



Unrequited friendship? How reciprocity mediates adolescent peer effects[☆]



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ABSTRACT

Researchers using directed network data to estimate peer effects must somehow handle unreciprocated nominations. To better understand how peer effects operate and how best to estimate their effects, this paper investigates how the reciprocation of friendship mediates peer effects. We begin by characterizing how reciprocated and unreciprocated friendships compare in terms of the amount of interaction and social distance. We then use a higher order spatial autoregressive (SAR) model to investigate the differential effects of reciprocated friends, unreciprocated friends, and unchosen friends (i.e. an incoming friendship nomination that is not reciprocated) on adolescents' behaviors and outcomes using data from the Add Health study. We find that adolescents experience heterogeneous influences from friends, with the greatest effect from reciprocated friends, intermediate effects from unreciprocated friends, and the smallest, but positive effects from unchosen friends. Our results indicate that it is misleading to assign equal weight to all friends or to impose symmetry on unreciprocated friendship nominations, as is often done.

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1. Introduction

Friendships are believed to be important for the social, cognitive and emotional development of adolescents. As noted by many studies, including Becker (1996), Duncan et al. (2001), Haynie (2001, 2002) and Maxwell (2000), during the transition from childhood to adolescence, youth are more susceptible to influences from friends, who provide information, shape social norms and expectations, and provide social support. However, many studies which investigate the influences

of friends, including Bramoullé et al. (2009); Calvó-Armengol et al. (2009); Fortin and Yazbeck (2011); Lin (2010); and Patacchini and Zenou (2012), have treated all friends equally, abstracting from how friendship quality may mediate the strength of influences.

As a matter of fact, friendships differ from one another qualitatively in many aspects. For example, the time spent together and the activities undertaken differ significantly for different friend pairs. The degree of qualitative heterogeneity may have important implications for the strength of peer interaction effects. In his 1995 presidential address to the Society for Research in Child Development, Willard Hartup points out that reciprocated relationships differ substantially from unreciprocated ones in their closeness, which may have important developmental implications. He calls for research into friendship quality in order to better understand friendships and their developmental significance. Despite Hartup's call, the research has progressed slowly in this regard, mainly due to data limitations.

This article is a first step toward addressing Hartup's call, addressing questions like, is reciprocity necessary for influence? To what extent are people influenced by people who they may "look up to" (e.g., people who they nominate, but who don't reciprocate that nomination)? To what extent are people influenced by people they interact with but who they do not regard as friends? We distinguish three types of friendships. *Reciprocated* friends are friends who reciprocate the respondent's

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nomination. *Unreciprocated* friends are those who do not reciprocate the respondent's nomination. *Unchosen* friends are those who nominate the respondent as a friend, but are not nominated by the respondent as a friend.² We begin by characterizing reciprocated friendships relative to unreciprocated friendships in terms of degree of interaction and social distance, using rich network data. We show that reciprocated friends interact more than unreciprocated friends. We show that reciprocated friends are more similar to each other than unreciprocated friends and that reciprocated friendships are more durable than unreciprocated friendships. Lastly, older and higher status students, as measured by biological age, grade, time at school, mother's education, and living with their father, and white students have more reciprocated and fewer unreciprocated friendships.

Recent studies provide evidence that identity of friends and friendship qualities are important dimensions in adolescents' development. Haynie (2001) studies the influences of peers on adolescents' delinquent behaviors and finds that adolescents are not influenced equally by their friends. In a recent paper, Card and Giuliano (2013) show that the level of reciprocity in their relationship may lead to significant asymmetries in the social interactions between friends. In this study, we focus on the impact of reciprocal status of the friendship on a variety of developmental outcomes of adolescents. We employ a higher order spatial autoregressive (SAR) model to investigate the varying effects of different friendship configurations on adolescents' cognitive outcomes, behavioral problems, and substance use using data from National Longitudinal Study of Adolescent Health (Add Health). In particular, we specify three spatial weighting matrices to capture the influences from three different types of friends respectively, i.e., reciprocated friends, unreciprocated friends and unchosen friends.

Our findings shed light on the nature of friendships and the specification of the spatial weighting (or interaction) matrix. Our findings of heterogeneous effects from different types of friends imply that it is misleading to assign equal weight to all friends in the spatial weighting matrix, a practice that has been followed by many studies, including Fortin and Yazbeck (2011) and Lin (2010). Furthermore, it is also inappropriate to make the spatial weighting matrix symmetric by assuming that all friendships are reciprocated, as is often done in the literature. More importantly, our study of reciprocation provides a window into influence and the nature of friendship.

