Social Networks in the Lab and in the Field

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Summary: Social Networks in the Lab and in the Field

My research agenda focuses on the economics of social networks and is centered around three related questions: conceptual, positive and normative. First, how does social distance affect players' other-regarding preferences? Second, how does social distance affect outcomes through social learning? Third, how do social networks affect the allocation of resources?

In all of my projects, I first compile an extensive social network database of a particular community (Wesleyan and Harvard undergraduates, residents of shanty-towns of Lima, Peru). In the first project, I propose to use a sequence of modified dictator games to analyze how other-regarding preferences depend on social distance between players and apply a calibrated model to predict play in team games. In the second project, I plan to conduct three health-related field experiments. At Harvard I expand a social network database to include incoming freshmen who are known to gain about 15 pounds of body weight in their first year. By providing randomized financial incentives to join athletic clubs I create a random variation in caloric intake to estimate the effects on roommates and friends. In a parallel study on flu vaccinations at Harvard I look at the role of social learning on the decision to get a flu shot. At Wesleyan, I am working with the university-run grocery store to provide randomized price discounts for healthy snacks. Through information treatments and advertising I can identify whether friends affect healthy eating.

My third project on cronyism uses a combination of lab and field experiments to analyze how efficiently social networks allocate resources. In an ongoing micro-finance project clients have to find 'sponsors' with a pre-determined credit line to co-sign their loans. I am analyzing how a decrease in the interest rate affects the allocation of scarce credit lines.

Finally, I am using original census form to build a micro-database documenting Harlem's (NYC) transition from a white upper-class neighborhood into an African-American ghetto to estimate the effects of social interactions.

Intellectual Merit

Recent research on altruism has demonstrated pronounced heterogeneity in player types and social networks are a natural and measurable source of an important part of this heterogeneity. The effects of networks on resource allocation emphasizes a negative aspect of social network unlike most of the literature which stresses reductions in transaction costs.

Obesity is a growing health problem in the US and there is ample anecdotal evidence that young people want to make a favorable impression on their peers. Social networks can therefore amplify investments in health education.

Broader Impact

I have been conducting web-based lab experiments for the past two years and the specialized server software is now being used by other researchers and will be freely made available on the web. Moreover, my coauthors and I have trained five research assistants in Argentina and Peru during the past 5 years to conduct lab and field experiments. I am also closely working with Harvard and Wesleyan health services who are looking to improve their health education.

Project Proposal: Social Networks in the Lab and in the Field

1 Introduction

I am an experimental economist with a special interest in the economic effects of social networks. My current research agenda is evolving around three related questions: conceptual, positive and normative. First, how does social distance affect players' other-regarding preferences? Second, how does social distance affect outcomes through social learning? Third, how do social networks affect the allocation of resources?

My interest in the relationship between social distance and preferences was inspired by Andreoni and Miller (2002) who showed that altruistic preferences can be modeled through standard utility functions and that there is considerable heterogeneity which was recently confirmed by Fisman, Kariv, and Markovits (2005). Some of this heterogeneity can be explained by observable individual characteristics such as gender (Andreoni and Vesterlund 2001). In a 2004 pilot study Markus Mobius, Quoc-Anh Do and I found evidence that subjects are far more altruistic towards their close friends than towards strangers and that within subject variation in players' types is of similar magnitude as the cross-sectional variation in average subject altruism. I want to expand on this work by calibrating a model of altruistic preferences and social distance and to use this model to predict play in simple strategic games. I am particularly interested in team production games and to what extent matching socially closer agents (who are more altruistic towards each other) can alleviate free-riding by aligning players' preferences.

While preferences can be well studied with abstract lab games, an experimental analysis of social learning and word of mouth requires a real-world setting because communication and therefore the amount of social learning is highly endogenous. The specific outcomes I want to study are health outcomes - in particular (a) the effect of one's social network on the ability to control body weight, (b) the willingness to incur time costs to get a flu shot, (c) the effect of one's social network on nutrition. Each of these projects is a web-administered field experiment conducted with all undergraduates at either Wesleyan or Harvard universities. For each project I first measure the social network and then introduce random treatments which are designed to induce beneficial health outcomes with the treated subgroup: (a) In the obesity study financial incentives are provided for some freshmen to attend athletic classes to increase their caloric consumption; (b) in the flu study some students are invited to information sessions during which shots are offered; (c) in the nutrition study some students are educated about the nutritional value of different types of snacks to affect their demand. I can then measure in a follow-up survey how information spreads through the social network and how much the health outcomes of the non-treated population are affected as a result and how these social interaction effects depend on social distance. The only other study I am aware of which uses field experiments to measure social learning is Kremer and Miguel (2003) who in fact find negative effects of social networks on drug uptake (and hence health outcomes). Even non-experimental studies typically do not use micro data on social networks (Conley and Udry (2002) is a notable exception). With obesity and flu shots I expect that social interactions positively affect health outcomes. The ongoing debate on how to best combat the 'obesity epidemic' suggests that reliable experimental estimates of how precisely social learning can amplify investments in public health education are valuable.

My third set of projects centers around the question of how efficiently resources are allocated through networks. A standard argument is that networks facilitate exchange by lowering transaction costs (Coleman 1990, Fukuyama 1995, Putnam 2000). However, even though markets might have higher transaction costs they tend to efficiently allocate resources to the most profitable projects first, while networks might allocate too many resources to 'cronies' who have

only marginally profitable projects. Recent papers such as Khwaja and Mian (2004) have demonstrated that social networks can give rise to such cronyism and inefficient allocation of resources.[1] A priori, it is difficult to define and distinguish inefficient cronyism from efficient discrimination against borrowers whose type is less well known because they are more socially distant. To test for cronyism I implement essentially the same game twice - once as an abstract lab game which is played by Wesleyan students online and once as an extension of an ongoing microfinance program in 60 communities in Peru.[2] In each community we are inviting a subset of households to become 'sponsors' and receive a line of credit (a 'resource'). Clients can get a loan as long as it is cosigned by one of the sponsors in the community. I want to vary the average client/sponsor interest rate level , , , communities: if a decrease in that rate leads to an increase in the share of sponsored loans provided to 'insiders' (socially close agents) versus outsiders (socially distant agents) then I interpret this as evidence of true cronyism.

