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Notes

Coalitions, tipping points and the speed of evolution

Jonathan Newton [a,*,1], Simon D. Angus [b]

[a] *School of Economics, University of Sydney, Australia*
[b] *Department of Economics, Monash University, Australia*

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Abstract

This study considers waiting times for populations to achieve efficient social coordination. Belloc and Bowles [1] conjecture that coalitional behavior will hasten such coordination. This turns out to be true when every member of the population interacts with every other member, but does not extend to more complex networks of interaction. Although it is in the interest of every player to coordinate on a single globally efficient norm, coalitional behavior at a local level can greatly slow, as well as hasten, convergence to efficiency.

JEL classification: C71; C72; C73

Keywords: Evolution; Coalition; Social norm; Reform; Conservatism; Networks

1. Introduction

A pervasive criticism of stochastic stability as a tool of equilibrium selection has been the large lengths of time it can take for perturbed adaptive processes to reach stochastically stable states (Young [25], Kandori and Mailath [9], Ellison [4]). There has been extensive study of such waiting times for coordination games when interaction is governed by a network. Results have

* Corresponding author.
E-mail address: jonathan.newton@sydney.edu.au (J. Newton).

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	A	B
A	α, α	$0, 0$
B	$0, 0$	$1, 1$

Fig. 1. A two player coordination game, $\alpha > 1$.

been found to depend on network topology, network size, and whether the small error probability limit is analyzed or error probabilities are kept fixed (Ellison [5], Young [26,27], Montanari and Saberi [13], Kreindler and Young [11]).

This paper examines the effect of coalitional behavior on expected waiting times for processes to reach stochastically stable states. We focus on two action coordination games with one efficient action A, and one inefficient action B, as illustrated in Fig. 1. The relative efficiency of the efficient action to the inefficient action is given by the parameter α. The set of players with whom any given player interacts is governed by an underlying network. A stochastically stable state is the state in which every player plays the efficient action (Peski [21]). The waiting time for the process to reach this state can thus be understood as the delay before a society converges to an efficient social norm. In line with the theoretical predictions of Olson [20] and much of the subsequent literature on collective action, we are particularly interested in the effect of joint strategic switching by coalitions which are small relative to the total population size.[2]

Two possible effects of coalitional behavior are discovered, a *reforming* effect and a *conservative* effect. For any network and high values of α, we observe a reforming effect: convergence to the long run equilibrium is much faster when coalitional behavior is allowed. Less obviously, for some networks and low values of α, there is a conservative effect: convergence to the long run equilibrium is much slower in the presence of coalitional behavior. These effects, taken singly or together, imply that coalitional behavior increases the sensitivity of convergence speeds to the relative efficiency of competing norms. Several network types display tipping point effects. For values of α below some threshold $\underline{\alpha}$, coalitional behavior has a conservative effect. For values of α above some threshold $\bar{\alpha}$, coalitional behavior has a reforming effect. In some instances $\underline{\alpha}$ and $\bar{\alpha}$ take the same value. The principal results of the analysis are as follows:

(i) For any network, a reforming effect is observed for large enough α. Furthermore, for any α, a reforming effect is observed if large enough coalitions can form.
(ii) For some networks and coalition sizes, a conservative effect is observed for small enough α.
(iii) The notion of a *parochial* set of players is defined recursively, building outwards from some core players who are completely isolated from the network outside of the parochial set. It is shown that parochial sets of players are the only sets which are immune to conservative effects for any α and coalition size.
(iv) If all Nash equilibria for a network involve every player choosing the same action, then there cannot be a conservative effect for any α and coalition size. This set of networks includes the ring network and the complete network. This confirms the hypothesis of Belloc and Bowles [1] that coalitional behavior will speed convergence to efficient social norms in population games, which are equivalent to interaction on the complete network.

[2] See also Poteete and Ostrom [22]. There also exist important provisos to such predictions (Chamberlin [2]), particularly in the presence of punishment (Mathew and Boyd [12], Hwang [7]).