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## Gender differences in social interactions

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## ABSTRACT

We study how the random assignment of new students to introductory-week groups shapes subsequent friendship networks. Both women and men report being much more likely to be friends with same-gender students with whom they were (randomly) assigned in a group during their first week on campus, and the effect is much stronger for women. When students from the same cohort play a repeated trust game in the experimental laboratory, their behavior helps explain what we observed in the field. Women display more stability and less flexibility than men in their interactions with individuals with whom they had previously played. This difference is enough to generate homophily in the observational data even though subjects show no intrinsic preference for same-gender interaction.

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## 1. Introduction

This paper explores differences between men and women in the formation of social networks. Such networks are important in modern life: they influence where we are hired, with whom we collaborate, and how our careers evolve (Cingano and Rosolia, 2012; Schmutte, 2014; Zimmerman, 2019; Ductor, 2015; Goyal et al., 2006; Berardi et al., 2019). A rich case study literature suggests that women tend to have smaller social networks than men and that women's networks feature more strong links and fewer weak links Booth, 1972; Moore, 1990; Benenson, 1993; Baumeister and Sommer, 1997; Friebel and Seabright, 2011. According to Granovetter (1973, 1995), weak links are often more useful in contexts like job search where acquaintances' greater ability to provide novel information outweighs their lesser motivation to provide support and help.

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Moreover, recent evidence suggests that women and men leverage their networks differently (Mengel, 2020; Beaman et al., 2018; Zeltzer, 2019) and obtain different work-related benefits because of different network structures (Lindenlaub and Prummer, 2020; Lalanne and Seabright, 2016; Neugart and Zaharieva, 2018; Yang et al., 2019). Differences in men's and women's social networks may therefore be key in understanding gender differences in career outcomes and may complement existing explanations of the persistent gender gap in labor market outcomes (see Bertrand, 2011 for a survey).

This paper investigates gender differences in preferences for social interactions that may underlie observed differences in the structure of men's and women's social networks. We report on both a field experiment on the formation of real friendship networks and a laboratory experiment with the same cohort that seeks to elucidate potential drivers of the network formation we observe in the field.

Our field experiment exploits the fact that, at Goethe University, Frankfurt, student newcomers are randomly assigned to introductory-week groups in which they interact for their first week on campus. As most students have moved away from home to study at university, they have few if any pre-existing social contacts on the campus. We therefore expect their initial experiences to have a strong formative effect on their later networks of friends, and are curious to see whether men and women react differently to these initial experiences.

Looking at friendship networks several months later, we find a greater dependence of women's networks on the individuals with whom they were randomly matched in the initial assignment. While two men who had been assigned to the same introductory group are two-and-a-half times more likely both to report a subsequent friendship than two men who were in different groups, two women from the same group are *five times* more likely both to report a subsequent friendship than two women who were in different groups.

The field experiment was designed to avoid creating gender differences in the structure of network formation purely through gender differences in the composition of initial groups. Students were randomly assigned to *gender balanced* introductory groups. This meant that although there was exogenous variation in the particular set of potential acquaintances to which each student was initially exposed, there was no significant difference in the proportion of men and women in these groups. This assures us that any eventual differences in the choices of our subjects to form friendships with other men or with other women would not be the result of differences in the opportunities to do so.

To cast light on potential reasons for the observed gender differences in the evolution of friendship networks we conducted a laboratory experiment. Because the central feature of our field experiment was that initial encounters between subjects shaped later interactions, the experiment featured a modified trust game that allowed for the experience of a first round to inform choices of partners in a second round.

Our use of a trust game was meant to capture the reciprocal nature of friendship networks. In particular, network connections have to be reciprocal if they are to be of any value. Individuals may have to make investments of time, emotional energy, economic resources or even exposure to significant personal risk in order to establish connections. Yet they cannot find out whether their investments will be reciprocated until they are sunk, so that reliance on the trustworthiness of others is unavoidable.

Subjects in the experiment played the trust game in two rounds. In the first round, a sender could choose to send any amount of tokens from an initial endowment to an anonymous receiver. The amount sent was then tripled by the experimenters, and the receiver could return any sum from the tripled amount received.

