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P. Brañas-Garza
N. Jiménez
R. Cobo-Reyes
J. Kovárík
M. P. Espinosa
G. Ponti

Quadeni deit

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Inequity Concerns in Social Networks*

Pablo Brañas-Garza†
Universidad de Granada

Ramón Cobo-Reyes
Universidad de Granada

María Paz Espinosa‡
Universidad del País Vasco

Natalia Jiménez
Universidad de Granada

Jaromír Kovářík§
Universidad de Alicante

Giovanni Ponti
Universidad de Alicante and Università di Ferrara

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Abstract

This paper explores the role of social integration on inequity concerns. Using a three-phase experimental protocol we first elicit a social network from a group of undergraduate students in Economics; in the second phase, 169 of these subjects have to assign a fixed amount of money to only one of two individuals and, then, in the third stage they decide how much they are willing to pay to "repair" the created inequality. Our experimental data indicate that standard measures of network theory, such as betweenness, out-degree and reciprocal degree, have a positive effect on inequity concerns. These results suggest that (1) pro-sociality and social networks coevolve and (2) information on the social network structure, in which subjects are embedded is important to account for their behavior.

1 Motivation

It is well documented that humans tend to behave cooperatively towards other unknown individuals. It has been observed though that the level of social concern itself depends on several factors. Some of these factors affecting the level

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†Pablo Brañas-Garza, Ramón Cobo-Reyes, and Natalia Jiménez, Universidad de Granada, Dept. de Teoría e H. Económica, Fac. C. Económicas, Campus de la Cartuja s/n, E-18011 Granada, Spain.

‡Universidad del País Vasco, Dept. de Fundamentos del Análisis Económico II, Avda. Lehendakari Aguirre 83, E-48015 Bilbao, Spain.

§Jaromír Kovářík and Giovanni Ponti, Universidad de Alicante, Dept. de Fundamentos del Análisis Económico, Campus de San Vicente, E-03080 Alicante, Spain.

of unselfishness, such as repeated interaction, reputation and strong reciprocity among others, are now well understood (Fehr and Camerer (2006), Fehr and Fischbacher (2003), Fehr and Gachter (2002), Rabin (1993)). However, there remains a level of cooperation that apparently cannot be explained by any of these variables.

This paper adds a new dimension to this discussion by exploring the role of social integration on inequity concerns (Fehr and Schmidt (1999) and Bolton and Ockenfels (2000)). Recently, a number of experiments have focused on several social aspects, such as the degree of anonymity among experimental subjects and between subjects and the experimenter, mainly in the framework of Dictator and Ultimatum Games (Bohnet and Frey (1999), Brañas-Garza (2006), Burnham (2003), Charness and Gneezy (forthcoming)). This literature unambiguously shows that the smaller the (social) distance between the parties involved, the larger the social concern. This evidence notwithstanding, to the best of our knowledge little attention has been paid to social network relationships to explain the pro-social behavior.[1]

Brañas-Garza *et al.* (2006a) explore whether the social network in which experimental subjects are embedded, is related to their attitude to give. They report that, on average, more central (i.e. highly integrated within the network) players give more in a classic experimental protocol of the Dictator Game. Thus, they provide evidence that the pure altruism of an individual is positively related with her centrality in the network measured by betweenness, although their results concerning other measures of centrality are not conclusive.

To provide a (statistically) stronger evidence, we analyze in a larger sample the relationship between the social network position of individuals, measured by three classic measures of network theory, and their inequity concerns. The experimental evidence suggests that network centrality enhances inequity aversion. Moreover, we find a positive relation between the revealed inequity aversion and both the number of stated and reciprocated links. These relations between the network position and inequity concerns are highly significant.

