1-22-2019

The Attack and Defense Games

Roman Sheremeta
Chapman University, rshereme@gmail.com

The Attack and Defense Games

The Attack and Defense Games

Roman M. Sheremeta [a,b,*]

[a] Weatherhead School of Management, Case Western Reserve University
11119 Bellflower Road, Cleveland, OH 44106, USA

[b] Economic Science Institute, Chapman University
One University Drive, Orange, CA 92866, USA

[*] Contact information
E-mail: rshereme@gmail.com
Phone number: 1-216-368-4271
Homepage: https://sites.google.com/site/romansheremeta/

January 22, 2019

Abstract

The attack and defense game is a game in which an attacker (a group of attackers) has an incentive to revise the status quo and a defender (a group of defenders) wants to protect it. The asymmetry in objectives creates incompatible interests and results in a mixed-strategy Nash equilibrium. However, this equilibrium could be heavily impacted by behavioral considerations.

Word count
Abstract: 59
Main text: 795
References: 407
Entire text: 1325

The definition of conflict

Although conflict is a subject of study in all fields of the social sciences, the definition of conflict is not the same across disciplines. Economists, for example, define conflict as a situation in which competitors choose costly inputs in pursuit of private payoffs framed as wins and losses (Garfinkel and Skaperdas, 2007; Kimbrough et al., 2019). Evolutionary biologists, define conflict in terms of Darwinian fitness (Darwin, 1859), where at least one of the species negatively affects the others' fitness (Rusch and Gavrilets, 2019).

De Dreu and Gross (2019) propose a definition of conflict as a game of attack and defense. Indeed, many conflicts have such structure: there is an attacker who wants to revise the status quo and a defender who wants to protect it. Also, such a definition of conflict conceptually fits most disciplines, by pointing out incompatibility of interests by the parties involved in the conflict.

Attack and defense games

The main assumption behind the attack and defense game of De Dreu and Gross (2019) is that conflicting parties have asymmetric objectives. As a result of this asymmetry, the solution to such a game is a mixed-strategy Nash equilibrium.

The continuous version of the attack and defense game resembles an all-pay auction (contest) with externalities (Chowdhury and Sheremeta, 2011; Baye et al., 2012). Also, such a game is closely connected to the attack and defense games of a weakest-link network of targets (Clark and Konrad, 2007; Kovenock and Roberson, 2018; Kovenock et al., 2019), in which the attacker's objective is to assault at least one target successfully and the defender's objective is to defend all targets. Finally, the attack and defense game is closely related to games of profiling

(Kydd, 2011; Holt et al., 2016), in which attackers choose which demographic "type" to recruit and defenders choose which demographic types to search. All aforementioned conflict games have a structure where there is an attacker and a defender, who have asymmetric objectives, and whose interests are incompatible. Therefore, these games are directly linked to the attack and defense game of De Dreu and Gross (2019).

Behavioral considerations

There are many behavioral considerations that may influence the actual behavior of competitors in the game of attack and defense. First, if attackers are inequity averse (Fehr and Schmidt, 1999) then conflicts could be less intense than predicted by the standard game theory. However, if attackers are spiteful (which is a more realistic assumption) then conflicts are more likely to escalate (Mago et al., 2016). Conflicts could also escalate if competitors, in addition to monetary utility, derive a utility from winning itself (Sheremeta, 2010), or if competitors are regret averse (Filiz-Ozbay and Ozbay, 2007).

Other important behavioral considerations include guilt aversion, loss aversion, overconfidence, impulsivity, and various emotional responses. Without proper game-theoretic analysis (Konrad, 2009) and experimental testing (Dechenaux et al., 2015) it is not clear how these behavioral factors impact individual behavior of competitors in the game of attack and defense.

Intergroup games of attack and defense

Many conflicts involve multiple attackers and defenders, resulting in an intergroup conflict game with asymmetric objectives (Chowdhury et al., 2013; Chowdhury and Topolyan,

2016). Scientists from different fields have been fascinated by such games not only because of their prevalence in real life, but also because intergroup conflicts have a number of interesting features with non-trivial tradeoffs. For example, attackers may have an incentive to cooperate with each other by expending effort in order to carry out a successful attack, but since effort is costly, each attacker also has an incentive to abstain from expending any effort and instead free-ride on the efforts of others. Also, since attackers and defenders have asymmetric objectives, the problem of free-riding can be different for the group of attackers and the group of defenders. De Dreu and Gross (2019) point out that defender groups share a common fate when they lose, and so their individual interests are more aligned than that of attacker groups. Consequently, this asymmetry results in stronger incentives to free-ride among attackers than among defenders. Another interesting asymmetry pointed out by Dreu and Gross (2019) is that in-group identification could be stronger among defenders than attackers. These are interesting hypotheses that are worth further investigation.

