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Social networks and non-market valuations

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ABSTRACT

This paper considers the role of social networks in the non-market valuation of public goods. In the model individuals derive utility both from their own direct enjoyment of the public good and from the enjoyment of those in their network. We find that network structure almost always matters, both for utility and for valuation. The network increases aggregate valuation when it assigns higher importance, that is, stronger connections, to individuals with higher private values for the public good. The model provides a theoretical foundation for the idea of opinion leaders who have disproportionate influence over their communities. Specifically, opinion leaders are individuals assigned high importance by the network, and projects favored by opinion leaders tend to be favored by the network as a whole. The model can also guide future empirical studies by enabling a more structural approach to non-market valuation in a socially connected group.

Introduction

For the most part, the theoretical public good valuation literature considers decision-makers in social isolation. There are two reasons why social structure might impact valuation. One is that individuals may be altruistic and care about public goods that benefit their friends even if they do not benefit themselves.[1] For example, the presence of a park might not generate any private utility for the individual, but if the park gives her friends utility and she values those friends' utility, she might have positive willingness to pay for the park due to social utility.[2] A second reason is that people might use the public good in groups.[3] For example, someone might like going to a park, but not alone, so to get enjoyment from the park her friends must also like the park. She gets utility from going to the park with friends, but might also get utility from going with friends' friends, and so on. Whichever the channel, altruism or joint use, the utility that one gets from the public good may be affected by friends' utility. Furthermore, friends may behave in the same way and the utility of friends of friends may affect friends' utility. This leads to network effects.

The purpose of this paper is to construct a model of public good valuation that can accommodate both these network effects. As argued by Jackson (2009, p. 491), "Many economic interactions are embedded in networks of relationships and the structure of the network plays an important role in governing the outcome." As a result, network models have been

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[1] This is consistent with the finding of directed altruism by Leider et al. (2009). In their field experiment subjects allocate 52% more to close friends than to strangers in dictator games.

[2] As private utility we mean the direct (or own) utility that one receives from consuming a public good in social isolation, i.e. ignoring social effects. Social utility is the overall (or total) utility from the public good, which includes one's private utility and (possibly) the social utility from friends.

[3] For instance, Morey and Kritzberg (2010) provide evidence that the presence of a companion changes the willingness to pay for biking trails.

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developed to explain a wide range of economic phenomena.[4] Our primary result links aggregate willingness-to-pay to network centrality. In particular, societies are willing to pay more in aggregate for a public good when that public good provides more benefit to people more central to the society. A straightforward implication is that public projects that pass the cost-benefit test and ultimately receive funding tend to favor more central agents.

To capture network interactions we use the sociometric approach in which the interaction patterns of agents are captured through the rows of a matrix (see DeGroot, 1974; DeMarzo et al., 2003). The matrix-based approach proves well-suited for the problem of computing individuals′ valuations for a public good when their valuations depend on those of others in their social network.[5] We assume that each individual has her own private value of the public good, and this private value is the one that would pertain if the public good were consumed in social isolation. Each individual′s social value of the public good may depend on how much others in her social network enjoy it, though, and so the individual′s social value of the public good may differ from her private value. We show that all network effects, including feedback effects, can be captured by a single weighting matrix so that each individual′s social value is a weighted average of the population private values. In particular, each individual′s centrality to the network is captured by the relevant column sum of the resulting weighting matrix. We refer to this column sum as an agent′s *importance*.

The thought exercise pursued in the paper involves a comparison between the valuations assigned to a public good when individuals are socially isolated and the valuations assigned when society has a network structure, holding the original vector of private valuations constant across the two settings. The paper concentrates on when, and how, the network structure impacts the social value of the public good. For individual valuation of a public good the requirement for a network effect is very weak: the individual′s social value of the public good differs from her private value if she cares about at least one agent with a different private value than her own. In other words, the structure of the network almost always impacts an individual′s valuation for a public good. The paper also identifies when the aggregate social value of the public good depends on the network, and this occurs if agents in the population are not uniformly important. If more important agents have higher private values of the public good, the population′s aggregate social valuation is higher.

The paper provides an economic foundation to a widely used idea in the other social sciences, that of an opinion leader whose position in a community makes him or her instrumental in affecting social change. This idea has been used, among other places, in such diverse areas as agricultural development (Monge et al., 2008), corporate training programs (Lam and Schaubroeck, 2000), and microfinance diffusion (Banerjee et al., 2011). Opinion leadership is clearly tied to the idea of network centrality (see Katz, 1953; Friedkin, 1991). However, the model in this paper ties opinion leadership directly to an influence on others′ willingness to pay for a public good. The results show that this leadership is easily identified with the agents whose columns have the largest sums in the social weighting matrix. Furthermore, the paper establishes situations in which projects valued more by opinion leaders are also valued more by the entire network.

The results have important implications for policy analysis. When the network matters, sampling values from the population provides the right information for performing a cost-benefit analysis for that population, but that same sample cannot be used as the basis for cost-benefit analysis for a similar public project benefiting a different population. In other words, even when two populations are very similar, e.g. they have similar distributions of relevant socio-economic characteristics, benefit transfer cannot be done without placing restrictions about the shape of the social networks. Because of the network, one population might find it worthwhile to provide the public good while the other does not.[6]

The paper adds to the economics literature linking social preferences and public good provision. A group of papers concentrates on whether social values should be considered in cost-benefit analyses of public projects.[7] Flores (2002) and Bergstrom (2006) demonstrate that there are cases where welfare-improving public good projects would be rejected if cost-benefit analysis was based only on private values as opposed to social values. Therefore, with social preferences, a public project may be Pareto-enhancing even if the cost of the project exceeds the sum of all agents′ private values.

Our contribution to this literature involves the use of a social network structure to explore the differences between the private and social welfare generated by public good provision. In doing so, our framework is similar to that of Bergstrom (1999) and Bramoullé (2001) in which a weighting matrix distinguishes private values from social values. The paper differs from the prior literature in the manner in which others′ utility impact own utility. Bergstrom (1999) looks at a system of benevolent utility functions in which social connections automatically add to an individual′s utility. Bramoulle′s (2001) treatment also involves adding friends′ social utility to an individual′s utility, however, he allows for individuals to be envious toward other agents and, in this case, other agents′ social utilities are subtracted from own utility. Our paper uses a different utility structure so that social connections neither automatically add nor automatically subtract welfare, thereby disentangling the effects of social preferences and network structure.

[4] Network models have been used to explain labor market outcomes (see Calvó-Armengol and Jackson, 2004, 2007), risk sharing (see Fafchamps and Lund, 2003; Bramoullé and Kranton, 2007b), and opinion formation (see DeGroot, 1974; Friedkin and Johnsen, 1990; DeMarzo et al., 2003; Neilson and Winter, 2008).

[5] As discussed by Wasserman and Faust (1994, Chapter 3), the graph-theoretic approach, common in the work of Jackson and others (e.g. Jackson and Watts, 2002; Jackson, 2005; Jackson and Rogers, 2007), proves to be beneficial for modeling networks with multiple relations. The sociometric notation is, however, a simple way to model directed networks in which links between agents have different strength.

[6] This result is in line with experimental evidence that social preferences are stronger towards socially connected agents. For instance, Leider et al. (2009) distinguish baseline altruism towards strangers from directed altruism that favors friends.

[7] See Bergstrom (2006) for a review of theoretical work.