2 Experimental Design

We use the experimental data in Brañas-Garza *et al.* (2005), who study inequity concerns in different situations. Their experiment was conducted at the University of Granada (Spain) in May 2005. Subjects were first-year undergraduate students in Economics. The possibility to participate in an experiment was announced in class to first year students. Since a list of friends for each subject was needed, it was more likely to find it within the same class. However, participation was voluntary. Students wishing to participate were invited to go to

[1] Notable exceptions are Mobius *et al.* (2004) and Goeree *et al.* (2006). See Brañas-Garza and Espinosa (2006) for a review. There is also a stream of evolutionary literature that shows that spatial structures may enhance the proliferation of unselfish behavior (Nowak (2006), Fosco and Mengel (2007) and Marsilli *et al.* (2004)). Nevertheless, this literature does not provide any evidence that unselfishness and social networks coevolve.

a nearby room. The data contain both social network position and a measure of inequity concern from 169 individuals.

The experiment was run in three stages: In the first phase, a "Benefit-your-Friend" Incentive Device for Network Elicitation was used to elicit the (directed) social network.[2] The protocol for network elicitation was extremely simple: subjects were asked to write down on a piece of paper the name of their classmate friends who "may have the chance to be benefited later in the experiment". Since they aimed the subjects to reveal the identity of their closest friends, the instructions clearly stated that they might be given the chance to benefit only one of the friends, randomly chosen from their list, so that the more friends they had listed, the lower the chance of benefiting any particular individual. Despite its simplicity, they obtained an average of 50.1% of corresponded links, which is a very accurate mapping of social correspondences when compared with more sophisticated protocols used for analogous purposes (Mobius *et al.* (2004)).[3]

In the second phase subjects had to decide the assignment of 10 units of experimental currency (EC) to one of two subjects.[4] The purpose of this stage is to create an inequality, since one of the two recipients gets 10 EC, while the other gets nothing. In one treatment condition, the deciding player is one of the two recipients. Thus, this treatment has a feature of the Dictator Game, where a player decides the distribution of payoffs between herself and another player. The difference with respect to the traditional Dictator Game is that she can either keep *all* for herself or give *the whole amount* to the other player.[5] In the second treatment, the deciding player is not a recipient; she decides the assignment to one of two individuals, again giving the whole amount to one of them, but her payoff is not involved. In each of the two conditions, there were two frames: stranger and friend. The other player(s) is (are) either a randomly assigned stranger(s) (individual(s) that she had not listed in the first phase) or a randomly assigned friend(s) from her stated links.[6] This creates a $2 \times 2 = 4$ factorial design. Table 1 shows the number of observations in each treatment.

Insert Table 1 around here.

To deal with the treatment differences, in the treatment where the deciding

[2] See Brañas *et al.* (2007) for a discussion of network elicitation mechanisms.

[3] Part of the non–corresponded links were due to the fact that some students in the class list were absent and could not correspond.

[4] The experimental currency were classpoints that served to increase the final grade in the Microeconomics course. This experiment was the first out of four different experiments and the payoff system was as follows: The best performing subject in the four experiments earned 3 points in grade out of 10. In other words, the winner earned 30% of the final grade of the course. The remaining subjects' earnings depend on how close their performance is to the winner. Each of the four experiments weighed equally in the final count. Thus, the winner could have earned 7.5% of the final grade of the course by the perfomance in this experiment.

[5] This game can be consider as a Dictator Game in which players take a binary decision, (10,0) or (0,10).

[6] More precisely, in the treatment where the subject decides whether to keep 10 EC for herself or give it to someone else, friend (stranger) frame means that the other person is (not) her friend. When deciding the assignment between two other individuals, friend (stranger) frame means that both are friends (strangers).

agent's payoffs are not involved in the game, she received a show-up fee of 10 EC to be used in the second stage, as described below, for the reduction of the created inequity. This design feature ensures that all deciding subjects have 10 EC at the beginning of the following stage.[7]

Third stage served to extract individuals' attitudes towards inequity. After taking their decisions in the previous phase, subjects are given the possibility to reduce the created inequity. They have to state how much they were willing to pay for the person that has *not* been given anything to receive 10 EC as well. The decision was taken using a payment card. Subjects faced ten different situations with the following structure:

> "I am willing to pay 1 EC in order to give the other player the opportunity of obtaining 10 EC"
> "I am willing to pay 2 EC in order to give the other player the opportunity of obtaining 10 EC"
> ...
> "I am willing to pay 10 EC in order to give the other player the opportunity of obtaining 10 EC"

Subjects' task in this stage was only to mark the options individuals are willing to accept. Only one of their decision randomly selected would be implemented.[8] Since the amount subjects are willing to pay reflects how much subjects value equity, this serves as a measure of individual inequity aversion. Subjects did not know in advance they would face this decision.

