The Influence of Social Networks on Pro-Environment Behaviors

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Abstract

We examine how social networks influence pro-environment behaviors. We use new data from a nationally representative U.S. sample to estimate latent cluster models in which we assign individuals to family, neighbor, and coworker networks that differ in the strength of connections and pro-environment norms. We find consistent effects of green family networks on altruistic behaviors. We also find that the effect of coworker networks is particularly visible for cost-saving activities and that neighbor networks matters for working with others in the community to solve a local problem, volunteering, and recycling.

Key Words: Pro-environment behaviors, social networks, latent class models

1. Introduction

Individuals and households do not make decisions in isolation, but embedded in a social structure. Economists and sociologist have explored the links between social relationships and behavior and there is now substantial and growing evidence that social ties influence beliefs, values, preferences, and choices (Alesina and Giuliano, 2009; Akerlof and Kranton, 2005; Manski, 2000; Glaeser, Sacerdote, and Scheinkman, 1996; among others).

In this paper, we examine whether and how social relationships are related to behaviors that determine a household's carbon footprint. We use new data from a nationally representative U.S. sample to estimate latent cluster models in which we assign individuals to family, neighbor, and coworker networks that differ in the strength of connections and "greenness." We find that for each social group (family, neighbors, and coworkers) there are distinct classes that differ in the strength of connections and norms related to the environment.

After we classify individuals into social networks, we estimate how the characteristics of the networks they are embedded in correlate with pro-environment behaviors. We find that higher levels of environmentalism within a network correlate with greater likelihood that individuals engage in pro-environment behaviors, but that the strength of ties does not correlate with these behaviors. We also show that different "green" networks encourage different pro-environment activities.

We also show evidence of the validity of our social network classification. First, we estimate a model for life satisfaction. We should find that differences in the strength of social ties matter for self-reported life satisfaction but the prevalence of pro-environment norms are not important. As expected, we find that belonging to networks with strong ties correlates positively with self-reported life satisfaction, independent of the level of greenness. Second, we explore whether the different results we find for family, neighbor, and coworker networks are an artifact of distinguishing across specific social groups and whether what matters is that the individual is embedded in *any* green network. We find that the group-specific results hold even after including a dummy variable that equals one if the respondent is classified into any green network.

Because we use cross-sectional data, we face two potential problems when we interpret our results. First, it is possible that there are confounding variables that influence simultaneously the behaviors we estimate and membership in social networks. To address this problem, we control for several variables that are likely to capture incentives to engage in pro-environment activities and to seek out or influence other people to become "green." A second potential issue is reverse causality: individuals who engage in pro-environment activities may seek out green networks. Although we cannot rule out the possibility of reverse causality, we show that there are statistically significant correlations between network membership and behaviors for a sub-sample of individuals for whom reverse causality is a priori less of a problem (individuals who do not consider themselves to be environmentalists). In addition, we find that being embedded in family and coworker networks, for which individuals have a more limited choice about membership, is also associated with pro-environment behaviors. These findings suggest that the causation may run from group membership to behavior rather than the other way around.

Our paper contributes to the literature that examines how interpersonal relationships influence economic behaviors and institutions (Granovetter, 1985) and, more generally, to the literature on social capital.[1] The literature on the effects of social networks and peers has examined outcomes such as crime (Glaeser, Sacerdote, and Scheinkman, 1996), labor market outcomes (Bayer, Ross, Topa 2008), smoking (Harris and Gonzalez, 2008; Nakajima, 2007),

[1] Our approach to the measurement of networks is consistent with Dasgupta (2003) who argues that researchers should define social capital as social structure, that is, as a system of social ties.

obesity (Christakis and Fowler 2007), and the transmission of risk and trust across generations (Dohmen et al, 2008). A recent paper that is related to our research is the work by Alesina and Giuliano (2009). The authors use data from the World Values Survey and the European Social Survey to measure family ties with beliefs about the role of one's family (such as respect for parents). The authors find a negative relationship between family ties and generalized trust as well as between family ties and political participation.

We contribute to the literature by examining pro-environment behaviors, adopting a probability-based approach to measure networks, and examining three different social groups (neighbor, coworker, and family networks). Importantly, we consider two dimensions of networks, norms and strength of ties, when classifying individuals' networks.

Our results offer a nuanced view of how social ties matter for economic decisions. The likelihood that individuals engage in some pro-environment behaviors correlate with their social networks as long as pro-environment norms are prevalent within the network but different networks matter in a consistent way for the same types of behaviors. It is important for policymakers and researchers to acknowledge whether and to what extent social relationships are a source of heterogeneity in behaviors as public policies might be designed and implemented to exploit the beneficial impact of social factors, what Thaler and Sunstein (2008) call social nudges.

Section 2 presents the conceptual framework that motivates our hypotheses. Section 3 discusses the survey design. Section 4 discusses the methods and results from latent cluster models while Section 5 discusses the results of models linking social network membership to pro-environment behaviors. Section 6 concludes.

2. Conceptual Framework and Hypotheses

Social relationships influence people's motivation to act, their problem-solving skills and efficacy, and the extent to which they can rely on social support to engage in costly efforts. Social networks can also influence preferences in the short-run and the long-run by the internalization of norms and values (Sorensen et al., 2007; Durlauf and Fafchamps, 2004; Passy, 2003).

In this paper we examine the links between the social networks the individual is embedded in and the likelihood that the individual engages in pro-environment behaviors. There are several reasons why we expect an association between social ties and pro-environment behaviors. First, networks can facilitate the access to information that is required to evaluate the potential savings from energy-conservation projects, the health benefits from certain consumption choices, or the environmental impact of one's efforts. Second, reliance on networks can potentially reduce the cost of engaging in some pro-environment efforts. Third, to the extent that membership in a network conveys the internalization of norms and values, peer pressure and attachment to one's social networks can influence behaviors.

These effects of networks on pro-environment behaviors are likely to depend on both the strength of ties and the extent of pro-environment norms within the network. The effects may also differ according to social group and behavior; for example, because household recycling occurs at home, strong ties with neighbors who are environmentally-minded may have a different effect on this behavior than ties with "green" coworkers do.

To examine how the likelihood that individuals engage in pro-environment behaviors depends on the types of social networks they are a part of, we first classify each individual into a network for each of the three social groups we consider. We find that networks vary both in terms of the strength of connections and the prevalence of pro-environment norms, and that there is variability in network types according to social group (for example, an individual in a “green” family network does not necessarily belong to “green” coworker or neighbor networks).