Finally, Markus Mobius and I are starting to compile a historical micro-database of Harlem (NYC). Our basic idea is that residential social networks are very local. Therefore, even small changes in the ethnic or racial composition of a street or apartment house can have a big impact on some close-by residents with discriminatory preferences who move away which sets in motion a chain reaction. Anecdotal evidence suggests that Harlem's transition from a white upper-class neighborhood to an African-American ghetto followed such a local chain-reaction where an initial influx of African-Americans expanded street-by-street between 1890 and 1930. The black ghettos of most US cities formed during this period. In a pilot study involving 10 city blocks in Chicago we have collected individual household data from the US 1890-1930 census, combined this data with contemporary firemaps to pinpoint the geographic location of each household and then used this combined data to match households by surname across census years. We now want to use these tools to extend our work to the entire district of Harlem which saw a particularly dramatic transformation to become one of the largest emerging ghettos by 1920. The data will provide us and other researchers with a unique opportunity to study this transformation and the role of social networks.

For my lab-based projects on other-regarding preferences and for the three health-related projects at Harvard and Wesleyan I am using an important methodological innovation. Since I need to measure social networks, a high participation rate is required to capture most of the direct and indirect links between agents.[3] Markus Mobius and I have therefore developed web-based software which accomplishes four goals very efficiently.

1. It allows me to elicit social networks using a coordination game where subjects can earn small rewards by naming a friend who also names them. We have already tested this software in two pilot studies with subjects pools of up to 2,500 students. The resulting data is of high quality and with a significant degree of coordination.

2. It ensures a high participation rate because subjects do not have to come to a lab.

3. It allows me to invite subjects to play lab-type games using the strategy method using an email invitation with a login-link. Importantly, we can invite subjects several times in a row for a sequence of brief experiments. This improves the quality of the data by (a) reducing fatigue and (b) removing unwanted framing effects when subjects play a sequence of different games. Subjects play these games without feedback and are paid for only one of the decisions to avoid income and compound lottery effects and strategic manipulation.

[1] Khwaja and Mian (2004) show that politically connected firms in Pakistan both borrow double as much *and* default 50 percent more often than other firms.

[2] The Peru project is joint with Dean Karlan and Markus Mobius

[3] If the participation rate is very low 'shortcuts' between agents get lost and social distance is over-estimated.

4. I can follow up subjects over time even after they graduate from a university. This is relevant for my project on other-regarding preferences. We are working together with thefacebook.com, a popular social networking site on US campuses. About 80 to 90 percent of Wesleyan and Harvard alumni use this site regularly to stay in contact with college friends. This provides us with up-to-date contact information for most former students.

All these projects build on earlier research. My interest in network analysis goes back to my graduate work in which I studied local interaction models of monetary exchange and to a recent paper that investigates changes in the patterns of communication as the result of improving technology (Rosenblat and Mobius 2004). The proposed project on other-regarding preferences extends a 2004 pilot study in two Harvard houses (Mobius, Rosenblat, and Do 2004). My project on obesity and other health outcomes builds on a study of social learning and consumer demand which Markus Mobius, Paul Niehaus and I conducted in April-June 2005 with 1,500 students at Harvard. In that study we distributed samples of new products such as cellphone/PDA's to students. We conducted a baseline survey to proxy subjects' ex ante valuations and a follow-up survey/auction where we quizzed subjects about what they had learned about each product and where they could submit a bid to a multi-unit auction. My work on cronyism is an extension of an NSF-funded study on trust and social networks joint with Dean Karlan and Markus Mobius and all the infrastructure is in place to introduce my methodology. Finally, my Harlem project builds on a small-scale pilot with Chicago data (Mobius and Rosenblat 2003).

I have a strong interest in incorporating my research in my teaching. I have introduced a new undergraduate course on experimental economics at Wesleyan, [illegible], which is very popular. I am planning to offer a second course on field experiments in the future. I am also planning to make all the data from the various projects available for download and easily accessible for teaching and assignment homework. I often find that my teaching informs my research and vice versa. For example, the study of the beauty premium (Mobius and Rosenblat 2005) was inspired by an Econ 311 group project.

The Harvard project was supported by two undergraduates Raphael Schoenle and Paul Niehaus who are now both at graduate school (Princeton and Harvard, respectively) and will continue to work on the project in the future. Paul Niehaus is coauthor on my recent work on consumer demand. Markus Mobius and I are also training a Harvard graduate student, Quoc-Anh Do to help with design and analysis of the experiments from the pilot study on other-regarding preferences.

I also taught a minicourse on social networks and experimental methods at Universidad Nacional de Tucuman during Summer 2003 that allowed students from several universities in Argentina and neighboring South American countries learn about new research in the field. Several of these students are now enrolled in Ph.D. programs in Economics at top US universities. I plan to continue this outreach on an ongoing basis.

I introduce the three main projects of my research agenda in the following sections. In section 7 I explain how I plan to incorporate my research into my teaching and the training of graduate and undergraduate students.

2 Prerequisites: Eliciting Social Network

I use web-based social network elicitation for my US-based projects and survey methods for the Peru project. In three field experiments between 2003 and 2005 Markus Mobius and I pioneered two different experimental methods for eliciting social networks through the web.

2.1 Coordination Game Approach

In our 2004 pilot study we used a simple coordination game to measure social networks: students are invited to visit a webpage where they can select up to 10 friends and receive a small probabilistic prize whenever the two students named each other.