3 The Analysis

To obtain the inequity concerns of individuals we used data from the four treatments. Thus, as a first step, we need to homogenize the measures of inequity aversion. For each i, we construct the following measure of inequity concerns:

$$ineq_i = wtp_i - \widehat{wtp}_i$$

where wtp_i is i 's willingness-to-pay to reduce the created inequality, as described in previous section, and $\widehat{wtp}_i$ is the median willingness-to-pay of the treatment i participates in. Observe that the subtraction of the corresponding medians gets rid of the possible treatment differences. With this variable in hand, we can pool all the observations into one dataset. Figure 1 shows the distribution of the constructed variable.

Insert Figure 1 around here.

[7] Note that deciding subjects, whose payoffs were involved in the decision, have not received the show-up fee. Thus, individuals, who gave the whole amount to their partners, did not have the opportunity to reduce the created inequality and are excluded from the analysis of this paper.

[8] This information was known to all participants in the experiment.

The majority of subjects are as inequity concerned as the median of their group and the distribution roughly resembles normal distribution.

We apply standard measures in network theory to test our working hypothesis that individuals' inequity concerns are (positively) correlated with their social integration. Among the classic measures provided by the literature, we focus on three of them, *betweenness centrality*, *out-degree*, and *reciprocal degree*. Loosely speaking, betweenness centrality of individual i measures the number of shortest paths through i between any pair of subjects. Hence, betweenness is an index which measures centrality of individual i through the impact on the connection structure if i were removed from the network. Another measure of centrality is out-degree, which measures the number of stated links of individual i. Thus, out-degree is the level of individuals' subjective popularity in the network. A third measure is reciprocal degree, the number of bidirectional links. In terms of our experiment, reciprocal degree is the number of a subject' friends who listed him as a friend. Table 2 summarizes these measures in our data.[9]

Insert Table 2 around here.

Table 3 explores the effect of the discussed measures of social integration on revealed inequity concerns. We estimate a standard ordered Logit regression, in which the probability of any possible level of inequity concern is regressed against one of the discussed measures of social integration, and gender.[10] The p-values of the estimated coefficients suggest that social integration matters in explaining the inequity concerns of individuals. The effects are positive and significant at 5% level. The estimations lead to the following conclusions:

- Betweenness has a positive effect on the level of inequity. Moreover, the effect is statistically very strong ($p = 0.010$).
- The estimate of perceived popularity, measured by out-degree, suggests a positive, statistically highly significant impact (the odd ratio is 1.335 and $p = 0.003$).
- The reciprocal degree affects the inequity concerns as much as out-degree (odd ratio is equal to 1.260), but the relation is less significant ($p = 0.047$), even though still significant at 5%.

In sum, the regression analysis provides evidence that individuals who are more socially integrated in their social network tend to be more inequity concerned with respect to the median behavior.

[9] We also estimated the effect of degree and in-degree. Degree abstracts from the direction of the links. This measure also has a significant positive effect. In-degree of individual i is interesting in that it is an outcome of decisions of other individuals. The estimated effect confirms the positive relation between social integration and inequity concerns, but is not significant on traditional 5%.

[10] We observe no gender effect in the regressions.

4 Discussion

This paper explores a new aspect on the determinants of pro-social behavior: social integration. Most of previous experimental literature has focused on economic incentives, reputation effects, framing or between-subject relations, and these factors have been shown to be important for pro-social behavior. The puzzle is that, even when all these factors have been accounted for, there is still some human cooperation that remains unexplained. Some work has pointed to socialization and cultural transmission of social values as a solution to this puzzle. There is experimental evidence with children, showing that younger children are less generous/cooperative in the Dictator/Public Good Games (Harbough *et al.* (2003), Kraus and Harbaugh (2000)). These results could be due to the fact that older children are more advanced in their socialization process and as a consequence, they show a more pro-social behavior. Along these lines, our research explores the idea that social integration may also be an important determinant for inequity concerns. Note that this hypothesis is consistent with the evidence on children playing the Dictator Game since older children also have, on average, a higher level of social capital. However, since socialization and transmission of values is a more complex process, rather than just social capital accumulation, we test our hypothesis with subjects at the same stage of the socialization process but, nonetheless, with different positions in their social network. In line with these arguments, in our data social integration is related to inequity concerns.