Then we estimate how membership in family, neighbor, and coworker networks correlate with pro-environment behaviors. We examine several specific behaviors that may be driven by different motivations and for which different networks may provide different resources: altruistic behaviors (for example, whether or not the individual has donated to an environmental organization), activities that reduce energy costs (having an insulated water heater in the household), behaviors that involve interactions with others (such as working with others in the community to solve a local environmental problem), and activities that are likely to depend on social norms (such as recycling). We also estimate the relationships between network membership and pro-environment behaviors by considering a larger set of activities: we construct a count of six different cost-saving behaviors and a count of four different altruistic behaviors. Section 5 discusses the dependent variables in more detail.

We expect that individuals in networks with strong social ties and prevalent pro-environment norms are more likely to engage in pro-environment behaviors than individuals who belong to networks with weak social ties and no salient pro-environment norms. We also hypothesize that individuals in networks with strong social ties and prevalent pro-environment norms are more likely to engage in pro-environment behaviors than individuals who are part of green networks, but who have weaker ties. We also expect that individuals who belong to green networks with weak ties are more likely to engage in pro-environment behaviors than people who are in networks with weak ties but in which pro-environment norms are not salient.

3. Survey Design

We use new data from a sample of U.S. households. Knowledge Networks administered the survey in August 2009 as an off-wave of the American National Election Studies (ANES) panel. Knowledge Networks recruited the panel via random digit dialing.[2] The surveys are approximately 30 minutes in length and are completed on-line. Sixty-three percent of the individuals who were contacted completed the survey (3,601 individuals were sampled and 2,277 completed the survey). We supplemented the ANES off-wave with 2009 data for 450 responses from a sample that we had queried about environmental behaviors and attitudes in October 2007. For this sample Knowledge Networks also recruited the panel via random digit dialing. In this case, 746 individuals were contacted and 452 completed the survey (60.6 percent completion rate). We have estimated our models controlling for sample source and found that there is no evidence of differences on mean responses across the two samples for the behaviors we examine.

The survey instrument elicits responses about pro-environment behaviors, attitudes towards the environment and public policies; social networks; changes in life circumstances; and the influence of religion and religious affiliations on environmental behaviors and attitudes.[3]

Responses to the pro-environment behavior questions in our questionnaire are comparable to responses from other surveys. For example, only 14 percent of our sample recycles less often than several times a year and 17 percent contributed to an environmental organization in the last 12 months. In the third wave of the World Values Survey, 14 percent of the respondents from the U.S. indicate that they do not recycle and 25 percent say they have contributed to an environmental organization (time frame not specified).

[2] Respondents were offered $10 per month to complete monthly surveys. Individuals who did not have access to the Internet were offered a web appliance and free Internet access during the survey period.

[3] We tested a subset of the questions on a sample of 200 individuals and two experts reviewed the questionnaire and results from the pilot sample. The questionnaire and tabulation of responses are available at: http://www.hamilton.edu/levitt/Sustainability/Environmental_survey_2009.html

4. Latent Cluster Model: Method and Results

We use a probability-based approach to classify individuals into social networks defined by several indicators: latent cluster models. The basic idea of a latent cluster model is that the probability of a specific response pattern is the average probability of the response pattern given each class, weighted by the prior probability of class membership (Magidson and Vermunt, 2003).[4]

We consider a person's social network an unobserved discrete latent variable and treat the responses to questions about social ties and norms as indicators with errors of that unobserved latent construct. Let $i = 1,\ldots, I$, denote the respondents. For each individual we observe the response to a set of indicators for each social group (family, neighbors, and coworkers). Let the vector $\mathbf{Y}_i$ represent the response pattern of an individual to each of the k indicators for a particular social group. We assume a finite number of social networks denoted $s = 1,\ldots,$ S. The discrete latent variable X represents the class. Then:

$$P(\mathbf{Y}_i) = \sum_{s=1}^{S} P(X_i = s_i) \times \prod_{k=1}^{K} P(Y_{ik} \mid X_i = s),$$

where the probability of class memberships is:

$$P(X_i = s) = \frac{\exp(\eta_s)}{\sum_{s'=1}^{S} \exp(\eta_{s'})},$$

where:

$$\eta_s = \log\left(\frac{P(x = s)}{[\prod_{s'=1}^{S} P(x = s')]^{1/S}}\right) = \gamma_{s0}$$

and the gamma term is a free parameter.

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[4] Recent applications in the economics literature of latent models (also known as finite-mixture models) include Clark, Etile, Postel-Vinay, Senik and Van der Straeten (2005), Scarpa and Thiene (2005), Morey, Thacher, and Breffle (2006), and Owen and Videras (2007, 2009).

Latent class analysis determines the smallest number of latent classes that account for the observed relationships among indicators. We first assume one class – independence among response variables – and then increase the number of classes. To determine the number of latent classes among the models that fit the data, we use the Bayesian information criterion (BIC) based on the model's log-likelihood.[5] We fit the models using Maximum Likelihood methods and sampling weights. The results yield the conditional response probabilities for each indicator. We compare these conditional probabilities to define the classes. Applying Bayes rule, we assign a posterior probability of membership in each class to each individual. We then use these membership probabilities in models estimating the likelihood that the individual engages in several pro-environment behaviors.

We use several variables that are indicators of the strength of connections and the "greenness" of an individual's networks. To measure the strength of ties we use responses about frequency of contacts, trust and sense of belonging, and friendship with family members, neighbors, and coworkers. To measure pro-environment norms we use whether the respondent believes that others in the group do things to help the environment and the frequency with which people in the group discuss specific issues about the environment. Tables A1, A2, and A3 in the appendix present the questions and frequency of responses for the indicators of family, neighbor, and coworker networks.

As we state above, we explore whether network membership may have different effects depending on the social group and behavior. Thus, for each social group we estimate separate latent cluster models that include indicators of ties and norms for that group.[6]

[5] The Bayesian information criterion is calculated as –LL+Ln(N)*P, where -LL is the model's Log-likelihood, P is the number of parameters, and N is the number of observations.
[6] We also estimated latent cluster models that include indicators for all social groups. The models are more complex and the sample size is smaller. As a consequence, the models are less stable.

Table A4 presents the fit statistics for the latent cluster models. For all groups, a model with two or more classes fits the data better than the model that assumes a homogeneous population (one class). Using the Bayesian information criterion (BIC) based on the model's log-likelihood, we select the four-class model for family networks and three-class models for neighbors and coworkers networks.

