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Endogenous group formation in experimental contests

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ABSTRACT

We experimentally study endogenous alliance formation and contest effort choices in a generic three-player contest. Differences in intrinsic or extrinsic incentives to expend effort cause self-selection. Weakly motivated players have an incentive to enter into an alliance and to free-ride on strongly motivated players; hence, strong players prefer to stand alone. Self-selection has direct consequences for effort in endogenously formed alliances. But we also find evidence of an effort stimulating effect if players endogenously form an alliance, which is in line with theories of in-group favoritism. The experimental evidence on self-selection is in conformity with a theory analysis of the game.

1. Introduction

This paper analyzes the determinants and consequences of group formation in a conflict framework of competition for a fixed amount of resources. Which characteristics determine whether a player prefers to compete in a group (an 'alliance') or to stand alone in an upcoming contest? How do players react to the choices of other players to join an alliance or to stand alone? How does the process of alliance formation affect contest behavior and what are the implications of alliance formation for the players' effort contributions and payoffs? These questions are difficult to address with empirical data on conflict.[1] Our paper uses an experimental approach. It provides answers to these questions and offers insights that are useful for institutional design when resources are allocated on the basis of relative performance.

For anecdotal evidence on possible answers to the questions outlined we can resort to classic fiction. In his drama *William Tell*, Schiller (1804) describes the formation of an alliance as well as the conscious decision to abstain from joining an alliance, both for good economic reasons. First, the drama features the famous "Rütli-Oath" in which three men unite forces in an alliance to fight against tyranny.[2] Their oath is their mutual promise to act collectively and to jointly pursue a

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[1] Empirically, the formation and resolution of alliances in conflicts has been studied by international relations scholars, using the ATOP (Alliance Treaty Obligations and Provisions Project) and the COW (Correlates of War) data sets. Precise answers on the questions we address are difficult to extract from these data since each international conflict has a number of idiosyncratic aspects. Moreover, international conflict typically does not emerge as a singular event, but is embedded in a specific historical context. Often, a conflict cannot be understood or interpreted without reference to preceding conflict. See Kimball (2006) and references therein for an account of the literature.

[2] The drama refers to the legend according to which three cantons formed a confederation that developed into what is Switzerland today.

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common interest in reference to a common history and family roots. It indirectly refers to the general problem of moral hazard in teams and appeals to the role of group spirit and in-group favoritism to overcome the moral hazard problem. Second, as the benefits of alliance formation can be asymmetric, we may expect players who would contribute a disproportionately large share in the alliance to decide against alliance formation. William Tell himself, the protagonist of the drama, behaves according to this principle. When Stauffacher argues that "even the weak grow strong by union," Tell counters the argument by claiming: "But the strong man is the strongest when alone," and refuses to join the alliance.

Our framework builds on the theory of contests and tournaments where success depends on relative performance. Tournaments have become increasingly important in organizations to incentivize and motivate employees; in many sectors, team formation in the workplace is a frequent phenomenon.[3] If several players form a team, this group formation adds a problem of moral hazard in teams to the tournament: An individual member's effort benefits all members of his group, and this free-riding problem has received considerable attention (Olson and Zeckhauser, 1966; Holmstrom, 1982). If individuals differ in their 'strength', expressed in terms of their fighting ability or their cost of contributing fighting effort, self-selection among players should further aggravate the problem and make voluntarily formed alliances a negative selection composed of 'weak' players: Joining an alliance is attractive for players who are less willing and/or less able to contribute to group effort. Strong and determined players may be concerned about having to bear a high share of the burden of contributing and may prefer to stand alone.[4]

The team-moral-hazard problem in groups might be mitigated by factors such as group spirit or in-group solidarity. As indicated by psychologists, members of a group may be motivated to contribute to the benefit of the group. And such in-group solidarity is even more pronounced in the presence of an out-group. Members of a group may develop a 'feeling to belong' to their group and may exhibit in-group favoritism and spiteful attitudes towards the out-group.[5] These motivations exist even if individuals are exogenously grouped together. Allowing individuals to choose whether or not to form a team may affect in-group solidarity and hence may have an impact on the individuals' contributions to team effort. This effect has attracted attention in other contexts. Although it is not the main focus of our analysis, this effect also appears in our framework and is a countervailing force to the negative strategic effects of alliance formation.