Our results unambiguously show that the social network architecture has to be included within the list of determinants of human behavior. Social structure and human prosociality, represented by inequity concerns in our study, indeed coevolve as suggested by evolutionary literature.

On the other hand, our data does not provide an answer to an important question: Are subjects (on average) more inequity concerned because they are pivotal and well connected in their social network, or rather they are socially integrated precisely because they show (for whatever reason) a more socially concerned attitude toward the rest of the group?[11] To answer this question, a more detailed investigation on which (demographic, social or psychological) characteristics are correlated with our network measures would be useful.

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[11] Note that the statistical exercise of Table 3 fixes a causal relation between inequity concerns and social integration, with network theory measures as regressors. This is consistent with the fact that the subjects' decision on how much to pay to avoid inequity is made after the network elicitation and, most likely, we can consider the elicited social network already well established at the time subjects had to make their contribution decision.

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	stranger	friend	Total
player involved	28	27	55
player not involved	64	50	114
Total	92	77	169

Table 1. Number of observations per treatment.

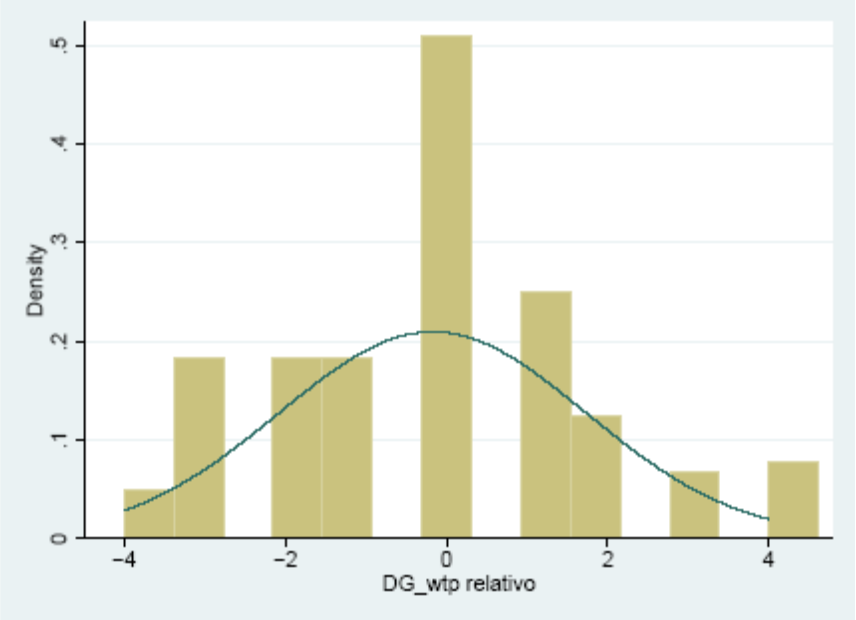

Figure 1. Histogram of the variable *ineq*.

Variable	Obs.	Mean	Std.Dev.	Min	Max
$between ness$	169	574.08	1011.47	0	6224.62
$out - degree$	169	2.19	1.46	0	6
$reciprocal$	169	1.27	1.17	0	5

Table 2. Summary of measures of social integration.

	Model 1	Model 2	Model 3
$between ness$	.0003373** (.0001312)	-	-
$out - degree$	-	.2891732** (.0965542)	-
$reciprocal$	-	-	.2310941* (.1161662)
$female$	−.370347 (.2787557)	−.3957274 (.2827263)	−.3379402 (.2813517)
N	169	167	167
Wald χ^2_2	7.33	10.00	4.86
P $> \chi^2_2$	.0256	.0067	.0882
Pseudo R^2	.011	.0152	.0074

Significance level: ** 1%, * 5%. Standard errors in parentheses.

Table 3. Estimation Results.