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Unilateral and multilateral sanctions: A network approach☆

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ABSTRACT

The extensive literature on efficacy of sanctions has been mainly focused on a dyadic interaction between sender and target. In contrast, this paper examines sanctions when the sender and target are embedded in a network of linkages to other agents and each agent's utility is a function of the size of the agent's component. Efficacy of sanctions is then a function of two factors: the network structure binding the sender and target, and the concavity/convexity of utility in the component size. We consider both unilateral sanctions and multilateral sanctions. We demonstrate how the network architecture, together with the specification of utility, qualifies and sometimes reverses the main tenets of the dyadic approach. We add to the recent work on identifying network architectures that sustain cooperation via the threat of exclusion by showing that the utility specification matters. Thus the same network can be efficacious for sanctions if utility is convex in component size but not if it is concave.

1. Introduction

1.1. Motivation

Sanctions have a long history and refer to the mechanism through which one agent exercises punitive measures against another for failing to implement some desired action. The sanctioning agent is called the *sender* (S), and the sanctioned agent is called the *target* (T). The recalcitrance of T, measured by a "resistance" parameter $\beta > 0$, is due to the fact that the desired action is costly to implement. Examples include providing a social favor when asked, making requisite transfers to those affected by negative shocks, removing trade barriers, investing in public goods, or sharing information in a cooperative agreement. Sanctions can induce compliance from T only if they impose costs in excess of β. The existing literature has largely considered sanctions within a dyadic or two-way interaction between S and T. It is seldom that S and T are isolated and more often than not will find themselves bound in some *network* of links (social, economic, or political). Our main

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contribution is to consider sanctions in an environment which explicitly accounts for the network of links that bind S and T. The underlying rationale is that when S and T are embedded within a network, then the costs inflicted by sanctions on T is critically dependent on the location of S and T within the network architecture. The effectiveness of sanctions to secure the desired action from T is thus best analyzed in a framework that explicitly accounts for the web of linkages connecting S and T as compared to one in which their relationship is purely dyadic and shorn of the finer details of their connection to others. We examine sanctions in the context of a network model where an agent's utility is a function of the size of the agent's component. We show that two factors play a critical role in determining whether T can be forced to comply: the network *architecture* and the *concavity/convexity* of utility in component size. Both factors have important implications when considering either the duration of sanctions (short run versus long run) or its organization (unilateral versus multilateral).

The literature on a dyadic interaction between S and T is voluminous and spans diverse fields (economics, politics, international relations), treatments (theoretical, empirical) and approaches (interest group models, single-rational actor models).[1] Culling this large literature we can identify some recurring themes that can be said to constitute the main tenets of the dyadic approach.

1. *Asymmetry between sender and target*: Sanctions are successful when the cost to T is relatively high and that to S is relatively low (Hufbauer et al., 1990; Morgan and Schwebach, 1997; Drury, 1998; Eaton and Engers, 1999). This in turn requires that S be significantly "tougher", and T correspondingly "weaker", along some payoff-relevant dimension. For example, T can be more impatient (Eaton and Engers, 1992), politically or economically distressed (Drury, 1998) or smaller as measured by GNP or market size (Hufbauer et al., 1990; Drury, 1998).[2]

2. *Short run versus long run*: The duration of sanctions is negatively related to their effectiveness (Kaempfer and Lowenberg, 2007 and the references therein, Drury, 1998). Sanctions that are imposed over a longer horizon generally have their effectiveness blunted by allowing T a longer reaction time to explore substitution possibilities.

3. *Unilateral versus multilateral sanctions*: Multilateral sanctions – when S also draws on other agents to sanction T – are generally less effective than unilateral sanctions (Doxey, 1987; Drury, 1998; Kaempfer and Lowenberg, 1988). This is often due to the coordination and implementation problems associated with organizing a sanctioning coalition composed of agents with dissimilar objectives or asymmetric leverage over T.

Before outlining the qualifications offered by networks on these tenets of the dyadic approach, we need to specify how an agent's position in the network impacts her (reduced form) utility. Networks are complex constructs and can influence an agent's utility through myriad channels. Therefore no one model can fully capture the impact of a network on the effectiveness of sanctions. In this paper we utilize the well known *components* model in which an agent's utility is a function of those she is connected to directly or indirectly. This model is flexible enough to accommodate a large variety of examples of sanctions. We will call a network *effective* if its architecture induces T to comply and switch to the desired action when S threatens to sanction. In addition to the network topology, effectiveness of sanctions is also seen to crucially hinge on the *concavity/convexity* of utility in the component size. Henceforth, for brevity, we will only say *concave* (respectively *convex*) utility, taking it as understood that it is with respect to the component size and holds strictly, i.e. the incremental utility of an agent from a unit increase in her component size is *strictly decreasing* (respectively *strictly increasing*). We now offer a heuristic overview of the connection between the network architecture, concavity or convexity of utility, and effectiveness of sanctions.

1.2. The network approach

Let us begin with unilateral sanctions when S acts alone to sanction T by deleting their link (denoted as ST).[3] With regard to asymmetry between S and T, in networks the dominance of S over T is manifested through *centrality* in location. Therefore S could be disadvantaged along dimensions such as GNP or market size and still exercise significant leverage over T simply by serving as a "bridge" who provides singular connectivity to T to a large component. Consider Fig. 1. With concave utility, an effective network needs to be highly asymmetric placing S in a position of significant advantage over T. Thus S could be the center of a "star" as in g^5 with the ability to relegate T to a singleton via unilateral sanctions. The network g^4 is however more interesting because S has the same number of links as T but can force T to comply through the threat of denying connectivity to a large component. With convex utility, networks such as g^1 and g^0 that post-sanctions place S and T into fragmented

[1] Single-rational actor theoretical models have been examined among others by Barrett (1997), Eaton and Engers (1992,1999. Theoretical models of interest groups have been examined for example by Gershenson (2002) and Kaempfer and Lowenberg (1988, 1999). For reasons of space we have cited only a few papers for illustration. Please see Kaempfer and Lowenberg (2007) for an excellent survey of the theoretical and empirical literature and an exhaustive reading list.

[2] Hufbauer et al. (1990) find the size effect to be insignificant although the empirical literature on sanctions has been criticized for selection bias (Kaempfer and Lowenberg, 2007).

[3] Note that sanctions also impose costs on S. This may call into question S's incentives to carry out sanctions. There are two possible responses to this concern. First, S may be guided by broader concerns to impose sanctions even when they are costly for S; this is explicitly accounted for when considering long run multilateral sanctions by introducing a "tolerance" level for S. Second, in an effective network, the sanctions will never actually be carried out because T will have an incentive to comply. This is reminiscent of the punishments embedded into trigger strategies in repeated games that are never executed along the equilibrium path.