Table A5, A6, and A7 present the conditional probabilities for each model; Table A8 summarizes the types of networks qualitatively. Table A5 shows the results for family networks. There are two classes with strong family ties but different environmental norms: individuals in Class 1 are unlikely to think most of their relatives do things to help the environment and they are also unlikely to discuss environmental issues while individuals in Class 2 have the highest conditional probabilities for these two indicators of pro-environment norms. The other two classes have weaker ties and norms that follow the previous pattern of pro-environment norms (Class 3) and no norms (Class 4).

For neighbors, we select the three-class model. Individuals in Class 1 have weak ties with neighbors and the lowest conditional probabilities on the two indicators of norms. Individuals in Class 2 have the strongest ties, are the most likely to think most of their neighbors do things to help the environment, and have medium probability in discussing environmental issues. Individuals in Class 3 have medium-strength ties (but low probability of trusting their neighbors a lot), are the most likely to discuss environmental issues with neighbors, and have medium probability of thinking most of their neighbors do things to help the environment. The class profiles for coworkers are qualitatively very similar to the types of neighbor networks.

Based on these results and applying Bayes rules, we assign to each individual a posterior probability of membership for each class and social group. Pair-wise correlation coefficients of posterior probabilities across groups range, in absolute value, from 0.02 to 0.34. Using the largest posterior probability to classify individuals to one class for each social group, we find that there is substantial variability of individual class membership across groups. For example, 56 percent of individuals classified in a green family network are also classified in a green neighbor network and 58 percent of respondents in green coworker networks are classified in a green neighbor network. The largest amount of overlap occurs between family and coworker networks: 66 percent of respondents in a green coworker network are also classified in a green family network. These statistics suggest that distinguishing across social groups might be useful as individuals do not necessarily belong to the same type of network across all groups.

5. Social Networks on Pro-Environment Behaviors

In this section, we use the posterior probabilities of network membership from latent cluster models to examine the links between social networks and the likelihood to engage in pro-environment behaviors. First, we discuss the dependent variables and control variables. Second, we estimate models for seven specific behaviors that individuals may undertake for different reasons. We also consider a larger set of activities by creating counts of six different cost-saving behaviors and four altruistic behaviors. Third, we perform a series of robustness checks to explore whether reverse causality might affect our results and to provide further evidence of the validity of the latent cluster model's classification.

5.1 Dependent and Independent Variables

We estimate models for seven behaviors to explore whether social networks may have different effects on behaviors that individuals may undertake for different reasons: donations to environmental organizations (DONATE), purchasing fair-trade products (FAIR), having an insulated water heater (HEATER), working with others on the community to solve a local environmental problem (COMMUNITY), volunteering to an environmental project (VOLUNTEER), recycling cardboard packaging or paper (RECYCLING), and investing in socially-responsible funds (FUND). RECYCLING is equal to one if in the last 12 months the respondent has personally recycled cardboard packaging or paper almost daily, and is equal to zero if the respondent has recycled less often. The other variables are also binary and equal to one if the respondent has undertaken the corresponding behavior in the last 12 months. Table 1 presents the variables' labels and proportions.

All models include controls for gender, age and age squared, educational attainment, employment status, household size, and marital status. The models also include dummy variables for income (above $35,000), homeownership, and regional dummies. In addition, the model for RECYCLE includes whether the respondent's local community has a recycling program (as reported by the respondents). The models use sampling weights.

Motivated individuals who are concerned about the environment are likely to engage in pro-environment behaviors and to seek out green networks. Thus, it is important to control for potential confounding factors. Our models include attitudinal variables that are likely to capture incentives to be pro-environment and belong to pro-environment networks. First, the survey asks individuals whether they consider themselves to be environmentalists. From the responses to this question, we construct GREEN_SOME and GREEN_DEF indicating those who responded "yes, somewhat" and "yes, definitely," respectively. The variable FATALIST[7] equals one if the individual strongly agrees or agrees that it is "difficult for somebody like me to do much about the environment." On a scale of one to four, PERSONAL indicates the extent to which people

[7] This variable may also capture free-riding attitudes.

believe that climate change will affect them personally. We also calculate a proxy for social responsibility by summing the responses to questions about how justifiable it is to cheat on taxes, ride public transportation without paying the fare, download copyrighted music or movies without permission, and buy stolen goods. Respondents state on a scale of one to ten where a ten indicates that the behavior can "never be justified" while a one indicates that the behavior is "always justifiable."[8] The sum of these responses we denote CIVIC. Table 1 shows descriptive statistics for these controls.

5.2 Results

Table 2 presents marginal effects for the base models including all the controls but excluding the social networks variables. Declared environmentalism and environmental attitudes are generally related to the likelihood of engaging in pro-environment behaviors. Everything else equal, homeowners are on average more likely to undertake some of the behaviors (in particular, having an insulated heater); higher levels of education correlate positively with the likelihood of working with others in the community, volunteering, and purchasing fair-trade products; individuals in the high-income group are also more likely to purchase fair-trade products and invest in socially responsible funds while larger household size is negatively correlated with the prevalence of these two behaviors; and women are less likely to work with others in the community and have an insulated heater. These results hold when we add the social network variables.

Next, we include in the model network membership. These variables are posterior probabilities of membership in each latent class. For each network type, the default is the probability of membership in the low connection and low greenness class.

[8] These questions and scales of responses are similar to ones that appear in the World Values Survey.

Tables 3, 4, 5, and 6 present results from several model specifications for donations, recycling, working with others in the community, and having an insulated water heater. The first three columns show the estimates when we enter probabilities for each social group independently. For these specifications, the estimates are likely to capture overall strength of ties and overall network "greenness" rather than the effect of membership in a given network for a particular group. Thus, columns four to six show the estimates when we include combinations of two social groups and column seven presents the results when the models control for all social groups. When examining the results we look for consistent effects across specifications. Table 7 presents the results for three additional behaviors for the models that include posterior probabilities for all social groups. The tables show the marginal effects of membership probabilities after controlling for socio-demographic factors, attitudinal variables, and regional dummies.