In our 2005 consumer demand study we implemented a slightly different coordination game called the [illegible]. We worked together with thefacebook.com, a social networking website founded in January 2004 and available to about 500,000 students at more than 200 campuses across the U.S. All students on participating campuses are eligible to sign up. Like any old-style facebook it gives access to students' profiles, their interests and hobbies. A unique feature of the electronic facebook is the ability to specify friends and to see the friends of friends. This allows subjects to explore their social network and has proved to be a highly popular (and addictive) activity for many students. At Harvard about 90 percent of students have signed up to the thefacebook.com. Of those, almost 70 percent login daily and 90 percent at least once a week.

The problem with thefacebook.com data is that students discriminate too little when signing up their friends: the mean number of friends is approximately 30-40 and it is not uncommon to have more than 100 'friends'. An auxiliary 'trivia' game helps elicit 'true' friends. In this game students are invited to select 10 friends among their facebook friends about whom they will answer trivia questions. If student A gives a correct answer about student B, they both earn prizes with some probability. While we are not interested in the answers, we expect that the more time two students spend interacting the more likely he or she will name that friend in this game.

Since we already collected social network data for the classes of 2006, 2007 and 2008 during the 2004/2005 academic year using the trivia game we plan to expand our sample by the incoming class of 2009 using the same approach.

2.2 'Joint Prize' Approach

During a pilot nutrition study in the 2005 spring semester I have tested a third elicitation technique at Wesleyan which has a similarly low acquisition cost per subject as the trivia game method.[4]

I invited students to fill-out a baseline survey and then asked them to name up to 10 friends to be entered in a raffle with prizes (e.g., movie tickets) as a group. This proved to be a very simple incentive to encourage students to reveal their social network and I plan to use it again for the nutrition study at Wesleyan.

3 Other Regarding Preferences Project (joint with Stephen Leider)

3.1 Hypothesis

The literature on altruistic preferences generally measures [illegible] differences in altruism towards anonymous players (Andreoni and Miller 2002). In contrast, we are interested in [illegible] or [illegible] altruism - in particular, whether altruism varies systematically with social distance.

Question 1 [illegible]

[4]The costs of signing up one student in both approaches is about $2.50 for the trivia game and the joint prize technique and around $5 for the pure coordination game approach.

We define social distance in two complementary ways: (1) by average path length between two agents and (2) by number of common friends (Watts and Strogatz 1998). In a pilot study Markus Mobius, Quoc-Anh Do and I found strong evidence of directed altruism along both directions.[5] Within-person variations in altruism was comparable in size to between-person variation.

Question 2

We suspect that expectations vary similarly with social distance as do preferences. In order to use a calibrated model of altruism for predicting behavior we need to calibrate both preferences and expectations.

Question 3

For example, an agent who is an altruistic social value maximizer towards her friends but selfish towards strangers might pass all tokens in a modified dictator game if tokens are worth more to her friend than to herself. However, when choosing a partner for a dictator game the agent might prefer the stranger to her close friend because it allows her to 'opt out' of being altruistic. An altruist might really only care about her own utility but incurs a psychic cost (call it 'shame') if she behaves selfishly in a decision problem where she can choose to be generous. By choosing a stranger she might avoid this cost.[6]

Question 4

The particular type of games we want to study are team production games where two players produce joint output. Matching players who are altruists should mitigate the free-riding problem because players should care more strongly about total output. This is most obvious for a perfect social value maximizer who cares about the sum of earnings (which equals team output).

3.2 Model

I outline a stylized model to formally define altruistic preferences and motivate our experimental design.

3.2.1 Social Network

There are n agents who live on a connected social network N. We denote the distance between two agents i and j on the network with d_{ij} which takes the value 1 if i is a direct friend of j, the value 2 if i is the friend of friend of j etc. Similarly we define the number of common friends of two players i and j with c_{ij}.

[5] Two weaknesses of the pilot were (1) that we could estimate with-in type variation only imprecisely because we only had one observation for each pair and (2) we only conducted the study in two out of 12 upper-class Harvard houses even at least half of all friendships extend beyond one's house.

[6] Some fascinating evidence for such a theory can be found in Lazear, Malmandier, and Weber (2005) where subjects are given the opportunity to opt out in a dictator game which reduces sharing from 74 percent to less than 30 percent. Slonim (2004) and Eckel and Wilson (2004) analyze partner choice in the trust game and also find inconsistencies in play when partner choice is endogenous versus exogenous.

3.2.2 Preferences

We start with the following utility function over own consumption x_i and the other player's consumption x_j

$$U_ij(x_i, x_j) = \left(s_{ij} x_i^{\rho_{ij}} + (1 - s_{ij})\, x_j^{\rho_{ij}}\right)^{\frac{1}{\rho_{ij}}} \tag{1}$$

where s_{ij} and $1 - s_{ij}$ are the relative weights on own consumption and the other player's utility from consumption and $\sigma_{ij} = \frac{1}{1-\rho_{ij}}$ is the elasticity of substitution. The parameter s_{ij} captures altruism while the parameter σ_{ij} captures the tradeoff between efficiency and a fair allocation of the surplus. Andreoni and Miller (2002) found that about half the players behave like one of the following types: [illegible] ($s = 0$), [illegible] ($s = 1$, $\sigma = 0$) and [illegible] ($s = 1$, $\sigma = \infty$). In our pilot study we found similar proportions - however, about 20%-30% otherwise selfish players become Leontieff and social maximizers when playing with friends while Leontieff and social maximizer types behave much more consistently (Mobius, Rosenblat, and Do 2004).

