(사)한국산업경제학회 춘계학술발표대회 논문집 2015년 5월 30일(pp.475∼481)

Total Expenditures with Alternative Instruments in Lobbying Contests

Sung-Hoon Park
Department of Economics, Chosun University
park@chosun.ac.kr

Ⅰ. Introduction

Since the seminal work by Tullock (1980), contest models have been extensively applied in the economy. Examples include: (i) lobbing by corporations and/or consumer groups for regulatory treatment; (ii) inter-firm or international R&D rivalry for a profitable innovation; (iii) environmental conflict between citizen groups and polluting firms; (iv) litigation between plaintiffs and defendants; and so on. Contests are studied in many scholars. Examples are Dixit (1987), Baik and Shogren (1992), Nitzan 1994), Hirshleifer (1995), Farmer and Pecorino (1999), Baik and kim(1997), Epstein and Hefeker (2003), Schoonbeek (2007), Shaffer and Shogren (2008), Park (2013, 2014).

Contests have been studied under an assumption that players only use an instrument in order to win a prize. This assumption may inconsistent with some common contests. In some situations, each player may have several instruments that are used to increase his likelihood of winning a prize. For example, a potential polluting firm, that wants to put forward plans for a project which will yield profits, could try lobbying the government directly by offering money or by contributing to political parties. In addition, the firm could place advertisements in newspapers, try to influence other developers who see the firm's project as benefits to economic conditions. In opposition to the firm's project, a citizen group may try to stage protest in front of the National Assembly. In addition to protests, the group could place advertisements in newspapers, show sick people due to environmental damages.

To model such situations, we use the specification proposed by Epstein and Hefeker

(2003), that considers a two instrument contest and compare it to the standard Tullock contest. Epstein and Hefeker (2003) show that the results derived with their model significantly differ from those derived with the standard Tullock contest. Hence, one cannot innocently replace two instruments by one instrument. To show the results, Epstein and Hefeker (2003) look at the probabilities of winning the contest and the total expenditures. Like Epstein and Hefeker (2003), we also analyze the probabilities and the total expenditure. The difference between Epstein and Hefeker (2003) and this paper is as follows. Epstein and Hefeker (2003) consider two cases: (1) case 1 – both players only use the first instrument; and (2) case 2 – they use two instruments. Comparing case 1 to case 2, Epstein and Hefeker (2003) show that the total expenditures may increase or decrease as a result of the use of two instrument. Unlike Epstein and Hefeker (2003), we allow each player to choose one between the use of one instrument and the use of two instruments, maximizing his expected payoff. Then we show that the total expenditures always increase as a result of the use of two instrument. In other words, if we consider rent dissipation as a waste of resources, the use of two instruments, relative to the use of one instrument, lowers welfare.

Section II describes our two models and derives the equilibrium respectively. In section III we compare two instrument contest to the standard Tullock contest. Section Ⅳ contains some concluding remarks.

II. Framework of the Models

The specification of our model borrows from Epstein and Hefeker (2003). Consider a contest in which two parties, labeled 1 and 2, are interested in a prize of value, v. Each player can compete with two instruments. The effort levels of these two instruments chosen by player n are denoted as L_n and y_n (n = 1, 2).

The probability that player n wins the prize is denoted by p_n. The probabilities depend on the relative magnitudes of the efforts of the actual contestants. We use the specification proposed by Epstein and Hefeker (2003) and also used by Schoonbeek (2007). The objective probability that player 1 wins the prize is defined by

$$p_1 = L_1(y_1 + 1)/\{L_1(y_1 + 1) + L_2(y_2 + 1)\} \qquad (1)$$

if $L_1 + L_2 > 0$, whereas $p_1 = 1/2$ if $L_1 + L_2 = 0$. Observe that (1) has the following attractive properties: (i) both instruments are complementary to each other, i.e. the second instrument y_n reinforce the effect of the first instrument L_n; (ii) if a player cannot use the second instrument but a rival can, each player's strategic behaviour can be changed; and (iii) if both players do not use their second instrument, then (1) reduces to the standard Tullock contest success function:

$$p_1 = L_1/(L_1 + L_2). \qquad (2)$$

Player 1's expected net payoff is

$$\pi_1 = p_1 v - L_1 - y_1 \qquad (3)$$

and player 2's expected net payoff is

$$\pi_2 = (1 - p_1)kv - L_2 - y_2. \qquad (4)$$

2.1. Contest with One Instrument

In the one instrument game, two players compete with each other by expending their only one instrument to win the prize. Considering the probability-of-winning for player 1 in expression (2) and the expected payoffs for the players in expressions (3) and (4), we obtain a unique Nash equilibrium such as L_1^N and L_2^N. We obtain the following lemma.