Table 3 presents marginal effects when we estimate the likelihood that in the last year respondents have donated money to environmental organizations. Everything else equal, individuals who belong to green family networks are more likely to donate than individuals in family networks that are not green, independently of the strength of ties. There is some evidence that people in green coworker networks are more likely to donate, although the effect is weakly significant in column seven. We do not find consistent evidence that neighbor networks matter as the estimates become weakly significant or insignificant when we include other social groups.[9]

Table 4 presents the marginal effects of network membership on the likelihood of recycling cardboard packaging or paper almost daily during the last year. There is statistical evidence that neighbor networks matter, in particular, individuals who have strong connections

[9] We obtain very similar results for DONATE when we exclude from the estimation sample individuals who belonged to an environmental group in the last 12 months, except the estimate on coworker network is no longer statistically significant at the 10 percent level.

with neighbors and who think most of their neighbors do things to help the environment are more likely to recycle (at the 10 percent level in the model that includes all social groups). The estimate for green family networks with strong connections is also statistically significant at the 10 percent level.

Table 5 shows the results for working with others in the community to solve an environmental problem. Membership in green neighbor networks is again consistently and strongly significant, in particular, membership in a network where neighbors discuss frequently environmental issues. For this behavior, the estimate for green family networks with strong connections is statistically significant at the 5 percent level.

Table 6 presents the results for a behavior related to energy savings: having an insulated water heater. We find statistical evidence that higher probability of membership in green coworker networks is correlated with the household's having an insulated water heater. In particular, the marginal effect for membership in a network where coworkers discuss frequently environmental issues is statistically significant at the five percent level. On the other hand, family networks do not correlate with this behavior and the effect of neighbor networks is significant at the 10 percent only when we control for coworkers.

Table 7 presents results for three additional behaviors. People in green coworker networks with strong connections and people in green family networks are more likely to purchase fair-trade products and invest in socially-responsible funds, everything else equal. Consistent with the results for COMMUNITY, membership in a network where neighbors discuss frequently environmental issues is strongly correlated with volunteering.

Comparing across behaviors, we find that networks have different effects according to the type of social group. Membership in green family networks matters consistently for all behaviors except HEATER. In terms of statistical significance and magnitude, the effects of green family networks are larger for altruistic behaviors: donating to environmental groups and purchasing fair-trade product, as well as investing in a socially-responsible fund. Being classified in green coworker networks correlates at the five percent level or better with HEATER, COMMUNITY, FAIR, and FUND. Interestingly, being classified in a green coworker network is the only network variable that is related to having an insulated water heater. Finally, green neighbor networks matter for working with others in the community to solve a local environmental problem, for volunteering for an environmental project, and for recycling cardboard products and paper (at the ten percent level); but, there is no evidence that these networks matter for other activities. These results are reasonable as strong green neighbor networks are likely to impact the costs of coordination and highlight social pressures (Burn, 1991).

We continue exploring how networks may serve different purposes by constructing an index that adds up the following cost-saving behaviors: having an insulated heater, having a programmable thermostat, putting on an extra layer of clothing instead of turning up the heat, buying compact fluorescent light bulbs, unplugging the cell phone charger when not using it, and running the dishwasher or washing machine without a full load less often than several times a year. The most common response is four behaviors (28 percent of the responses). The results of OLS and Poisson models that include all posterior probabilities show that neighbor networks are not related to the number of cost-saving behaviors. On the other hand, respondents embedded in green family networks and coworker networks in which individuals are more likely to think their coworkers do things to help the environment do engage in more cost-saving activities.

We also estimated OLS and Poisson models for the number of purely altruistic behaviors: purchasing green power, purchasing carbon offsets, donating to environmental organizations, and purchasing fair-trade products. These behaviors are less common than cost-saving behaviors and the most common response is zero (65 percent of the observations). In terms of the direction of the effects, the findings are similar to those of the model for donations and fair-trade products. The largest effects on altruistic behaviors are due to green family networks. For example, using the results of the Poisson model we find that one standard deviation increase in the probabilities of being classified in a family network increases the expected count of behaviors by more than 40 percent (in contrast, one standard deviation increase in the probabilities of being classified in a coworker network increases the expected count of behaviors by 9 to 12 percent).[10]

5.3 Robustness Checks

A potential problem with the interpretation of results is reverse causality. Reverse causality would affect the results if individuals undertook a given behavior for reasons unrelated to their networks and, as a consequence of engaging in that behavior, they became connected to other people who discuss environmental issues frequently and do things to help the environment, or, as a consequence of engaging in that behavior, they influenced other people to discuss environmental issues frequently and do things to help the environment. Because we use cross-sectional data we cannot rule out the possibility that reverse causality is driving our results. However, we argue that reverse causality is less plausible among individuals who define themselves as non-environmentalists. Reverse causality for a non-environmentalist would imply an unlikely chain of events in which individuals would undertake a given activity for some personal reason and, as a consequence of that action, they would seek out individuals who share

[10] These results are available from the authors upon request.

pro-environment norms or would motivate other people in their network to have pro-environment norms, without declaring themselves to be environmentalists. On the other hand, causality would imply that even non-environmentalists who interact with family members, neighbors, or coworkers who are pro-environment may contribute due to access to valuable information or peer pressure and sense of belonging to the group.[11] Therefore, if we find statistically significant effects even among a group of non-environmentalists, the results would suggest the more plausible causal story.

Table 8 presents these results for the models that include all seven membership probabilities for the sub-sample of non-environmentalists. Approximately 26 percent of non-environmentalists are classified into green coworker networks, almost 38 percent are part of a green neighbor network, and almost 29 percent are part of a green family network. We find that green family networks still matter for donations, purchasing fair-trade products, and investments in socially-responsible fund; membership in green neighbor networks relates to COMMUNITY and VOLUNTEER; and green coworker networks matter for HEATER, FAIR, and FUND.

To check the validity of the latent cluster model's classification, we estimate OLS models for self-reported life satisfaction. We hypothesize that the strength of connections are related to life satisfaction but green norms within a network are unlikely to matter. Table 9 shows the results. As we expected, individuals embedded in neighbors and coworkers networks with strong ties report higher levels of life satisfaction, everything else equal, than individuals in networks with weak or medium social ties, independently of the pro-environment norms within the network. The fact that the coefficient estimates on family networks are statistically insignificant

[11] In a recent paper, Dellavigna, List, and Malmendier (2009) conducts an experiment that shows social pressure increases donations.

may be due to the fact that the indicators of family connections do not reflect sense of belonging or level of trust.