3.3 Experimental Design

3.3.1 Diagnostic Games

We match up each agent with a randomly chosen (i) direct friend, (ii) indirect friend, (iii) subjects distance 3 away, (iv) anonymous subject and let them play modified dictator games. Each pair of agents is matched on different days and the dictator is invited by email. This keeps each online session brief. We use modified dictator games as in Andreoni and Miller (2002) and Fisman, Kariv, and Markovits (2005): the dictator is asked repeatedly to divide a certain number of tokens between herself and the recipient and we vary the relative value of a token for the recipient and the dictator. This allows us to map out indifference curves for the dictator's preferences and hence estimate s_{ij} and σ_{ij}. Only one of the decisions for one of the dictator/recipient pairs is implemented at the end of the study and neither recipient nor dictator find out which decision is implemented.[7]

3.3.2 Measuring Beliefs

We measure recipients' beliefs of how many tokens a dictator will pass by matching recipients with potential dictators and by asking for the recipient's best estimate of the dictator's decision. We provide proper incentives to reveal the median belief of the recipient by imposing a 'punishment' for wrong predictions which is proportional to the absolute difference between prediction and actual decision of the dictator.

3.3.3 Choosing Partners

After the diagnostic games, we divide the subject pool into two and invite the first half of subjects to a new round of dictator games. This time they can choose between two partners (presented by their name) and we always give them a choice between one of the close and of the distant friends whom we have already matched them with during the diagnostic phase.

3.3.4 Team Production Games

The second half of subjects is invited to two online sessions. The task in each session is to solve increasingly difficult puzzles where the player has to compare two almost identical square

[7] Otherwise, I would need to worry about repeated game effects for dictators and recipients who know each other.

matrices of alphabetic letters where exactly two characters differ. In the first session a player gets a constant reward for each solved puzzle. In the second session (played on a different day) the player is matched with another player in a 'team' such that each player is paid according to the average score. This is a standard team production setup with the incentive to free-ride. However, altruistic preferences can mitigate free-riding: social value maximizer, for example, can completely overcome it. During the production phase players cannot observe the total score - this avoids competition effects.

3.4 Analysis

3.4.1 Step I - Estimating s_{ij} and σ_{ij}

Altruism and concern for fair allocations can be estimated for each pair using MLE. The estimates are more precise the more decisions for each pair are made by the dictator (Fisman, Kariv, and Markovits 2005). Similarly, altruism and concern for fairness can be estimated using recipient data on expectations.

3.4.2 Step II - Calibrating a Model of Altruism

We regress estimated s_{ij} and σ_{ij} on our two measures of social distance:

$$s_{ij} = \alpha + \beta c_{ij} + \gamma d_{ij} + \eta_{1,i} + \epsilon_{1,ij}$$
$$\sigma_{ij} = \delta + \theta c_{ij} + \phi d_{ij} + \eta_{2,i} + \epsilon_{2,ij}$$

We include fixed effects to control for baseline altruism and concern for fairness. This provides us with a calibrated model of altruism.

3.4.3 Step III - Predicting Behavior

The stopping time in the first production session provides a proxy for the marginal cost of effort of a player. This allows us to predict the stopping time in the second session for a selfish player and compare it to the actual stopping time. We can then test whether other-regarding preferences mitigate free-riding.

4 Health Projects: Nutrition, Obesity, Flu

I plan to expand my Wesleyan pilot study to analyze the effects of social interaction on nutrition. At Harvard I am working with Markus Mobius on two health-related projects on obesity (freshmen only) and flu vaccinations (upperclass students only).

Much has been written about the obesity 'epidemic' in the US (Glaeser, Cutler, and Shapiro 2003). Harvard University Health Services has for a long time noted that freshmen tend to gain weight as soon as they move to Harvard - colloquially this is known as the phenomenon among staff and doctors at HUHS. Moreover, ample anecdotal evidence suggests that college students are self-conscious about their physical appearance - therefore weight control seems to be a promising candidate for analyzing social interactions and how they can amplify the effects of health education. We are not aware of any research on obesity using detailed micro-data on social interactions.

At Wesleyan I exploit the fact that the university is relatively isolated so that most students shop for food at the Wesleyan-run grocery. Furthermore, most students use their Wescard for

purchases which allows us to track purchases through the entire year. Furthermore, we can treat subjects and measure demand curves by giving targeted discounts to individuals (which are automatically applied when they use their Wescard for particular purchases). At Harvard we plan to reuse the social network data already collected for the altruism study.

The benefits of flu shots for preventing flu epidemics in dorm environment are also well known. However, social learning has not been widely studied in the public health literature - instead it has focused on the positive role of reminders and information treatments on an individual's decision to get vaccinated (Smith, Zhou, Weinberger, Smith, and McDonald 1999, Marron, Lanphear, Kouides, Dudman, Manchester, and Christy 1998, McDowell, Newell, and Rosser 1996, Siriwardena, Rashid, Johnson, and Dewey 2002). Field epidemiologists have studied the role of networks in the spread of diseases (Potterat, Phillips-Plummer, Muth, Rothenberg, Woodhouse, Maldonado-Long, Zimmerman, and Muth 2002, Morris 1997, Liljeros, Edling, Amaral, Stanley, and AAberg 2001, Jones and Handcock 2003, Sattenspiel and Simon 1988).

Harvard University Health Services (UHS) offers free shots to its students starting in November of each year. About 30 percent of students get vaccinated but the numbers have increased significantly over the years suggesting long-term social learning. we have conducted a pilot study during the 2003/2004 flu season which we could not complete, however, because of a US-wide scarcity of flu vaccines.

4.1 Hypothesis

First of all, we are simply interested in how large social interaction effects are.

Question 5

This allows us to analyze how strongly social networks amplify any effects of health education.

Second, we want to understand the channels through which social learning operates.

Question 6

Imitation might arise either by a desire to be just like everybody else, by cues derived from seeing other students go to flu clinics (or control their caloric intake) which can serve as reminders or by a form of weak social learning where subjects imitate the behavior of others whom they deem knowledgable about health issues. We attempt to distinguish between simple imitation and social learning by treating a random sample of students with factual information only and another sample with factual information plus a targeted discount for a healthy snack/ an incentive receive a flu shot/ sign up to an athletics club.

