the individual and collective rent seeking literatures have been scientifically successful. Collective rent seeking analysis is appropriate when some external actor provides an exogenously given rent, for example, the government offering rights for oil drilling or nature offering mineral resources. Collective rent seeking comes in two versions. The first, exemplified by Katz et al. (1990) and Nitzan (1991) and axiomatized by Münster (2009), assumes that each agent in each group exerts an effort which jointly determines the group's and the agent's success. The second, exemplified by Bös (2002), Garfinkel (2004), Inderst et al. (2007), Katz and Tokatlidu (1996), Müller and Wärneryd's (2001), and Wärneryd (1998), assumes that each agent exerts one effort for the within-group contest and a second effort for the between-group contest. This paper shows that this second version is problematic, and that it is inappropriate when used to explain production. Comparison is made with the appropriate way of analyzing production, which is to incorporate the productive technology, thus endogenizing the rent.[1]

Each agent produces goods, and fights within his/her group and between groups for the produced goods. In order to compare this production and conflict (P&C) analysis with the rent seeking (RS) analysis, the agents incur the same unit costs of fighting within and between groups in the two analyses, and the groups have the same sizes in the two analyses. The difference is that there is a fixed rent in the RS analysis, and a unit cost of production accompanied with the option of production in the P&C analysis.

The similarities and differences between RS and P&C models raise concerns about how the models are applied to various phenomena. Evaluating the logic of the two models is essential in order to interpret the results in various application areas. This paper compares the RS and P&C models systematically, and shows how and why they cause different results. Far-reaching conclusions cannot be drawn without scrutinizing the different premises of the two models. Applications are considered to inside versus outside ownership, divestitures, mergers and acquisitions, multi-divisional versus single-tier firms, the U form versus the M form of economic organization (Chandler, 1966; Williamson, 1975), and intergroup migration.

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[1] For individual firms,this has been done by, e.g., Grossman (1991), Hirshleifer (2001), and Skaperdas (1992). They argue that, in addition to producing commodities, agents may appropriate goods produced by others.

0165-1765/$ – see front matter
doi:10.1016/j.econlet.2012.04.060

2. The rent seeking (RS) model

Consider two groups with sizes $n_k \geq 1$, $k = 1, 2$, competing for a rent valued at S. Agent i in group k has a resource $r_k = b_k f_{ki} + c_k g_{ki}$, $i = 1, \ldots, n_k$, where b_k and c_k are unit conversion costs, transformable into two kinds of rent seeking (fighting). Using the ratio form contest success function (Tullock, 1980), within-group fighting f_{ki} gives a ratio $f_{ki}/\sum_{i=1}^{n_k} f_{ki}$ to agent i. Between-group fighting g_{ki} gives a ratio $\sum_{i=1}^{n_k} g_{ki}/[\sum_{i=1}^{n_1} g_{1i} + \sum_{i=1}^{n_2} g_{2i}]$ to group k. Agent i's utility in group k is

$$u_{ki} = \frac{f_{ki}}{\sum_{i=1}^{n_k} f_{ki}} \frac{\sum_{i=1}^{n_k} g_{ki} S}{\left[\sum_{i=1}^{n_1} g_{1i} + \sum_{i=1}^{n_2} g_{2i}\right]} - b_k f_{ki} - c_k g_{ki}. \quad (1)$$