Mechanisms of intragroup cooperation

The asymmetry in free-riding incentives between attackers and defenders creates a greater need for attackers to employ various cooperation mechanisms in solving the free-riding problem. Such mechanisms could involve negative reinforcement, such as shaming, sanctioning, punishment, and ostracism, as well as positive reinforcement, such as communication, leadership, and feedback. Although most of these mechanisms have been studied in the context of intergroup conflicts (Sheremeta, 2018), they have not been studied in the context of intergroup attack and defense games. This is an interesting avenue for future research.

References

Baye, M.R., Kovenock, D., & De Vries, C.G. (2012). Contests with rank-order spillovers. Economic Theory, 51, 315-350.

Chowdhury, S.M., & Sheremeta, R.M. (2011). A generalized Tullock contest. Public Choice, 147, 413-420.

Chowdhury, S.M., & Topolyan, I. (2015). The attack-defense group contests: Best-shot versus weakest-link. Economic Inquiry, 54, 548-557.

Chowdhury, S.M., Lee, D., & Sheremeta, R.M. (2013). Top guns may not fire: Best-shot group contests with group-specific public good prizes. Journal of Economic Behavior & Organization, 92, 94-103.

Clark, D.J., & Konrad, K.A. (2007). Asymmetric conflict: weakest link against best shot. Journal of Conflict Resolution, 51, 457-469.

Darwin, C. (1859). On the origin of species by means of natural selection: Or: The 778 preservation of favoured races in the struggle for life. London: John Murray.

De Dreu, C.K., & Gross, J. (2019). Revisiting the form and function of conflict: Neurobiological, psychological and cultural mechanisms for attack and defense within and between groups. Behavioral and Brain Sciences, forthcoming.

Dechenaux, E., Kovenock, D., & Sheremeta, R.M. (2015). A survey of experimental research on contests, all-pay auctions and tournaments. Experimental Economics, 18, 609-669.

Filiz-Ozbay, E., & Ozbay, E. Y. (2007). Auctions with anticipated regret: Theory and experiment. American Economic Review, 97, 1407-1418.

Garfinkel, M.R., & Skaperdas, S. (2007). Economics of conflict: An overview. Handbook of Defense Economics, 2, 649-709.

Holt, C.A., Kydd, A., Razzolini, L., & Sheremeta, R.M. (2016). The paradox of misaligned profiling: Theory and experimental evidence. Journal of Conflict Resolution, 60, 482-500.

Kimbrough, E. O., Laughren, K., & Sheremeta, R. (2019). War and conflict in economics: Theories, applications, and recent trends. Journal of Economic Behavior & Organization, forthcoming.

Konrad, K.A. (2009). Strategy and dynamics in contests. New York, NY: Oxford University Press.

Kovenock, D., & Roberson, B. (2018). The optimal defense of networks of targets. Economic Inquiry, 56, 2195-2211.

Kovenock, D., Roberson, B., & Sheremeta, R.M. (2019). The attack and defense of weakest-link networks. Public Choice, forthcoming.

Kydd, A. (2011). Terrorism and profiling. Terrorism and Political Violence, 23, 458-73.

Mago, S.D., Samak, A.C., & Sheremeta, R. M. (2016). Facing your opponents: Social identification and information feedback in contests. Journal of Conflict Resolution, 60, 459-481.

Rusch, H., & Gavrilets, S. (2019). The logic of animal intergroup conflict: a review. Journal of Economic Behavior & Organization, forthcoming.

Sheremeta, R.M. (2010). Experimental comparison of multi-stage and one-stage contests. Games and Economic Behavior, 68, 731-747.

Sheremeta, R.M. (2018). Behavior in group contests: A review of experimental research. Journal of Economic Surveys, 32, 683-704.