The difference between imitation and social learning matters for several reasons. First of all, we expect that social learning has a larger amplification effect than imitation because information does not degrade by retelling it. Moreover, the nature of the interaction channel matters for designing effective health education programs: for example, should money be spent on providing models or should be spent on literature, nurse visits and other information dissemination technologies.

Another confounding effect for the flu project is : students who live in a dormitory with a high vaccination rate will face a lower probability of getting infected and therefore might be less willing to get a flu shot. The herd immunity effect is a negative spillover effect unlike most other social interaction effects. We deal with this problem by providing a fourth random

sample of students with information about the vaccination rate amongst their circle of friends in the previous year.

4.2 Experimental Design

4.2.1 Baseline Survey

At Wesleyan I use the joint prize approach to (a) measure social networks of all undergraduates and (b) administer an online health survey. At Harvard we also combine the network elicitation for the altruism project with a freshmen survey on eating habits (regular meals, cook own food etc) and a question on body weight. We also work together with UHS to invite a subsample of surveyed students to come in for a brief health checkup which involves weighing them. This allows us to check how accurate self-reported weight is.

At Harvard we also add to the online survey for all undergraduates detailed flu-relevant questions on physical exercise, subjective assessment of susceptibility to illness, history of past illnesses including flu-like diseases, beliefs about vaccination rates of roommates and floormates in the previous year, beliefs about the efficacy of the flu shot and the cost of time to get a flu shot, and knowledge of location of flu clinics, general questions about the cost of time and how much students would pay to avoid the flu, and their intentions to get vaccinated in the current season. We tested these survey instruments for our 2003 pilot study. We also obtain prior history of vaccinations for students from University Health Services database.[8]

4.2.2 Treatments - Nutrition and Obesity Projects

I select random subsamples of Wesleyan undergraduates for the following treatments starting a month after the baseline survey. The same will happen at Harvard among Freshmen only.

A. Group A subjects are treated with information about the health benefits of healthy snacks (Wesleyan) and the "Freshmen 15" phenomenon (Harvard) - we plan to use a combination of printed materials, online information (only available to treatment group) and sessions at the central UHS building administered by a trained nurse.

B. Group B subjects receive the same information treatment as group A but in addition they are given targeted discounts which are directly applied when they buy certain snacks with their Wescards (Wesleyan) and financial incentives to attend athletics programs and other sports (Harvard). We expect that the effect of such incentives on Freshmen is particularly strong because they do not yet have a fixed schedule when coming to Harvard.

4.2.3 Treatments - Flu Project

Treatments start at the same as the HUHS flu clinics in November 2005. For each flu clinic we invite random sample of our subjects to the following treatments. Subjects are offered a compensation to attend a treatment session.

A. Group A subjects are invited to an info session that is held in a room next to the flu clinic and at the same time. A nurse informs subjects about the benefits and side effects of flu vaccination. They also receive information sheets with understanding quizzes. There are three types of info sheets: type (A1) emphasizes facts about self-protection; type (A2)

[8] According to UHS and the IRB we will be able to perform this match without explicit consent of subjects as long as the data is properly deidentified.

emphasizes that vaccination protects others and type (A3) emphasizes emotional facts such as the personal story of an influenza survivor who almost died from the disease. Each info sheet is also "seeded" with distinct facts about the flu such as background info about the Spanish flu epidemic of 1918/19. All subjects are quizzed about these facts in the follow-up survey allowing us to estimate information transmission through the social network.

B. Group B subjects are invited to precisely the same sub-treatments as group A subjects but the info sessions take place in a different building and at different times than the flu clinics. Comparing group A and group B subjects allows us to distinguish between learning from actions and learning from information while the sub-treatments allow us to identify the type of information that has the largest individual effect as well as social interaction effect.

C. Group C subjects receive random reminders of flu clinics but no factual information. This is designed to test whether cues are important. The public health literature has studied reminders extensively and found small but significant effects (Smith, Zhou, Weinberger, Smith, and McDonald 1999).

D. To test for confounding herd immunity effects we choose a random sample D of subjects who receive information about the share of students in their floor or staircase who were vaccinated the previous year.

4.2.4 Followup Survey

For our obesity study, we conduct a follow-up survey at the end of the academic year in May 2006. We also ask about their physical activities and to what extent they control their caloric intake. At Wesleyan we have full access to the purchase history of all Wesleyan students (both snacks and non-snack items) for the entire academic year as long as they pay with Wescard (which most of them do). At Harvard freshmen are again asked about their weight, and the previously weighed subsample is asked to have their weight checked a second time.

For the flu study a follow-up survey with upper-class students is conducted in March 2006. We ask subjects about their beliefs in the efficacy of the flu vaccine as well as the cost of time to get a flu shot. This allows us to pick up changes in subjects' beliefs. In particular, we want to analyze how beliefs were affected by in formation we provided to subjects, and the actions of their friends respectively. We also ask the "seed" questions to see how information spread through the social network.[9]

Vaccination records for the 2004/2005 flu season are obtained from University Health Services and matched with our deidentified data. These records indicate on which date (if any) a subject got vaccinated.

4.3 Analysis

From the network elicitation game we can identify the set of neighbors N_i of some subject i.

4.3.1 Nutrition and Obesity Projects - Analysis

For obesity the basic estimation simply regresses each subject's ex-post weight W_i on baseline weight $\tilde{W}_i$, the ex-post weight of friends and whether friends were exposed to health education

[9] We are also negotiating with HUHS to ask all attendees of their flu clinics to fill out a small questionnaire which measures beliefs. This form can be filled out while waiting for a shot. We expect that this data is more reliable than belief data captured two months later.

about the dangers of rapid gain which we capture with the indicator variable I_j:

$$W_i = \alpha + \beta X_i + \gamma \tilde{W}_i + \underbrace{\delta \sum_{j \in N_i} \frac{I_j}{|N_i|}}_{\text{social learning channel}} + \underbrace{\theta \sum_{j \in N_i} \frac{W_j}{|N_i|}}_{\text{imitation channel}} + \epsilon_i \quad (2)$$

We also include other baseline characteristics of the subject in the vector X_i. Due to the reflection bias and selection friends' weight is exogenous (Manski 1993) - however, we can instrument for it through treatment A.