In the second round, and after observing the results from the first, subjects decided how much to allocate from a new endowment to themselves, the former partner and a new anonymous partner. Subjects knew that there would be a second round of a game, but they discovered the nature of this second round only after playing the first, so they had no reason to incorporate strategic considerations into their first round play. Each subject played the role of both sender and receiver simultaneously with each partner in each round.

We find systematic differences between the choices of men and women in the trust game. Women respond differently than men to the amounts returned to them by former partners - in particular, in the second round, they send significantly more than men to former partners who did not return them very much, while sending much less than men to former partners who returned them large amounts (we call these two groups "low reciprocators" and "high reciprocators" respectively). Men send more in the first round but are relatively intolerant in the second round of partners who had returned less to them. In particular, men are more likely than women to send zero to a former partner, both unconditionally and particularly so if this partner was a low reciprocator.

Over time, these differences could generate homophily in friendship networks even if neither men nor women have an intrinsic homophily preference (indeed we find no evidence of such an intrinsic preference in our data). Men are much more likely than women to respond to low reciprocation by sending little or nothing in the second stage - and given the lower average rate of reciprocation of women, this will disproportionately tend to weaken their network links with women. So over time women would reinforce their relationships with women but their relationships with men would weaken. Men would have stable relationships with some of their male partners (the high reciprocators) but at a lower proportion than women with their female partners.

These results are therefore in line with what we observed in the field and suggest that the greater reliance on early encounters in women's friendship networks may be explained by women's greater tendency to be trusting of familiar rather than new partners. Women's relationships are hence more stable (they are less sensitive to the old partner's actions) and less flexible, investing less in new relationships.

**Table 1**  
Descriptive statistics - Personal characteristics.

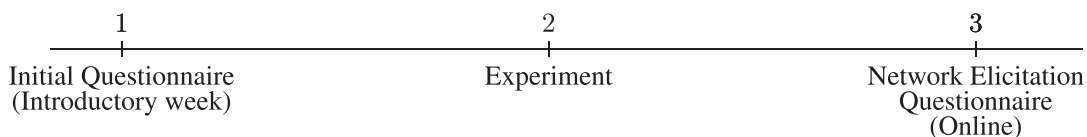
	Men			Women			Diff.	Std. Error
	Mean	Std. Dev.	N	Mean	Std. Dev.	N		
Age	20.571	2.481	196	20.448	2.236	145	0.123	0.261
Origin: Rhine Main Area	0.572	0.850	152	0.529	0.501	119	0.043	0.088
Risk Aversion Q	5.993	1.650	196	5.576	1.681	145	0.417*	0.182
Risk Aversion HL	5.719	1.414	196	5.744	1.456	145	0.024	0.157
Risk Aversion EG	3.278	0.673	196	2.656	0.738	145	0.622***	0.077
General Trust in other people	2.634	0.676	153	2.689	0.673	119	0.055	0.082
Rely on somebody else	1.922	0.757	153	1.958	0.785	119	0.036	0.094
Cautiousness upon strangers	3.039	0.751	153	3.218	0.727	119	0.179*	0.091

Note: The variable Risk Aversion HL is the switching point from the Holt and Laury test. For individuals with missing inconsistent data, we replace their switching point by the average switching point for women and men, respectively; the variable Risk Aversion Q is the chosen number from a scale from 1 (not prepared to take risks at all) to 10 (very prepared to take risks) from the questionnaire and, for individuals with missing data, we replace their number choice by the average number choice for women if the subject was a woman and similarly for men; the variable Risk Aversion EG is the chosen lottery from the Eckel and Grossman test and, for individuals with missing data, we replace their lottery choice by the average lottery choice for women and men, respectively. General trust in other people, relying on somebody else and cautiousness upon strangers are measured on a 4-points scale. Statistical significance levels: +  $p < 0.10$  \*  $p < 0.05$  \*\*  $p < 0.01$  \*\*\*  $p < 0.001$ .