Lemma 1. *At the Nash equilibrium in the one instrument contest, the following holds in the equilibrium: the corresponding efforts are* $L_1^N = kv/(k + 1)^2$ *and* $L_2^N = k^2v/(k + 1)^2$; *the corresponding probability-of-winnings are* $p_1^N = 1/(k + 1)$ *and* $p_2^N = k/(k + 1)$; *and the corresponding expected payoffs are* $\pi_1^N = v/(\mathrm{k} + 1)2$ *and* $\pi_2^N = k^3v/(k + 1)^2$.

Lemma 1 says that player 1 who puts the less valuation on the prize than player 2 expends the less effort than player 2, and obtains the less expected payoff than player 2: i.e., $L_1^N < L_2^N$ and $\pi_1^N < \pi_2^N$, respectively. In addition, Lemma 1 shows that player 1 is the underdog and player 2 is the favourite: $p_1^N < 1/2$ (Dixit, 1987).

2.2. Contest with Alternative instruments

We explore our next model in which both players can choose one or two with two instruments. Using expressions (1), (3), and (4), we obtain a unique Nash equilibrium. We denote it by (y_1^*, y_2^*; L_1^*, L_2^*). We then present the following result.

Lemma 2. *At the Nash equilibrium in the one instrument contest, the following holds in the equilibrium:*

(*i*) *Both players use one instrument if and only if* $v \leq (k+1)^2/k^2$. *The corresponding efforts are* $y_1^* = y_2^* = 0$ *and* $L_1^* = kv/(k+1)^2$ *and* $L_2^* = k^2v/(k+1)^2$; *the corresponding probability-of-winnings are* $p_1^* = 1/(k+1)$ *and* $p_2^* = k/(k+1)$; *and the corresponding expected payoffs are* $\pi_1^* = v/(k+1)^2$ *and* $\pi_2^* = k^3v/(k+1)^2$.

(*ii*) *Player* 1 *uses one instrument whereas player* 2 *uses both instruments if and only if* $(k+1)^2/k^2 < v \leq (k^2+1)^2/k^2$. *The corresponding efforts are* $y_1^* = 0$, $y_2^* = L_2^* - 1$, $L_1^* = \{kv^{1/2} - 1\}/k^2$ *and* $L_2^* = \{kv^{1/2} - 1\}/k$; *the corresponding probability-of-winnings are* $p_1^* = 1/kv^{1/2}$ and $p_2^* = \{kv^{1/2} - 1\}/kv^{1/2}$; *and the corresponding expected payoffs are* $\pi_1^* = 1/k^2$ and $\pi_2^* = \{kv - v^{1/2}\} - 2\{kv^{1/2} - 1\}/k + 1$.

(*iii*) *Both players use two instruments if and only if* $v > (k^2+1)^2/k^2$. *The corresponding efforts are* $y_1^* = L_1^* - 1$, $y_2^* = L_2^* - 1$, $L_1^* = k^2v/(k^2+1)^2$ and $L_2^* = k^3v/(k^2+1)^2$; *the corresponding probability-of-winnings are* $p_1^* = 1/(k^2+1)$ *and* $p_2^* = k^2/(k^2+1)$; *and the corresponding expected payoffs are* $\pi_1^* = -(k^2-1)v/(k^2+1)^2 + 1$ *and* $\pi_2^* = k^3(k^2-1)v/(k^2+1)^2 + 1$.

Statement (*i*) of Lemma 2 says that both players use only a main instrument if the value of the prize is low. In addition we obtain that $L_1^* < L_2^*$, $p_1^* < p_2^*$, and $\pi_1^* < \pi_2^*$. Statement (ii) says that player 1 uses only a main instrument and player 2 use two instruments if the value of the prize is not sufficiently low and it is not sufficiently high. In addition we obtain that $L_1^* < L_2^*$, $p_1^* < p_2^*$, and $\pi_1^* < \pi_2^*$. Statement (*iii*) says that both players use two instruments if the value of the prize is high. In addition we obtain that $L_1^* < L_2^*$, $y_1^* < y_2^*$, $p_1^* < p_2^*$, and $\pi_1^* < \pi_2^*$.

The question we consider is who use both instruments first between player 1 and player 2. Using Lemmas 1 and 2 we summarize the answers in Result 1.

Result 1. (*i*) The increase in k: (a) reduces the range where player 1 uses the secondary instrument; and (b) increases the range where player 2 uses the secondary instrument. (*ii*) The increase in v increases the range where both players use the secondary instrument.

The question we consider next is how much player i invests in the main instrument L_i. Using Lemma 2 we summarize the answer in Result 2.

Result 2. The increase in the values of the prizes incurs the more expenditure on the main instrument.

III. Comparison of RD between Two Contests

Let us describe the rent dissipation. In the rent-seeking literature considerable effort has been devoted to the study of rent dissipation (Nitzan, 1994). Rent dissipation is important because it measures the amount of resources contestants use from their expected gains in the contest (Epstein and Hefeker, 2003). Full dissipation implies the resources spent on obtaining a prize equal its value. Rent dissipation can hence serve as a measure for the welfare implication of rent-seeking (Tullock, 1980).