For the nutrition project we run the same type of regression except that 'weight' is replaced by the consumption of healthy snacks before and after the treatments.

4.3.2 Flu Project - Analysis

For flu we run a similar regression as for obesity. The indicator variable V_i is set if a subject had a flu shot during the flu season. The indicator variable V_j^i is set if neighbor j had a flu shot [illegible] subject i. Last year vaccination decision is denoted with $\tilde{V}_i$. The indicator variable I_j^i denotes whether neighbor j was exposed to an information treatment (either A or B) before i had a flu shot. R_i is 1 if the subject received a reminder and S_i is the share of friends of subject i who got vaccinated last year. The indicator variable D_i denotes whether the subject was informed about the share of friends S_i who were vaccinated. We then run the following regression:

$$V_i = \alpha + \beta X_i + \gamma \tilde{V}_i + \delta \underbrace{\sum_{j \in N_i} \frac{I_j^i}{|N_i|}}_{\text{social learning channel}} + \theta \underbrace{\sum_{j \in N_i} \frac{V_j^i}{|N_i|}}_{\text{imitation channel}} + \phi R_i + \psi S_i + \zeta D_i * S_i + \epsilon_i \quad (3)$$

We use the share of friends who participated in treatments A and B respectively as instruments for estimating δ and θ.

The coefficient γ captures the contribution of information to an agent's decision to get vaccinated. We can further refine the estimation by estimating a different γ coefficient for each of the three types of information we provide (self-protection, altruism and emotion). Cues and herd immunity effects are captured by coefficients ϕ and ζ.

To better distinguish weak forms of social learning (which are part of the imitation channel) and strong social learning learning we also want to run the same regression with beliefs of flu vaccine efficacy as dependent variable.

4.4 Preliminary Pilot Results

During the pilot in 2003/2004 Markus Mobius and I tested the baseline flu survey instruments in two houses. Although we ran no treatments yet the baseline results are helpful in establishing that social learning plays an important role in one's decision to get vaccinated:

- 62 percent of our sample of 569 students went alone, 25 percent with another person and 13 percent with three or more people. Only about 25 percent of these accompanying persons were room mates but almost all were friends.

- About half of all subjects report that they were directly influenced by friends.
- Two-thirds of our subjects knew whether their roommates had a flu-shot last year.
- We also asked subjects to estimate their susceptibility to the flu and how much they would pay to avoid it. We compare this perceived benefit to the cost of waiting (subjective estimate of waiting time times cost of time). We did this exercise for four subgroups: [illegible] (who never got a shot), [illegible] (who had a shot last year and planned not to get one this year), [illegible] (who got a shot this year only) and [illegible] (who always get shots). We found that given their stated belief the decisions of subjects in all four groups was rational: the net benefit for sceptics and dropouts was essentially 0 while converts and devotees perceived a $20 net benefit. This observation gave us some confidence that subjects do learn and act rationally upon their beliefs.
- The difference between converts/devotees on the one hand and dropouts/sceptics on the other hand is caused by (a) an higher belief in the efficacy of the vaccine by converts/devotees, and (b)a perceived waiting time of 20 minutes for dropouts/sceptics versus only 9 minutes for converts/devotees. We expect that social learning would affect agents' beliefs in both dimensions.
- Sceptics also view themselves as more healthy than others. This emphasizes the need for controlling sample heterogeneity by running a good baseline survey.

5 Cronyism Project

The cronyism project implements the same game in the lab and in the field to ask how efficiently networks allocate resources.

5.1 Lab Experiment

I start with the social network of Wesleyan students (from my nutrition study). A random subsample of students is given the title "sponsors" and a color code - so a subject might become a "red sponsor", for example. Each sponsor gets a "credit line" which consists of a fixed number of tokens. All non-sponsors are potential "clients" and get a color code as well. All clients also get a list of sponsors in their house and in the university emailed and their color codes.

Clients can invest a certain number of tokens in "projects" with some known and randomized return. They can obtain those tokens from the experimenter but need to approach a sponsor to cosign the loan online through a "contract". If they find a sponsor with the same color code they can get a "low-interest rate loan" (interest is paid to the experimenter). Otherwise the loan is high-interest. If the sponsor agrees to a contract a price for accessing some of the sponsor's credit line (scarce resource) is negotiated between the client and the sponsor and entered online by both of them.[10]

Color codes are assigned such that being of the same color is negatively correlated with social distance. We call agents who are close to some sponsor "insiders" and other agents outsiders. A "community" is a dorm-class year cell (there are 36 of them for upperclass students).

[10]It is possible that some transfers from client to sponsor occur through a supergame outside the lab. This is compatible with out basic methodology.

5.2 Field Experiment: Peru (joint with Maggie McConnell)

The field implementation of cronyism builds on my work on measuring trust in Peru (joint with Dean Karlan and Markus Mobius) for which we received NSF funding. We are introducing a new microfinance program in 60 communities in northern Lima. In each community we invite about 10 percent of household to become sponsors in which case they receive a line of credit. About 1/3 of this credit can be used by the household itself - the rest can be used to secure loans for non-sponsors. Crucially, we vary interest rates across all potential borrower/sponsor pairs - for example, Mr. A might have to pay a 2 percent monthly rate if he is sponsored by Mrs. B but a 3 percent rate if sponsored by Mr. C. This methodology allows us to implement the following thought experiment: how much does the interest rate have to fall for a socially more distant sponsor to ask this person rather than a close sponsor friend? Effectively, it allows us to measure the transaction cost T_{ij} of client i accessing the resource of sponsor j (e.g. her credit line).