We also explore whether the different results we find for family, neighbor, and coworker networks might be an artifact of distinguishing across social groups and whether what matters is that the individual is embedded in any green network. As a robustness check, we estimate the models that include all social groups and a dummy variable that equals one if the respondent's largest posterior probability corresponds to any of the green networks we find in the data. In this way, the group-specific posterior probabilities pick up the effect of being classified in each specific network after controlling for being classified in any green network. We find the coefficient estimates on posterior probabilities barely change in terms of magnitude and statistical significance.

We also examine whether collinearity due to correlation among network variables and controls might influence the signs and magnitudes of the coefficient estimates on the network posterior probabilities. We estimate models that include a subset of controls: education, age, and dummy variables for region, gender, high-income group, and race/ethnicity. We find that the signs of the network variables do not change in any case and that magnitudes are generally greater. We also estimate models that include exclusively the network variables and find that the signs of statistically significant coefficients do not change and that many of the variables remain statistically significant.

In sum, these results are corroborating evidence of the validity of our social network classification.

6. Summary

Policymakers can design public policies that rely on the beneficial impact of social factors (Thaler and Sunstein, 2008). Thus, it is important for researchers to examine whether and to what extent social relationships generate heterogeneity in behaviors. Our paper offers a nuanced view of how social ties matter for economic decisions, in particular, for behaviors that influence households' carbon footprint.

We use new data from a U.S. nationally representative sample to estimate latent cluster models in which we assign individuals to family, neighbor, and coworker networks that differ in the strength of connections and "greenness." We find distinct classes that differ in the strength of connections and "greenness" and that green networks are positively correlated to pro-environment behaviors. In particular, we observe consistent relationships between green family networks and altruistic behaviors. We also find that the effect of coworker networks is particular visible for cost-saving activities and that neighbor networks matters for working with others in the community to solve a local problem, volunteering, and recycling.

Because we use cross-sectional data, we face two issues: confounding variables and reverse causality. To address the first problem, we control for several attitudinal variables that are likely to capture incentives to engage in pro-environment activities and to seek out or influence other people to become "green." Regarding reverse causality, we show that there are statistically significant correlations between social network membership and behaviors for a sub-sample of non-environmentalists for whom reverse causality is less of a problem.

Future research may examine whether the effects of socio-economic and attitudinal variables may differ according to network membership, that is, whether there are differential slope effects driven by network membership.[12] Future research would also benefit greatly from panel data. Panel data would allow us to control for unobservable individual-specific factors and examine how exogenous shocks to networks can explain changes in behaviors.

[12] We did explore this approach by estimating jointly latent-class membership and likelihood of engaging in the behaviors. However, the models are complex and the results indicated that the models were not attaining a global maximum.

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Table 1: Descriptive Statistics

Dependent Variables		
Question/Description	*Variable*	*Proportion/Mean*
In the last 12 months, have you donated to environmental organizations?	DONATE • Yes = 1 • No = 0	19.68
Fair trade products are ones that are produced in accordance with social and environmental standards. They are labeled as "fair trade" products. In the last 12 months, have you intentionally purchased fair trade products?	FAIR • Yes = 1 • No = 0	22.17
In the last 12 months, have you personally worked with others in your local community to solve an environmental problem?	COMMUNITY • Yes = 1 • No = 0	9.57
Does your household have an insulated water heater?	HEATER • Yes = 1 • No = 0	68.77
Do you have money invested in a socially responsible fund?	FUND • Yes = 1 • No = 0	23.06
In the last 12 months, have you personally volunteered for an environmental project?	VOLUNTEER • Yes = 1 • No = 0	9.76
In the last 12 months, how often have you personally recycled cardboard packaging or paper?	RECYCLE • Almost daily = 1 • Once or twice a week or less often = 0	46.48
Life Satisfaction, 1 to 10	SATISFACTION	7.24
Controls		
= 1 if respondent is female	FEMALE	56.17
Age	AGE	51.91
= if household annual income above $35,000	INCOME	78.61
Educational Level, 4 to 14 (4 = 7th or 8th grade, 14 = professional or doctorate)	EDUCATION	10.84
= 1 if respondent is married	MARRIED	64.91
Household size	HH_SIZE	2.63
= 1 if respondent is a homeowner	HOMEOWN	83.17
= 1 if respondent is employed or self-employed	EMPLOYED	63.77
= 1 if the individual strongly agrees or agrees that it is "difficult for somebody like me to do much about the environment"	FATALIST	55.96
= 1 if individual believes it is very likely or likely to that climate change will affect him or her personally in the future	PERSONAL	60.05
Four to 40 index, higher values mean respondent states to be more civic-minded about cheating on taxes, riding public transportation without paying the fare, downloading copyrighted music or movies without permission, and buying stolen goods	CIVIC	35.51
= 1 if respondent answers "Yes, somewhat" to "Would you describe yourself as an environmentalist?"	GREEN_SOME	47.83
= 1 if respondent answers "Yes, definitely" to "Would you describe yourself as an environmentalist?"	GREEN_DEF	7.35
= 1 if respondent answers "Yes" to "Does your local community have a recycling program?"	REC_CENTER	81.43

Proportions of dependent variables using largest estimation sample; statistics of controls for full sample; not using sampling weights

Table 2: Probit Base Models (Marginal Effects)