Calculating $\partial u_{1i}/\partial f_{1i} = 0$ and $\partial u_{2i}/\partial f_{2i} = 0$, calculating $\partial u_{1i}/\partial g_{1i} = 0$ and $\partial u_{2i}/\partial g_{2i} = 0$, equating the two equivalent square brackets, and letting all agents in group k incur equal rent seeking cost $g_{ki} = g_k$ in equilibrium, causing $u_{ki} = u_k$, gives (permute indices for group 2)

$$f_1 = \frac{(n_1-1)n_2^2 c_2 S}{b_1 n_1^2 (n_1^2 c_1 + n_2^2 c_2)}, \qquad g_1 = \frac{n_2^2 c_2 S}{n_1 (n_1^2 c_1 + n_2^2 c_2)^2},$$

$$\frac{f_1}{g_1} = \frac{(n_1-1)(n_1^2 c_1 + n_2^2 c_2)}{b_1 n_1} = \begin{cases} \frac{(n_1-1)(n_1^2+n_2^2)}{n_1} & \text{when } b_i = c_i = 1 \\ 2n_1(n_1-1) & \text{when } b_i = c_i = 1,\ n_2 = n_1 \\ 180 & \text{when } b_i = c_i = 1,\ n_2 = n_1 = 10 \\ 1998000 & \text{when } b_i = c_i = 1,\ n_2 = n_1 = 10^3 \end{cases} \quad (2)$$

$$u_1 = \frac{n_2^2 c_2((n_1-1)n_1 c_1 + n_2^2 c_2)S}{n_1^2(n_1^2 c_1 + n_2^2 c_2)^2} = \begin{cases} \frac{n_2^2((n_1-1)n_1 + n_2^2)S}{n_1^2(n_1^2+n_2^2)^2} & \text{when } c_i = 1 \\ \frac{(2n_1-1)S}{4n_1^3} & \text{when } c_i = 1,\ n_2 = n_1 \\ \frac{19S}{4000} & \text{when } c_i = 1,\ n_2 = n_1 = 10 \\ \frac{1999S}{4\times 10^9} & \text{when } c_i = 1,\ n_2 = n_1 = 10^3. \end{cases} \quad (3)$$

That 10 agents in each of the two groups allocate 180 times more to within-group fighting than to between-group fighting is not realistic. Utilities approach 0 as the group sizes increase.

3. The production and conflict (P&C) model

Agent i in group k has a resource $R_k = a_k E_{ki} + b_k F_{ki} + c_k G_{ki}$ transformable into within-group fighting F_{ki}, between-group fighting G_{ki}, and productive effort E_{ki} at unit cost a_k, causing production

$$E_{ki} = (R_k - b_k F_{ki} - c_k G_{ki})/a_k. \quad (4)$$

The production $[\sum_{i=1}^{n_1} E_{k1} + \sum_{i=1}^{n_2} E_{k2}]$ is placed in a common pool for capture. Using the same logic as for rent seeking, agent i's utility in group k is

$$U_{ki} = \frac{F_{ki}}{\sum_{i=1}^{n_k} F_{ki}} \frac{\sum_{i=1}^{n_k} G_{ki}}{\left[\sum_{i=1}^{n_1} G_{1i} + \sum_{i=1}^{n_2} G_{2i}\right]} \left[\sum_{i=1}^{n_1} \frac{R_1 - b_1 F_{1i} - c_1 G_{1i}}{a_1} + \sum_{i=1}^{n_2} \frac{R_2 - b_2 F_{2i} - c_2 G_{2i}}{a_2}\right]. \quad (5)$$

Setting the derivative of U_{1i} in (5) with respect to F_{1i} equal to zero, and assuming identical agents in both groups so that $F_{1i} = F_1$ and $F_{2i} = F_2$ in equilibrium, gives

$$\frac{\partial U_{1i}}{\partial F_{1i}} = 0 \Rightarrow \frac{(n_1-1)}{n_1^2 F_1}\left[n_1 \frac{R_1 - b_1 F_1}{a_1} - \sum_{i=1}^{n_1} \frac{c_1 G_{1i}}{a_1} + n_2 \frac{R_2 - b_2 F_2}{a_2} - \sum_{i=1}^{n_2} \frac{c_2 G_{2i}}{a_2}\right] - \frac{b_1}{n_1 a_1} = 0. \quad (6)$$