5.3 Hypothesis

The main question I am interested in is:

Question 7

While anecdotal evidence suggests that social networks can give rise to cronyism it is not obvious how to even define cronyism let alone differentiate it from efficient discrimination against socially distant and less well connected agents whose type is uncertain and whose moral hazard cannot be easily controlled through the network.

5.4 Model

I use a simple model to explain how I want to test for cronyism. There are many communities and each community generates investment opportunities $U_1 > U_2 > U_3...$ according to some known distribution. For simplicity I start with the assumption that all client/sponsor pairs carry the same community interest rate r_C. The social planner would allocate the credit lines of sponsors as follows:

- She would start to fund the most profitable investment opportunity U_1 and continue to fund the second-highest, third-highest etc. until (1) all credit lines have been exhausted (2) the marginal investment opportunity has value r_C.
- We assume that credit lines are sufficiently small such that the marginal investment opportunity satisfies $U \gg r_C$ (e.g. the total loan volume is determined by available credit lines rather than the community interest rate).[11]

We next take into account that each sponsor j receives transaction cost T_{ij} from client i to compensate for the risk of default. Taking this constraint into account the efficient solution of the social planner is as follows:

- For each investment opportunity U of agent i find the lowest transaction cost $T(U) = \min_{j \in J} T_{ij}$ over the set of sponsors J. Rank all investment opportunities by $\tilde{U} = U - T(U)$ and fund the most profitable investment opportunity $\tilde{U}$ first.
- Allocate the residual credit lines to the next highest investment opportunity, then the third-highest etc. until all credit lines are exhausted.

[11] This is likely to be true in heavily credit constrained communities.

- For insiders and outsiders there will be marginal cutoff values U_I^* and U_O^* such that all investment opportunities above those cutoff values are funded. The precise cutoffs will depend on the distributions of investment opportunities amongst insiders and outsiders, the total amount of credit available and the extent to which sponsors trust insiders more than outsiders.

If the distribution of investment opportunities are similar for insiders and outsiders we would expect that $U_I^* > U_O^* > r_C$: in other words, more insider projects are funded because sponsors trust insiders more. It is important to note, that simply observing $U_I^* > U_O^*$ is [illegible] to claim that there is cronyism.

What are the effects of decreasing the community interest rate r_C? In this model there are none: the share of loans going to insiders would remain the same because the cutoff values U_I^* and U_O^* would not change.[12]

Under cronyism, however, we would expect the share of loans to insiders to [illegible] as the community interest rate r_C decreases. The reason is that sponsors will first fund projects of insiders as long as these projects have positive return and $U > r_C + T$. As the interest rate decreases sponsors can fund more marginal projects of insiders at the expense of providing funds for outsiders' investment opportunities with high social value.

The share of insider loans to total loans therefore provides a sharp prediction which distinguishes inefficient cronyism and favoritism from constrained efficient trust. My methodology suggests not only a natural and operational definition of cronyism but also a simple experimental test: if the interest rate decreases more projects of 'insiders' will become marginally profitable. Favoritism induces sponsors to substitute away from loans to outsiders with high social surplus in favor of more loans to insiders which marginal social surplus.

6 Harlem Project (joint with Markus Mobius)

The Harlem project is an attempt to recreate historical social networks from census data. Strictly speaking, we do not observe the network but only the neighborhood. However, there is strong anecdotal evidence that social interactions in city neighborhoods do not extend much beyond a radius of a few blocks at the most.

The main question we are interested in is just how local social interactions were in reality. We want to estimate this from the data by comparing households in Harlem whose direct neighborhoods were in different states of transition from a mostly white to a mostly black area.

We are also interested in the mean moving rate amongst both blacks and whites in Harlem. Our results from a small-scale pilot study 10 city blocks in Chicago suggested that moving rates were very high at the time with a mean survival rate of a household at any given location of about 3 years. We also found no evidence of white flight - the rapid transition we observed in our Chicago data was due to the fact the new residents were predominantly black and moving rates were high in general.

7 Education

A strong interest in research and teaching is the main reason why I work at a liberal arts college. I often find that my research informs my teaching and vice versa. I have been using experiments

[12] This would remain true even if clients start to compete for sponsors and have to pay sponsors for access. As long as sponsors charge every client identical access fees the cutoff values would not change as r_C decreases.

as teaching tools across the curriculum for a number of years and have been committed to making new teaching experiments available to other educators (e.g., Badasyan, Goeree, Hartmann, Holt, Morgan, Rosenblat, Servatka, and Yandell (2005) and Isgut, Rosenblat, and Ravishanker (2005)). However, my most rewarding experience has been in teaching Economics 311, the advanced undergraduate seminar on economic experiments in which students not only learn about experimental methods but also design and conduct studies of their own. My lecture notes as well as the syllabus for Econ 311 are a work in progress which I hope others will find useful. I therefore made most of my lecture notes, syllabus, problem sets and data available online at the following address: http://trosenblat.web.wesleyan.edu. Several of my research projects grew out of collaborative work done with undergraduates in this course. For example, I first started thinking about nutrition project after working closely with two students, Benjamin Brown and David Delcourt. I found that since I started doing experiments on social networks, my students became even more excited. Most students are drawn to this research partly because they think that social networks are important for explaining the world around them but standard economics has not yet absorbed the wave of recent research especially in labor and development economics on this topic. My students not only learn from analyzing data from my own experiments and designing their own studies, but they also provide me with new ideas and give invaluable feedback on experimental design.

I am committed to providing opportunities for advanced undergraduates to get hands-on involvement in research either during their undergraduate career or afterwards. For example, my former student Margaret McConnell spent this past year as a program coordinator in Peru helping with all aspects of the project. She not only provided invaluable research assistance but became a collaborator (as can be seen from the project on cronyism). Maggie will pursue her graduate studies at Caltech. In the future, I would like to be able to offer financial support to a select group of undergraduates who are contemplating research careers and would like to get involved in long-term projects prior to going to graduate school.