	(1)	(2)	(3)	(4)	(5)	(8)	(9)
VARIABLES	DONATE	RECYCLE	COMMUNITY	HEATER	FAIR TRADE	VOLUNTEER	FUND
FEMALE	0.008	0.044	-0.032**	-0.058**	0.039*	-0.014	0.021
	(0.019)	(0.030)	(0.013)	(0.027)	(0.020)	(0.013)	(0.025)
AGE	-0.006*	-0.006	0.004	-0.004	-0.006	0.000	-0.002
	(0.003)	(0.006)	(0.003)	(0.005)	(0.004)	(0.003)	(0.005)
AGE*AGE	0.000**	0.000	-0.000*	0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MINORITY	-0.025	-0.109***	0.014	-0.005	-0.005	0.020	0.014
	(0.024)	(0.041)	(0.019)	(0.036)	(0.026)	(0.020)	(0.037)
INCOME	-0.003	0.035	-0.043*	0.021	0.092***	-0.016	0.064*
	(0.027)	(0.045)	(0.022)	(0.037)	(0.023)	(0.020)	(0.035)
EDUCATION	0.011*	-0.001	0.009***	-0.004	0.014**	0.014***	0.011
	(0.006)	(0.009)	(0.003)	(0.008)	(0.006)	(0.003)	(0.008)
MARRIED	0.004	0.033	-0.020	0.034	-0.003	-0.021	0.043
	(0.021)	(0.040)	(0.018)	(0.034)	(0.024)	(0.017)	(0.031)
HH_SIZE	-0.008	0.023*	0.003	0.014	-0.022***	0.003	-0.028**
	(0.008)	(0.012)	(0.005)	(0.011)	(0.008)	(0.005)	(0.012)
HOMEOWN	0.052**	0.091*	0.017	0.109***	0.029	0.032**	0.050
	(0.024)	(0.047)	(0.016)	(0.041)	(0.028)	(0.015)	(0.043)
EMPLOYED	-0.028	-0.014	-0.014	-0.007	-0.020	0.005	-0.020
	(0.022)	(0.037)	(0.016)	(0.033)	(0.023)	(0.016)	(0.030)
FATALIST	-0.063***	-0.118***	-0.028**	0.014	-0.048**	-0.013	-0.039
	(0.020)	(0.032)	(0.012)	(0.029)	(0.021)	(0.012)	(0.026)
PERSONAL	0.091***	0.016	0.014	0.006	0.074***	0.022	0.065**
	(0.019)	(0.033)	(0.014)	(0.029)	(0.020)	(0.014)	(0.025)
CIVIC	-0.001	0.001	0.001	-0.001	-0.001	0.000	0.000
	(0.001)	(0.003)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
GREEN_SOME	0.121***	0.176***	0.046***	0.018	0.097***	0.052***	0.047*
	(0.022)	(0.032)	(0.015)	(0.029)	(0.021)	(0.015)	(0.028)
GREEN_DEF	0.337***	0.240***	0.149***	-0.040	0.364***	0.149***	0.051
	(0.059)	(0.061)	(0.043)	(0.057)	(0.056)	(0.045)	(0.052)
REC_CENTER	.	0.284***	.	.	.	.	.
		(0.037)					
Observations	2423	2200	2425	2423	2413	2417	1886

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; the models use sampling weights and include eight regional dummy variables

Table 3: Probit Model for DONATE (Marginal Effects)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Coworkers							
Strong connections, medium green talk, high green help	0.073**				0.052*	0.071**	0.051
	(0.030)				(0.030)	(0.032)	(0.031)
Medium connections, high green talk, medium green help	0.181***				0.108**	0.146***	0.081*
	(0.040)				(0.043)	(0.043)	(0.045)
Neighbors							
Strong connections, medium green talk, high green help		0.048**		0.022		0.026	0.015
		(0.023)		(0.024)		(0.028)	(0.028)
Medium connections, high green talk, medium green help		0.132***		0.086**		0.079*	0.064
		(0.036)		(0.035)		(0.042)	(0.041)
Family							
Strong connections, low green talk and green help			0.064*	0.059	0.046		0.031
			(0.039)	(0.041)	(0.045)		(0.046)
Strong connections, high green talk and green help			0.221***	0.210***	0.178***		0.167***
			(0.037)	(0.040)	(0.046)		(0.049)
Weak connection, medium green talk and green help			0.172***	0.165***	0.153***		0.145***
			(0.041)	(0.044)	(0.048)		(0.050)
Observations	1622	2232	2262	2127	1554	1553	1486

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
The models include controls in Table 10 and regional dummies

Table 4: Probit Model for RECYCLE (Marginal Effects)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Coworkers							
Strong connections, medium green talk, high green help	0.087*				0.065	0.054	0.034
	(0.049)				(0.051)	(0.051)	(0.053)
Medium connections, high green talk, medium green help	0.089				-0.022	0.075	-0.014
	(0.070)				(0.078)	(0.076)	(0.082)
Neighbors							
Strong connections, medium green talk, high green help		0.127***		0.101**		0.093*	0.085*
		(0.041)		(0.042)		(0.049)	(0.050)
Medium connections, high green talk, medium green help		0.039		-0.017		0.024	-0.015
		(0.060)		(0.063)		(0.076)	(0.079)
Family							
Strong connections, low green talk and green help			-0.044	-0.040	-0.075		-0.063
			(0.068)	(0.069)	(0.077)		(0.079)
Strong connections, high green talk and green help			0.156**	0.160**	0.163*		0.154*
			(0.067)	(0.071)	(0.085)		(0.089)
Weak connection, medium green talk and green help			0.073	0.085	0.104		0.101
			(0.077)	(0.080)	(0.093)		(0.095)
Observations	1481	2055	2068	1964	1426	1426	1371

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
The models include controls in Table 10 and regional dummies

Table 5: Probit Model for COMMUNITY (Marginal Effects)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Coworkers							
Strong connections, medium green talk, high green help	0.069***				0.052***	0.062***	0.046**
	(0.019)				(0.019)	(0.020)	(0.019)
Medium connections, high green talk, medium green help	0.129***				0.082***	0.078***	0.040
	(0.027)				(0.027)	(0.028)	(0.029)
Neighbors							
Strong connections, medium green talk, high green help		0.059***		0.050***		0.041**	0.038**
		(0.015)		(0.014)		(0.018)	(0.017)
Medium connections, high green talk, medium green help		0.123***		0.101***		0.102***	0.096***
		(0.022)		(0.020)		(0.026)	(0.026)
Family							
Strong connections, low green talk and green help			0.024	0.009	0.014		0.011
			(0.025)	(0.024)	(0.030)		(0.030)
Strong connections, high green talk and green help			0.119***	0.082***	0.087***		0.072**
			(0.025)	(0.023)	(0.032)		(0.032)
Weak connection, medium green talk and green help			0.084***	0.059**	0.052		0.045
			(0.025)	(0.025)	(0.031)		(0.032)
Observations	1625	2232	2263	2127	1557	1555	1488

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
The models include controls in Table 10 and regional dummies

Table 6: Probit Models for HEATER (Marginal Effects)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Coworkers							
Strong connections, medium green talk, high green help	0.063				0.062	0.065	0.064
	(0.048)				(0.049)	(0.051)	(0.051)
Medium connections, high green talk, medium green help	0.219***				0.217***	0.169***	0.166**
	(0.063)				(0.071)	(0.065)	(0.071)
Neighbors							
Strong connections, medium green talk, high green help		0.047		0.034		0.011	0.007
		(0.035)		(0.036)		(0.043)	(0.044)
Medium connections, high green talk, medium green help		0.144***		0.136**		0.119*	0.114*
		(0.052)		(0.055)		(0.061)	(0.062)
Family							
Strong connections, low green talk and green help			-0.035	-0.060	-0.080		-0.095
			(0.056)	(0.059)	(0.064)		(0.067)
Strong connections, high green talk and green help			0.041	0.023	-0.057		-0.059
			(0.056)	(0.060)	(0.070)		(0.074)
Weak connection, medium green talk and green help			-0.042	-0.081	-0.089		-0.100
			(0.067)	(0.070)	(0.082)		(0.084)
Observations	1548	2125	2147	2027	1483	1485	1421