Our results suggest that gender differences in the shape of social networks may be, at least in part, based on gender differences in preferences over social interactions. In particular, our findings imply that new opportunities for women to form connections are less likely to divert investments of time, energy and other resources from the maintenance of existing links than they are for men.<sup>2</sup>

## 2. Design of the study

Our study involves three stages (see the timeline below). An initial questionnaire was distributed to participants during their introductory week. The experiment took place two weeks after the initial questionnaire; its design is detailed in Section 4. The network elicitation questionnaire was sent to participants several months after the experiment; detailed information can be found in Section 3.



The participant pool consisted of two cohorts of students. The first cohort with 328 registered students was contacted in the summer term 2012, the second with 467 registered students in the winter term 2012/13.

During their respective introductory week, every student received a unique id and cover letter and was asked to respond to an initial questionnaire and to participate in a Holt and Laury (2002) risk elicitation task<sup>3</sup>. The questionnaire included questions on demographics, friendships and general trust and risky behavior.

Two weeks after the introductory week, students were invited to our experiment at the Frankfurt Laboratory for Experimental Economics (FLEX). In total, 128 (213) students of the first (second) cohort participated in the experiment<sup>4</sup>.

The online questionnaire used the survey system of the lab at Goethe University (FLEX - the Frankfurt Laboratory for Experimental Economic Research). Unique access codes were sent by e-mail and we incentivized participation by announcing that 10 people would be remunerated for their responses. We elicited their risk aversion using the Eckel and Grossman (2008a) lotteries and paid the 10 randomly drawn subjects according to their answer in that test. We obtain questionnaire data for 195 out of the 341 experimental subjects. Much of the paper focuses on these 195 subjects.

Table 1 provides some summary statistics. In line with the literature, we find that women are more risk averse than men. This is true for the Eckel & Grossman test, and for the questionnaire that participants filled in (measures Q and EG

<sup>2</sup> This does not imply anything about the relative economic rationality in general of women and men. Economic rationality is not the same as opportunism in seeking out new relationships; indeed it is well known that too much opportunism may be damaging to economic payoffs in the long run. However, in the context of modern labor markets, especially for senior appointments, the lesser openness of women's networks to new opportunities may constitute an economic disadvantage.

<sup>3</sup> In the first wave we chose 24 subjects to receive their actual payoff of the Holt and Laury (2002) lottery. On average, students that were paid earned 25.1 EUR. For the second wave we provided 5 EUR for every questionnaire participation and chose in total eight students to receive their actual lottery payoff. Subjects who were paid earned on average 25.6 EUR.

<sup>4</sup> Due to a programming error which incorrectly matched all participants with the same partner, we had to drop the data from one session, which corresponds to 22 subjects. Subjects in the first (second) wave of the experiment earned on average 11.2 EUR (11.5 EUR) for an experiment that lasted for around an hour.

**Table 2**  
Determinants of social connections.

Dependent variable:	Stated relationship	Stated friendship	Corroborated relationship	Corroborated friendship
<b>Independent Variables:</b>				
Different introductory group	0.269*** (0.0277)	0.149*** (0.0226)	0.127*** (0.0209)	0.0710*** (0.0164)
Female pair	0.0378 (0.0360)	0.0670* (0.0306)	0.0962** (0.0295)	0.109*** (0.0254)
Mixed gender pair	0.153*** (0.0305)	0.0899*** (0.0246)	0.0638** (0.0231)	0.0298 (0.0183)
Different introductory group*female pair	0.0441 (0.0361)	0.0704* (0.0307)	0.0968** (0.0295)	0.109*** (0.0254)
Different introductory group*mixed gender pair	0.145*** (0.0306)	0.0846*** (0.0246)	0.0607** (0.0232)	0.0274 (0.0184)
Controls	Yes	Yes	Yes	Yes
R <sup>2</sup>	0.144	0.0954	0.104	0.0823
Observations	21,630	21,620	21,630	21,610