During the past several years, I have been actively involved in teaching minicourses at Universidad Nacional de Tucuman in Argentina where Markus Mobius and I co-founded an experimental lab. Minicourses are particularly attractive because they allow the advanced students from all over South America to learn about the new developments in the field. I especially enjoy a minicourse focused on the economics of social networks. Several of my students from Tucuman are currently pursuing advanced graduate degrees in the US.

Finally, I strongly believe that my research agenda has important implications for public policy. The microfinance product that we are developing in Peru can be also modified for disadvantaged areas in the US. I have been working with the Housing Opportunities Program run by undergraduates at Harvard to help them design sponsor-mediated loans for the poor in the Boston area. I am planning to supervise similar activities at Wesleyan through service-learning courses.

I have been working closely with Health and Wellness services at both Wesleyan and Harvard that are very interested in the outcomes of the health and nutrition studies. I plan to design workable interventions for them to incorporate as part of their student orientation programs.

References

Andreoni, J., and J. Miller (2002): "Giving According to GARP: An Experiment on the Consistency of Preferences for Altruism," *Econometrica*, 70.

Andreoni, J., and L. Vesterlund (2001): "Which is the Fair Sex? Gender Differences in Altruism," *Quarterly Journal of Economics*, 116, 293–312.

Badasyan, N., J. Goeree, M. Hartmann, C. Holt, J. Morgan, T. Rosenblat, M. Servatka, and D. Yandell (2005): "Double Marginalization: A Classroom Experiment," Discussion paper, working paper.

Coleman, J. S. (1990): *Foundations of Social Theory*. Harvard University Press, Cambridge.

Conley, T. G., and C. R. Udry (2002): "Learning About a New Technology: Pineapple in Ghana," Working paper, University of Chicago.

Eckel, C., and R. Wilson (2004): "Whom to Trust? Choice of partner in a trust game," Discussion paper, working paper.

Fisman, R., S. Kariv, and D. Markovits (2005): "Individual Preferences for Giving," Discussion paper, mimeo, Berkeley University.

Fukuyama, F. (1995): *Trust*. Free Press, New York.

Glaeser, E. L., D. M. Cutler, and J. M. Shapiro (2003): "Why Have Americans Become More Obese?," Discussion paper, Harvard University working paper.

Isgut, A., T. Rosenblat, and G. Ravishanker (2005): "The Basics of International Trade: A Computer Experiment," *AEAWeb Annual Meeting Papers*.

Jones, J. H., and M. S. Handcock (2003): "Sexual contacts and epidemic thresholds," *Nature*, 423, 605–606.

Khwaja, A. I., and A. Mian (2004): "Do Lenders Favor Politically Connected Firms? Rent Provision in an Emerging Financial Market," Discussion paper, mimeo.

Kremer, M., and E. Miguel (2003): "Networks, Social Learning, and Technology Adoption: The Case of Deworming Drugs in Kenya," Discussion paper, Harvard University Working Paper.

Lazear, E., U. Malmandier, and R. Weber (2005): "Sorting in Experiments," Discussion paper, working paper.

Liljeros, F., C. R. Edling, L. A. N. Amaral, H. E. Stanley, and Y. AAberg (2001): "The web of human sexual contacts," *Nature*, 411, 907–908.

Manski, C. (1993): "Identification of Endogenous Social Effects: The Reflection Problem," *Review of Economic Studies*, 60, 531–542.

Marron, R., B. Lanphear, R. Kouides, L. Dudman, R. Manchester, and C. Christy (1998): "Efficacy of informational letters on hepatitis B immunization rates in university students," *Journal of American College Health*, 47, 123–7.

McDowell, I., C. Newell, and W. Rosser (1996): "Comparison of three methods of recalling patients for influenza vaccination," *CMAJ*, 135, 991–7.

Mobius, M., and T. Rosenblat (2005): "Why Beauty Matters," *forthcoming in the American Economic Review*.

Mobius, M. M., and T. S. Rosenblat (2003): "The Formation of Ghettos as a Local Interaction Phenomenon," Discussion paper, Harvard University Working Paper.

Mobius, M. M., T. S. Rosenblat, and Q.-A. Do (2004): "Social Capital in Social Networks," Discussion paper, mimeo, Harvard University.

Morris, M. (1997): "Sexual networks and HIV," *AIDS 97: Year in Review*, 11, 209–216.

Potterat, J. J., L. Phillips-Plummer, S. Q. Muth, R. B. Rothenberg, D. E. Woodhouse, T. S. Maldonado-Long, H. P. Zimmerman, and J. B. Muth (2002): "Risk network structure in the early epidemic phase of HIV transmission in Colorado Springs," *Sexually Transmitted Infections*, 78, 1159–1163.

Putnam, R. D. (2000): *Bowling Along*. Simon & Schuster.

Rosenblat, T. S., and M. M. Mobius (2004): "Getting Together or Drifting Apart," *Quarterly Journal of Economics*, 119(3).

Sattenspiel, L., and C. P. Simon (1988): "The spread and persistence of infectious diseases in structured populations," *Math. Biosciences*, 90, 341–366.

Siriwardena, A., A. Rashid, M. Johnson, and M. Dewey (2002): "Cluster randomised controlled trial of an educational outreach visit to improve influenza and pneumococcal immunisation rates in primary care," *British Journal of General Practice*, 52, 735–40.

Slonim, R. (2004): "Gender Selection Discrimination: Evidence from a Trust Game," Discussion paper, working paper.

Smith, D., X. Zhou, M. Weinberger, F. Smith, and R. McDonald (1999): "Mailed reminders for area-wide influenza immunization: a randomized controlled trial," *Journal of American Geriatric Society*, 47, 1–5.

Watts, D. J., and S. H. Strogatz (1998): "Collective Dynamics of 'Small-World' Networks," *Nature*, 393, 440–442.