We analyze the role of heterogeneity among players for self-selection into alliances or into stand-alone positions in a controlled laboratory experiment in which we can measure players' types. The players can choose whether or not to enter into an alliance and how much effort to expend in a contest with other players. We consider the generic three-player framework to study alliance formation in the theory of conflict. The three players compete for a prize of a given size according to the rules of a Tullock (1980) contest. Prior to this competition, two players are given the opportunity to join forces and form an alliance, where the outside option is stand-alone play (to fight independently). The competing out-group is always represented by the third player.[6]

To analyze the selection effects as well as the behavioral effects of the endogenous process of alliance formation, we compare contest efforts across environments with exogenous alliances ("NO CHOICE" phase) and environments with endogenous alliances ("CHOICE" phase). The NO CHOICE phase also provides information on players' 'types'. We use the players' effort choices as a stand-alone player in the NO CHOICE phase to measure whether a player is 'strong' (that is, expends high effort as a stand-alone player in NO CHOICE) or 'weak' (that is, expends little effort as stand-alone player in NO CHOICE). This effort choice reveals differences in players' motivation or willingness (subjective cost) to expend effort and we relate this information to the player's choice of whether to form an alliance or to stand alone in the CHOICE phase. Our experiment includes environments where alliance formation occurs under majority voting (ties are broken randomly) as well as alliance formation as a decision that requires unanimity.[7] Moreover, we consider treatments where extrinsic incentives are identical across players and there is only heterogeneity in intrinsic incentives as well as an environment in which there is heterogeneity (and self-selection) along both dimensions. Finally, a control treatment also elicits the individuals' beliefs about their co-players' effort. These beliefs may be influenced by players' own effort choices and by the co-players' alliance formation choice and may hence reveal information about the strategic effects of alliance formation.

[3] The seminal paper on tournaments in labor markets is Lazear and Rosen (1981). Team formation is often observed, for instance, in the context of sales or product development teams. The implementation of self-managed work teams that can lead to productivity increases (see Lazear and Shaw, 2007 for a discussion of the organization of work teams and the prevalence of teamwork). There is also anecdotal evidence of companies that have benefited from allowing their employees to initiate team formation (Wall Street Journal, 13 August 2007, How a Company Made Everyone a Team Player, http://online.wsj.com/article/SB118696661138495617.html).

[4] In order to explain the formation of alliances economists resorted, for instance, to technological benefits of fighting in an alliance (see Skaperdas, 1998; Kovenock, 2012; Konrad, 2014 for a survey), while political scientists explain alliance formation with deterrence effects and balancing behavior (Gulick, 1955; Morgenthau, 1963; Waltz, 1979; Sorokin, 1994) as a means to avoid violent conflict or to end it more quickly.

[5] See, e.g., Sherif et al. (1961), Tajfel and Turner (1979), and Tajfel (1982). There is also evidence from biology, and evolutionary game theory can explain such behavior (see, e.g., Maynard Smith, 1974 and, for more recent contributions, Eaton et al., 2011; Konrad and Morath, 2012).

[6] Alliances in contests have been extensively studied by theorists, see Ursprung (1990), Nitzan (1991), Baik and Lee (2001), Esteban and Sákovics (2003), Konrad and Kovenock (2009), and Kovenock and Roberson (2012), and, for a survey, Konrad (2014). For models of alliance formation see, for instance, Skaperdas (1998), Garfinkel (2004), Bloch et al. (2006), Sanchez Pages (2007a,b), and Tan and Wang (2010); a recent survey of the literature is Bloch (2012).

[7] Apart from its empirical relevance, majority voting leads to a greater heterogeneity in observed voluntary alliances, making the analysis of self-selection and how individuals react to it much richer. Moreover, it guarantees a clean experimental design by eliminating equilibria in weakly dominated strategies.