Note: OLS estimation of Eq. (1) with multi-way clustering; standard errors in parentheses. *Stated relationship* is a dummy variable being 1 if subject *i* reported being friend or having an acquaintance with subject *j* and 0 otherwise; *Stated Friendship* is a dummy variable being 1 if subject *i* reported being friend with subject *j* and 0 otherwise; *Corroborated Relationship* is a dummy variable being 1 if both subjects *i* and *j* reported being friend or having an acquaintance with each other and 0 otherwise; *Corroborated Friendship* is a dummy variable being 1 if both subjects *i* and *j* reported being friends with each other and 0 otherwise. *Different introductory group* is a dummy variable being 1 if subjects *i* and *j* were in different introductory group and 0 otherwise; *Female pair* is a dummy variable being 1 if subjects *i* and *j* are both women and 0 otherwise; *Mixed gender pair* is a dummy variable being 1 with subjects *i* and *j* are of opposite gender and 0 otherwise. Controls include age, Rhine-Main origin, risk aversion (from a 10-points scale question), general trust in other people (from a 4-points scale question), rely on somebody else (from a 4-points scale question), cautiousness upon strangers (from a 4-points scale question), and cohort dummy. Significance levels: +  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

in the table). For the Holt & Laury test (HL) we do not find a significant difference. It should be noted that for the EG, a higher number means lower risk aversion, while for the HL a higher number means higher risk aversion. We chose to elicit several measures of risk aversion because the literature shows that none of them is perfect and we wanted to make sure our results do not hinge on one (imperfect) measure. Tables A7 and A8 in the Appendix show that results do not depend on the risk aversion measure included in the regression.

### 3. Social relationships in the field

Through the second questionnaire, we explore how these same subjects behave outside the laboratory. Students usually start the first university year with little, if any, social contacts at university.<sup>5</sup> The introductory week provides them with opportunities to meet other students, thereby forming a social network. Because students are randomly allocated to gender-balanced groups to undertake socializing activities, this provides a useful setting to investigate whether students assigned to the same group tend to maintain the relationships formed in the groups.

The online questionnaire asked about the extent of students' continuing connections to other students. Subjects were asked to write down a list of (maximum) 15 other subjects' names and note whether these relationships were with friends or acquaintances<sup>6</sup> In addition to distinguishing relationships by strength - friends vs acquaintances - we also distinguish relationships that are reported by just one of the parties from those that are corroborated, i.e., reported as such by both parties. Table A1 in the Appendix presents summary statistics on these reported relationships.<sup>7</sup>

Our key finding is shown in Fig. 1. It reports estimated probabilities of reporting various types of link (relationships and friendships, reported and corroborated) for pairs of subjects who were in different introductory groups and pairs who were in the same introductory group.<sup>8</sup> These probabilities are estimated controlling for a range of individual characteristics, following the specification in Eq. (1) below and presented numerically in Table 2 below. Our level of analysis is links rather

<sup>5</sup> As can be seen in Table 1, around half of subjects (who report it) come from the Rhine Main area. Exploiting the answers to a question on the number of inhabitants in their city of origin, gives an estimate of 12% of them being originally from Frankfurt.

<sup>6</sup> Out of 195 subjects, none reported 15 relationships. Two men reported 14 relationships. From Table A1, we see that there is no significant differences between men and women in the number of reported relationships (i.e. friends and acquaintances), while there are numerous other differences that are captured in the regression equation (1) and the resulting Table 2.

<sup>7</sup> From Table A1, we can compute the proportion of men in mens networks and the proportion of women in womens networks and compare it to 0.5 (the ratio of an equally balanced network, likely to be the case for our university cohorts). If we focus on corroborated relationships, these figures are 0.616 and 0.746 for men and women respectively on average. Following Currarini et al. (2009), both men and women display inbreeding homophily among our students. One can notice that the inbreeding homophily is slightly stronger for women than for men, again in line with the evidence from Fig. 1 and Table 2.

<sup>8</sup> Table A1 in the Appendix provides all such estimated probabilities.

