A Model Of rivalries with endogenous prize and strength

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ABSTRACT

This paper extends Beviá and Corchón (2013) to a model with both endogenous contestable prize and endogenous relative strength. Such a setting is ideal for the study of intra-organizational rivalries, commonly observed in family, sports, promotion, and duopoly. We find that when the game starts with asymmetric players, the weaker player exerts more effort than the stronger player. As a result, the weaker player partially overcomes the disadvantage of being weak. In this setting, neither domino nor avalanche effect exists.

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1. Introduction

When two or more players are engaged in repeated competitions in the same field, they are said to be in a rivalry.[1] Some examples include school rivalries over supreme athletes and outstanding students, sports rivalries over individual honors and league titles, sibling rivalries over love and money from parents, and interservice rivalries over budget and authority among branches of military. The main focus of this study is the last two of these rivalries, which may be called intra-organizational rivalry. The contestable prizes in both sibling rivalry and interservice rivalry are endogenous—the more resources that are being allocated into the rivalry, the lower the final contestable prize may be.[2] This is due to the fact that resources used in these rivalries are unproductive but yet they are from within the organization.

Beviá and Corchón (2013) provide an excellent starting point for the analysis of rivalries. In their model, the relative strength of a player in a period is a function of the player's share of the prize won in the previous period. To capture the

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[1] The definition of rivalry presented here may be thought as "war of attrition" (Bulow and Klemperer, 1999; Fudenberg and Tirole, 1986) when exit is not possible.

[2] One may consider school rivalries and sports rivalries to also bear similar characteristic. Although players play their best to win in sports rivalries, they often share common goals, such as to raise the general popularity and awareness of the game. As a result, a team that puts too much time in training and practices, for instance, may be allocating fewer hours in community services.

aforementioned features of intra-organization rivalries, however, we make an important alteration to their model: we follow the conflict literature (Chang and Luo, 2013; 2017; Garfinkel and Skaperdas, 2000; 2007; Hirshleifer, 1991) and assume the contestable prize to be determined endogenously and affected by the efforts of the two players. This assumption of endogenous prize departs from standard contest models in which prizes are exogenously given and are unaffected by effort allocations of the players. Exogenous prize models fit most conventional rent seeking scenarios. But in other situations, such as duopoly competitions and promotion tournaments, effort allocations of competitors will affect the size of the contestable prize, although the effect may be either positive or negative. In this paper, we focus on the situation in which the contestable prize is a decreasing function of efforts expended by the two players.

Our model may be used to describe duopoly or oligopoly competitions in markets that are saturated. Examples of saturated markets include those of refrigerator, automobile, cellphones, and wireless services. In these markets, conventional business strategies such as pricing and advertising—"efforts" in our model—do not result in market expansion of the industry. Rather, the effective use of these strategies results in changes in market shares of the firms, and a greater market share helps to build the brand—"strength" in our model. For example, T-Mobile had the smallest market share among the four biggest wireless providers in the United States. After its unsuccessful merger with AT&T in 2011, T-Mobile announced the Un-carrier campaign in March 2013. Since the campaign, T-Mobile has gained market shares, especially from Sprint, which then had the second smallest market share. Recently, T-Mobile overtook Sprint in market share. Currently, and partly as a result of T-Mobile's Un-carrier campaign, all four major wireless providers—Sprint, T-Mobile, AT&T, and Verizon—offer contract buyout incentives to customers who switch from another carrier. Such business strategy harms overall income of the industry but can result in increase in market share of a firm.

We follow Beviá and Corchón (2013) and the literature in analyzing two dynamic effects in this paper: the domino effect and the avalanche effect. The domino effect refers to whether the player winning a smaller share will win even smaller shares over time. The avalanche effect refers to whether the initially weaker player will be weakened over time. We find no evidence of these two effects. In our model, the initially weaker player will exert greater effort than the stronger player and better her share of the prize although she still earns less than half of it. Due to the bettering in share, the initially weaker player gets stronger, relatively speaking, in the following period and is hence able to further increase her share.

Our study contributes to the literature of contest and conflict,[3] and is especially relevant to the following strands of literature. First are literature on sequential election and campaigning (Klumpp and Polborn, 2006; Snyder, 1989). Specifically, Klumpp and Polborn (2006) consider the possibility that one candidate is a more effective campaigner in the second setting of their model. Although not modeled explicitly, outcome of the overall campaign is inevitably affected by the effectiveness of the campaigners as well as their campaign efforts and earlier electoral outcomes.

The second strand of literature includes contest models with carryovers or enduring rents (Aidt and Hillman, 2008; Baik and Lee, 2000). In Baik and Lee (2000), as well as subsequent studies such as Lee (2003) and Schmitt et al. (2004), efforts made in previous stages are carried over in additive forms. The assumption of "carryovers" is similar to ours. However, the carryover in our model is not of additive or linear form. Moreover, we assume relative strength rather than efforts to be carried over. Aidt and Hillman (2008), on the other hand, consider the case in which rent is enduring. They assume that winner may lose the rent in a future period and rent may or may not be contestable again in the future. One may consider our model to be the case where rent is enduring but re-contested in each period.

Third, our model also relates to contest models with multiple activities or instruments (Amegashie and Runkel, 2007; Arbatskaya and Mialon, 2010; 2012; Chen, 2003; Epstein and Hefeker, 2003; Konrad, 2000; Kräkel, 2005). Following the terminology used in this strand of research, our model may be thought of as one with two instruments: strength and efforts. Compared to existing literature, the two "instruments" in our model are not decided during the same period; relative strength is decided in the previous periods.

Lastly, there are literatures on momentum (Harris and Vickers, 1987; Klumpp and Polborn, 2006; Konrad and Kovenock, 2009) and last-standing behavior (Agastya and McAfee, 2006; Gelder, 2014). In our model, the weaker player makes greater effort than its opponent in each period. As the game lasts longer, the two players become more even. Such outcome is similar to the case of continuing last-standing behavior with momentum toward equality.

The rest of the paper is organized as follows. Section 2 presents the setup and main results of our model, in which the interactions among efforts, strength, and share of the prize are fully described, while Section 2.3 examines the two dynamic effects-domino and avalanche. In Section 3, an alternative model specification is considered. The last section concludes.

2. The model

There are two Players, X and Y, and each is endowed with resource R_t at the beginning of period t. In each period, the two players allocate efforts x_t and y_t, respectively, into fighting. We follow the literature (Chang and Luo, 2013; Garfinkel and Skaperdas, 2000; Hirshleifer, 1991) and assume that the size of the contestable prize in period t is endogenously determined by the efforts of the two players and is given by $2R_t - x_t - y_t$.

Let p_t denote the share of the prize won by Player X in period t. Following Beviá and Corchón (2013), we assume

$$p_t = \frac{\alpha_t x_t}{\alpha_t x_t + (1 - \alpha_t) y_t}, \tag{1}$$

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[3] For references on contest models, see Konrad (2009). For reference on conflict models, see Garfinkel and Skaperdas (2007).