The extent of rent dissipation (RD) in the case of the one instrument game is defined as: $RD^N = L_1^N + L_2^N$. The extent RD in the case of two instruments game is defined as: $RD^* = L_1^* + L_2^* + y_1^* + y_2^*$. The results are summarized in Lemma 3.

Lemma 3. (*i*) *In the equilibrium effort levels in the one instrument game*, $RD^N = kv/(k + 1)$. (*ii*) *In the equilibrium effort levels in the two instruments game*; (a) $RD^{a*} =$

$kv/(k+1)$ for $v \le (k+1)^2/k^2$; (b) $RD^{b*} = (1+2k)(kv^{1/2} - 1\}/k^2 - 1$ for $v \le (k^2 + 1)^2/k^2$; and (c) $RD^{c*} = 2\{k^2(k+1\}v/(k^2+1)^2 - 1\}$ for $v > (k^2+1)^2/k^2$.

From Lemma 3 we obtain that $RD^{a*} < RD^{b*} < RD^{c*}$ since $RD^{a*} \le (k+1\}/k$ for $v \le (k+1)^2/k^2$, $(k+1\}/k < RD^{b*} \le 2k$ for $(k+1)^2/k^2 < v \le (k^2+1)^2/k^2$, and $RD^{c*} > 2k$ for $v > (k^2+1)^2/k^2$. We conclude that

Result 3. If at least one of the players uses both instruments, the rent dissipation increases relative to the case where both players only use one instrument.

Result 3 of this paper is different from Result 3 of Epstein and Hefeker (2003). The difference between this paper and Epstein and Hefeker (2003) is as follows. Epstein and Hefeker (2003) assumed two situations: (1) both players only use the first instrument; (2) they use two instruments, and they show that "With two instruments, both players' investment in instrument L_n will decrease compared to the situation with only one instrument." Unlike the assumption of Epstein and Hefeker (2003), we assumed each player can choose one between one instrument and two instruments, maximizing his expected payoff.

Ⅳ. Concluding Remarks

We have examined how a second instrument to change the outlays of the standard Tullock contest. Solving for Nash equilibrium at the contest with alternative instruments, we have shown three results. Firstly, the increase in the difference between the sizes of stakes may make the player who have the higher stake in the contest uses two instruments and the player who has the lower stake uses one instrument. Secondly, the increase in the stakes of the contest induces both players use two instruments. Thirdly, the increase in the stakes incurs the more expenditure on the main instrument. Comparing the contest with alternative instruments to the Tullock contest, we have shown that if at least one of the players uses both instruments, the rent dissipation increases relative to the case where both players only use one instrument.

Our results suggest that giving each player a second instrument as his disposal can change the outcomes of Tullock contest and makes each player be trapped in a prisoner's dilemma game.

References

Baik, K.H. and J.F. Shogren,(1992), "Strategic behaviour in contests: comment", *American Economic Review*, 82, 359-62.

Baik, K.H. and I.-K. Kim,(1997), "Delegation in Contests", *European Journal of Political Economy*, 13(2), 281-298.

Dixit, A.(1983), "Strategic Behavior in Contests", *American Economic Review*, 77(5), 891-898.

Epstein, G.S., and C. Hefeker(2003), "Lobbying contests with alternative instruments", *Economics of Governance*, 4, 81-89.

Farmer, A. and P. Pecorino(1999), "Legal expenditures as a rent-seeking game", *Public Choice*, 100, 271‐88.

Hirshleifer, J.(1995) Theorizing about conflict, in Handbook of Defense Economics, Vol.1 (Eds) K. Hartley and T. Sandler, Elsevier, New York, pp. 165-189.

Nitzan, S.(1994), "Modeling rent-seeking contests", *European Journal of Political Economy*, 10, 41-60.

Park, S. -H.(2013), "Delegated contest with two compensation contracts: pure-contingent-fees and hybrid-fees", *Journal of Economics and Business*, 26(6), 2621-2632.

__________.(2014), "Contingent-fees in litigation and settlement: contracts under asymmetric information", *Journal of Economics and Business*, 27(5), 1969-1991.

Nitzan, S.(1994), "Modeling rent-seeking contests", *European Journal of Political Economy*, 10, 41-60.

Schoonbeek, L.(2007), "Delegation with multiple instruments in a rent-seeking contest", *Public Choice*, 131, 453-464.

Shaffer, S. and J.F. Shogren(2008), "Infinitely repeated contests: How strategic interaction affects the efficiency of governance", *Regulation & Governance*, 2, 234-252.

Tullock, G.(1980), Efficient rent seeking, in Toward a Theory of the Rent-Seeking Society (Eds) J. Buchanan, R.D. Tollison and G. Tullock Texas A&M University Press, College Station, TX, pp. 97-1112.