Similarly, calculating $\partial U_{2i}/\partial F_{2i} = 0$, and equating the two equivalent square brackets, gives

$$\frac{F_1}{F_2} = \frac{(n_1-1)n_2 a_1 b_2}{(n_2-1)n_1 a_2 b_1}, \quad F_1 = \frac{a_1(n_1-1)}{n_1 b_1} \frac{\left[\frac{n_1 R_1}{a_1} + \frac{n_2 R_2}{a_2} - \sum_{i=1}^{n_1} \frac{c_1 G_{1i}}{a_1} - \sum_{i=1}^{n_2} \frac{c_2 G_{2i}}{a_2}\right]}{[n_1 + n_2 - 1]}, \quad (7)$$

where F_2 is found by permuting the indices. Inserting F_1 and F_2 into (5) and rearranging gives

$$U_{1i} = \frac{\left[\frac{n_1 R_1}{a_1} + \frac{n_2 R_2}{a_2} - \sum_{i=1}^{n_1} \frac{c_1 G_{1i}}{a_1} - \sum_{i=1}^{n_2} \frac{c_2 G_{2i}}{a_2}\right] \sum_{i=1}^{n_1} G_{1i}}{n_1 [n_1 + n_2 - 1] \left[\sum_{i=1}^{n_1} G_{1i} + \sum_{i=1}^{n_2} G_{2i}\right]}. \quad (8)$$

Calculating the first order conditions (FOCs) $\partial U_{1i}/\partial G_{1i} = 0$ and $\partial U_{2i}/\partial G_{2i} = 0$, equating the two equivalent square brackets as above, and setting $G_{ki} = G_k$ and $U_{ki} = U_k$, gives (permute indices for group 2)

$$F_1 = \frac{a_1(n_1-1)[n_1 R_1/a_1 + n_2 R_2/a_2]}{2b_1 n_1 [n_1 + n_2 - 1]}, \quad G_1 = \frac{a_1\sqrt{a_2}[n_1 R_1/a_1 + n_2 R_2/a_2]}{2n_1\sqrt{c_1}[\sqrt{c_1 a_2} + \sqrt{c_2 a_1}]},$$

$$\frac{F_1}{G_1} = \frac{(n_1-1)\sqrt{c_1}\left(\sqrt{c_1 a_2} + \sqrt{c_2 a_1}\right)}{b_1\sqrt{a_2}(n_1 + n_2 - 1)} = \begin{cases} \frac{2(n_1-1)}{n_1+n_2-1} & \text{when } a_i = b_i = c_i = 1 \\ \frac{2(n_1-1)}{2n_1-1} & \text{when } a_i = b_i = c_i = 1,\ n_2 = n_1 \\ \frac{18}{19} & \text{when } a_i = b_i = c_i = 1,\ n_2 = n_1 = 10 \\ \frac{1998}{1999} & \text{when } a_i = b_i = c_i = 1,\ n_2 = n_1 = 10^3 \end{cases} \quad (9)$$

$$U_1 = \frac{\sqrt{c_2 a_1}\sum_{k=1}^{2} \frac{n_k R_k}{a_k}}{2n_1 [n_1 + n_2 - 1]\left(\sqrt{c_1 a_2} + \sqrt{c_2 a_1}\right)} = \begin{cases} \frac{n_1 R_1 + n_2 R_2}{4n_1(n_1+n_2-1)} & \text{when } a_i = c_i = 1 \\ \frac{R_1 + R_2}{4(2n_1-1)} & \text{when } a_i = c_i = 1,\ n_2 = n_1 \\ \frac{R_1 + R_2}{76} & \text{when } a_i = c_i = 1,\ n_2 = n_1 = 10 \\ \frac{R_1 + R_2}{7996} & \text{when } a_i = c_i = 1,\ n_2 = n_1 = 10^3. \end{cases} \quad (10)$$

That 10 agents in each of the two groups allocate a fraction 18/19 (=94.7%) to within-group fighting relative to between-group fighting is realistic.