2. Literature review

Some studies have started to explore the possible heterogeneous nature of peer effects from different type of friendship links. In their study of peer effects in student school performance, Calvo-Armengol et al. (2009) consider both directed (friendship based on real nominations) and undirected (friendships are assumed to be reciprocal) networks and find that empirical results based on both specifications are not substantially different from each other. Patacchini et al. (2011) exploit the dynamic feature of the Add Health data to investigate the effects of peers on teenager's future education attainment. They consider directed friendship networks and capture heterogeneous peer effects by assigning weights on friends based on their corresponding nomination orders and the total number of nominations made by the individual. They find that the magnitudes of peer effects are higher when the heterogeneous nature of peers is taken into account. In closely related research, Patacchini et al. (2012) study the effect of high school friends on long-run educational outcomes, i.e. years of schooling. They distinguish between effects from strong ties (friends in both wave I and II of Add Health survey) and weak ties (friends in one wave only) and find that strong ties matter more than weak ties. In particular, they find that

the educational choice of weak ties has no significant effect on own education outcomes in the long run, while the education decisions of strong ties have a positively significant effect, which is stronger when the network is weighted by the nomination order. They also find that peer effects for short-run educational outcome such as GPA are homogenous, with both weak and strong ties generating a comparable and significant influence on GPA.

A few recent studies directly analyze the effect of reciprocation on the strength of social interactions. Using a Manski-type linear-in-means model (Manski, 1993), Goldsmith-Pinkham and Imbens (2013) assess heterogeneity of peer effects by considering one-way friendships as well as mutual friendships.³ Specifically, they introduce two network measures in their model, with the first representing the one-way or mutual friendship networks, and the second capturing the mutual friendship networks only. They find no significant effects from the second network measure and conclude that treating reciprocated and unreciprocated friendships homogeneously is adequate.⁴

Another study that is closely related to the current paper is Card and Giuliano (2013). They explore peer effects in sexual initiation and other risky behaviors by best-friend pairs in the Add Health. They develop bivariate ordered choice models for the behavior of friends and find significant social interaction effects in the initiation of sex and other risky behaviors. As an extension, they go on to investigate the effects of friendship heterogeneity, such as the degree of reciprocity, on the strength of peer interaction effects. They fit a model of actual activity separately for reciprocated and non-reciprocated friends and find that the peer interaction effects are strongest between reciprocated best friend pairs. And the interaction effects between friends in non-reciprocated relationships are highly asymmetric. In particular, the peer interaction effect experienced by the nominator is relatively strong, while the social effect experienced by the non-reciprocator is weak. However, their analysis focuses on best friend pairs, with each individual allowed to have only one best friend. This specification makes it impossible to compare the influences of an individual's different friends. In fact, Add Health contains information for up to five male and female friends for each respondent, thus it is important to see how an individual is affected differently by different types of friends. Furthermore, Card and Giuliano (2013) rely on a small sample of panel data constructed from Wave I and Wave II home Add Health survey, and due to the small sample sizes, their standard errors are large, preventing them from making strong inferences.

A few studies examine issues related to friendship reciprocity. Vaquera and Kao (2008) investigate how the characteristics of respondents and their friends affect the likelihood of reciprocity between adolescents using the Add Health data. They show that Asian Americans and females have higher rates of best friendship reciprocity and intraracial friendships are more likely to be reciprocated than interracial ones. They also show that friendship reciprocity influences adolescent's well-being at school. Specifically, adolescents with reciprocated friendships enjoy stronger ties to school, as well as higher levels of academic performance.⁵ Several studies, including Berndt (1982), Christakis and Fowler (2007), Coleman (1988), Epstein and Karweit (1983), Fujimoto and Valente (2012), Hartup (1996), and Haynie (2001), also provide general discussions on reciprocity. Thus, many researchers believe that

³ Their one-way friendships correspond to our unreciprocated and unchosen friends, and their mutual friendships are the same as our reciprocal friends.

⁴ As will be seen from our empirical results, their findings are not consistent with ours. One major difference between their study and the current paper is the sample size: they focus on only one single high school with a sample size of only 534, while our sample size is 40,039 (21,466 for the academic outcomes). In addition, their model specification is rather simple: only one covariate, i.e. initial grade-point average is included in the model. Therefore, as pointed by Jackson's (2013) comment following this paper, "the takeaway from this article by Goldsmith-Pinkham and Imbens should be the overarching methodological points, but not the particular specifications nor the particular findings when these are applied to the data."

⁵ Note that Vaquera and Kao (2008) only consider one friend of each individual, i.e. first-listed same-sex friend.

² Note that in the first type of relationship, the respondents are both nominators and nominees, in the second type of relationship, the respondents are nominators but not nominees, while in the third type of relationship, the respondents are nominees but not nominators.

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