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
The models include controls in Table 10 and regional dummies

Table 7: Probit Models for Other Behaviors (Marginal Effects)

	(1)	(4)	(5)
	FAIR TRADE	VOLUNTEER	SR FUND
Coworkers			
Strong connections, medium green talk, high green help	0.076**	0.021	0.115***
	(0.035)	(0.025)	(0.043)
Medium connections, high green talk, medium green help	0.070	-0.017	-0.019
	(0.048)	(0.036)	(0.066)
Neighbors			
Strong connections, medium green talk, high green help	-0.059*	0.050*	-0.005
	(0.030)	(0.027)	(0.041)
Medium connections, high green talk, medium green help	-0.048	0.109***	0.093
	(0.044)	(0.030)	(0.060)
Family			
Strong connections, low green talk and green help	0.100*	-0.014	0.079
	(0.061)	(0.045)	(0.073)
Strong connections, high green talk and green help	0.141**	0.077*	0.137*
	(0.062)	(0.042)	(0.073)
Weak connection, medium green talk and green help	0.158**	0.044	0.213***
	(0.067)	(0.043)	(0.081)
Observations	1478	1485	1198

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
The models include controls in Table 10 and regional dummies

Table 8: Marginal Effects of Probit Models for Sub-Sample of Non-Environmentalists

	(1)	(2)	(3)	(4)	(5)	(8)	(9)
VARIABLES	DONATE	RECYCLE	COMMUNITY	HEATER	FAIR TRADE	VOLUNTEER	FUND
Coworkers							
Strong connections, medium green talk, high green help	0.013	0.050	0.005	0.129*	0.085**	-0.049	0.122**
	(0.023)	(0.070)	(0.018)	(0.067)	(0.034)	(0.031)	(0.051)
Medium connections, high green talk, medium green help	0.020	-0.139	0.039	0.230*	-0.130*	-0.030	-0.101
	(0.034)	(0.143)	(0.034)	(0.127)	(0.068)	(0.054)	(0.100)
Neighbors							
Strong connections, medium green talk, high green help	-0.018	0.106	0.016	0.032	-0.006	0.064**	0.067
	(0.019)	(0.068)	(0.015)	(0.062)	(0.030)	(0.027)	(0.053)
Medium connections, high green talk, medium green help	0.046	0.099	0.092***	0.004	0.051	0.094**	0.295***
	(0.029)	(0.126)	(0.030)	(0.100)	(0.051)	(0.041)	(0.078)
Family							
Strong connections, low green talk and green help	0.017	0.006	-0.006	-0.089	0.131**	-0.033	0.091
	(0.030)	(0.089)	(0.027)	(0.084)	(0.053)	(0.038)	(0.067)
Strong connections, high green talk and green help	0.096***	0.140	0.026	-0.128	0.157***	0.034	0.125
	(0.037)	(0.121)	(0.027)	(0.103)	(0.060)	(0.043)	(0.089)
Weak connection, medium green talk and green help	0.054	-0.008	-0.008	-0.160	0.165**	-0.050	0.256***
	(0.038)	(0.124)	(0.034)	(0.121)	(0.066)	(0.052)	(0.089)
Observations	692	607	596	659	688	595	555

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; the models include controls in Table 10 and regional dummies

Table 9: OLS Model for SATISFACTION

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Coworkers							
Strong connections, medium green talk, high green help	0.790***				0.831***	0.657***	0.703***
	(0.180)				(0.183)	(0.184)	(0.187)
Medium connections, high green talk, medium green help	0.023				0.089	0.091	0.169
	(0.271)				(0.289)	(0.293)	(0.308)
Neighbors							
Strong connections, medium green talk, high green help		0.770***		0.755***		0.502***	0.482***
		(0.138)		(0.140)		(0.173)	(0.177)
Medium connections, high green talk, medium green help		-0.120		-0.105		-0.408	-0.426
		(0.240)		(0.243)		(0.312)	(0.315)
Family							
Strong connections, low green talk and green help			0.156	0.152	0.059		-0.024
			(0.254)	(0.264)	(0.310)		(0.321)
Strong connections, high green talk and green help			0.200	0.063	-0.038		-0.097
			(0.250)	(0.260)	(0.325)		(0.333)
Weak connection, medium green talk and green help			-0.117	-0.188	-0.246		-0.346
			(0.304)	(0.314)	(0.376)		(0.385)
Observations	1624	2230	2262	2126	1556	1554	1487

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
The models include controls in Table 10 and regional dummies

Appendix

Latent Cluster Models: Data and Results

Table A1: Indicators of Family Networks (N = 2,528)

Question	Indicator	Frequency
Ties		
How many of your relatives live within an hour's drive of your home?	Many Family	
• Many or Some	Many Family = 1	57.69
• A few or None	Many Family = 0	42.31
How often do you see any of these relatives?	Frequent Family	
• every day or almost every day or once a week	Frequent Family = 3	27.65
• almost every week or once or twice a month	Frequent Family = 2	40.08
• a few times a year or less often	Frequent Family = 1	32.27
Any of three closest friends is a family member (spouse/partner or other relative)	Friend Family = 1	58.81
Pro-Environment Norms		
Please tell us how many of the following people [Family members] you think do things to help the environment	Help Family	
• Most of them	Help Family = 1	17.45
• Some of them, Few of them, None of them, or Don't know	Help Family = 0	82.55
How often do you discuss with Family members ➢ ways to conserve gas, energy, and water ➢ environmental problems such as water pollution and air pollution ➢ ways to slow down global warming	Talk Family	
• All topics Several times a week, Once or twice a week, or A few times per month	Talk Family = 3	15.87
• Two of the topics Several times a week, Once or twice a week, or A few times per month	Talk Family = 2	18.57
• One of the topics Several times a week, Once or twice a week, or A few times per month	Talk Family = 1	24.36
• None of the topics Several times a week, Once or twice a week, or A few times per month	Talk Family = 0	41.20

Table A2: Indicators of Neighbor Networks (N = 2,504)

Question	Indicator	Frequency
Ties		
How many neighbors do you know and talk to regularly?	Many Neighbor	
• Many or Some	Many Neighbor = 1	35.80
• A few or None	Many Neighbor = 0	64.20
To what extent do [Neighbors] provide you with a sense of community or feeling of belonging?	Belong Neighbor	
• A lot	Belong Neighbor = 1	20.85
• Some or A little or Not at all	Belong Neighbor = 0	79.15
Generally speaking, how much do you trust: Neighbors	Trust Neighbor	
• A lot	Trust Neighbor = 1	37.29
• Some or Only a little or Not at all	Trust Neighbor = 0	62.71
Any of three closest friends is a neighbor	Friend Neighbor = 1	15.68
Pro-Environment Norms		
Please tell us how many of the following people [Neighbors] you think do things to help the environment	Help Neighbor	
• Most of them	Help Neighbor = 1	7.27
• Some of them, Few of them, None of them, or Don't know	Help Neighbor = 0	92.73
How often do you discuss with Neighbors ➢ ways to conserve gas, energy, and water ➢ environmental problems such as water pollution and air pollution ➢ ways to slow down global warming	Talk Neighbor	
• All topics Several times a week, Once or twice a week, or A few times per month	Talk Neighbor = 3	5.15
• Two of the topics Several times a week, Once or twice a week, or A few times per month	Talk Neighbor = 2	7.31
• One of the topics Several times a week, Once or twice a week, or A few times per month	Talk Neighbor = 1	10.99
• None of the topics Several times a week, Once or twice a week, or A few times per month	Talk Neighbor = 0	76.55

Table A3: Indicators of Coworker Networks (N = 1,827)

Question	Indicator	Frequency
Ties		
To what extent do [People at work] provide you with a sense of community or feeling of belonging?	Belong Work	
• A lot	Belong Work = 1	27.41
• Some or A little or Not at all	Belong Work = 0	72.59
Generally speaking, how much do you trust: People at work	Trust Work	
• A lot	Trust Work = 1	28.61
• Some or Only a little or Not at all	Trust Work = 0	71.39
Any of three closest friends is a coworker	Friend Work = 1	25.37
Pro-Environment Norms		
Please tell us how many of the following people [People at work] you think do things to help the environment	Help Work	
• Most of them	Help Work = 1	8.15
• Some of them, Few of them, None of them, or Don't know	Help Work = 0	91.85
How often do you discuss with People at work ➢ ways to conserve gas, energy, and water ➢ environmental problems such as water pollution and air pollution ➢ ways to slow down global warming	Talk Work	
• All topics Several times a week, Once or twice a week, or A few times per month	Talk Work = 3	11.27
• Two of the topics Several times a week, Once or twice a week, or A few times per month	Talk Work = 2	11.25
• One of the topics Several times a week, Once or twice a week, or A few times per month	Talk Work = 1	16.97
• None of the topics Several times a week, Once or twice a week, or A few times per month	Talk Work = 0	60.51

Table A4: Latent Cluster Models, Fitness Statistics

Model	Log-Likelihood	BIC	Parameters
Family			
1-Cluster	-10616.0948	21294.8267	8
2-Cluster	-10417.8954	20945.4055	14
3-Cluster	-10349.2221	20855.0368	20
4-Cluster	**-10304.7821**	**20813.1346**	**26**
5-Cluster	-10297.6642	20845.8765	32
Neighbors			
1-Cluster	-8250.5627	16563.6921	8
2-Cluster	-7700.8497	15519.0120	15
3-Cluster	**-7650.9950**	**15474.0484**	**22**
4-Cluster	-7635.1624	15497.1293	29
5-Cluster	-7618.3324	15518.2152	36
Coworkers			
1-Cluster	-5696.1620	11444.8663	7
2-Cluster	-5472.0995	11041.7775	13
3-Cluster	**-5435.5741**	**11013.7631**	**19**
4-Cluster	-5427.3143	11042.2797	25
5-Cluster	-5419.5446	11071.7765	31

Table A5: Conditional Probabilities of Four-Class Model for Family Indicators

	Class 1	Class 2	Class 3	Class 4
Class Size	0.3646	0.3004	0.1860	0.1491
Indicators				
Many Family	0.7691	0.6573	0.2341	0.3724
Mean of Frequent Family	2.4309	2.3567	1.0232	1.1369
Friend Family	0.5835	0.6608	0.6370	0.3921
Help Family	0.0009	0.3858	0.2840	0.0367
Mean of Talk Family	0.6812	1.8214	1.5034	0.1075

Table A6: Conditional Probabilities of Three-Class Model for Neighbor Indicators

	Class 1	Class 2	Class 3
Class Size	0.5736	0.2513	0.1752
Indicators			
Many Neighbor	0.1578	0.7089	0.5100
Friend Neighbor	0.0391	0.3019	0.3341
Belong Neighbor	0.0056	0.6108	0.2960
Trust Neighbor	0.2124	0.9809	0.0264
Help Neighbor	0.0154	0.1827	0.1024
Mean of Talk Neighbor	0.1042	0.6390	1.0859

Table A7: Conditional Probabilities of Three-Class Model for Co-worker Indicators

	Class 1	Class 2	Class 3
Class Size	0.6307	0.1960	0.1732
Indicators			
Friend Work	0.1797	0.4270	0.3267
Belong Work	0.0771	0.8637	0.3240
Trust Work	0.1545	0.8229	0.1579
Help Work	0.0059	0.2602	0.1546
Mean of Talk Work	0.3504	0.7395	2.1176

Table A8: Latent Cluster Models, Summary of Network Characteristics

Coworkers		Class Size
Class 1	Weak connections, low green talk, low green help	63.07%
Class 2	Strong connections, medium green talk, high green help	19.60%
Class 3	Medium connections, high green talk, medium green help	17.32%
Neighbors		
Class 1	Weak connections, low green talk, low green help	57.36%
Class 2	Strong connections, medium green talk, high green help	25.13%
Class 3	Medium connections, high green talk, medium green help	17.52%
Family		
Class 1	Strong connections, low green talk and green help	36.46%
Class 2	Strong connections, high green talk and green help	30.04%
Class 3	Weak connection, medium green talk and green help	18.60%
Class 4	Weak connection, low green talk and green help	14.91%