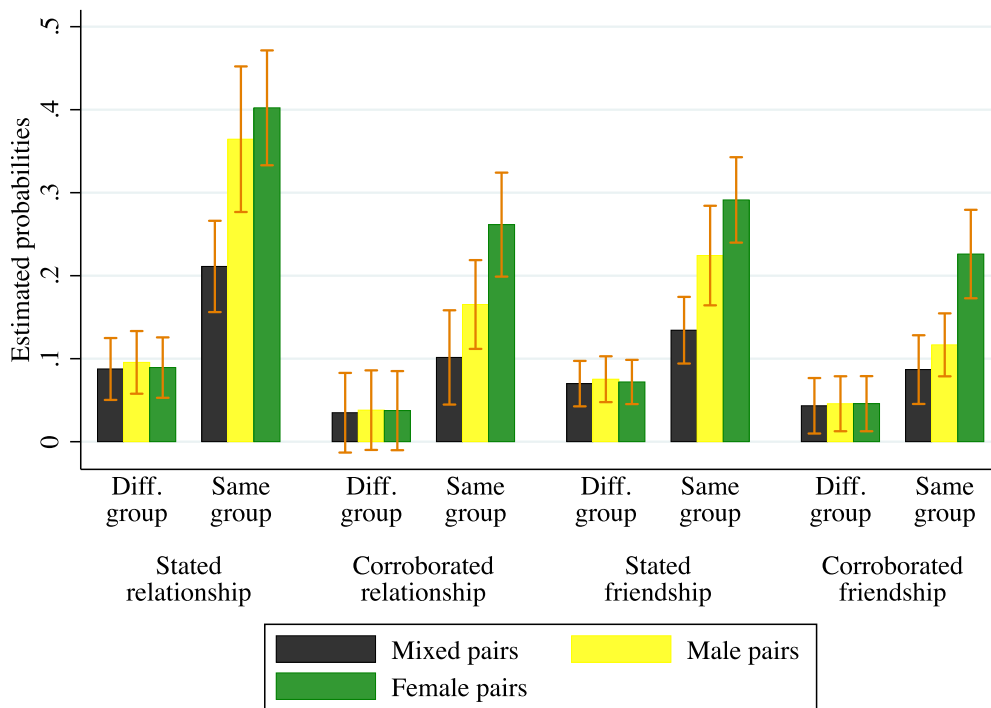


Fig. 1. Female pairs from same introductory group are more likely to report friendship.

than individuals, because we are not so much interested in how subjects differ between themselves but in whether potential relationships differ in their likelihood of becoming actual relationships depending on the history of how the individuals concerned have come across each other. Consider the hypothetical case in which all subjects had the same number of links; there would be no variation for an individual-level analysis to study. Nevertheless, women could still have links exclusively with members of their introductory group and men exclusively with people outside their introductory group, or vice versa. Making links the fundamental level of analysis has the advantage of clearly identifying such differences.

Fig. 1 shows no gender differences in the probabilities for pairs from different groups. While two men who had been assigned to the same introductory group are two-and-a-half times more likely both to report a subsequent friendship than two men who were in different groups, two women from the same group are *five times* more likely both to report a subsequent friendship than two women who were in different groups.<sup>9</sup>

Table 2 presents the same results in a table format. We estimate the following dyadic regression model:

$$\begin{aligned}
 Relationship_{ij} = & \gamma_0 + \gamma_1 Pair\_Characteristics_{ij} \\
 & + \gamma_2 Individual\_Characteristics_i \\
 & + \gamma_3 Individual\_Characteristics_j + \zeta_{ij}
 \end{aligned} \tag{1}$$

Here  $Relationship_{ij}$  is 1 if a relationship (reported or corroborated) exists and 0 otherwise. We distinguish the existence of any relationship (friendship or acquaintance), or, narrower, a friendship.<sup>10</sup>  $Pair\_Characteristics_{ij}$  includes dummies for different introductory group, gender of the pair (female or mixed), the interaction of different introductory group with gender of the pair, and cohort.<sup>11</sup>  $Individual\_Characteristics_i$  records several individuals characteristics: age, Rhine-Main origin (the region around Frankfurt), risk aversion, general trust in people, rely on somebody else, and cautiousness upon strangers

<sup>9</sup> Dividing the estimated probability of a corroborated friendship between two men from the same introductory group (0.11668286) by the estimated probability of a corroborated friendship between two men from different introductory groups (0.04571413) gives 2.55. Dividing the estimated probability of a corroborated friendship between two women from the same introductory group (0.22607787) by the estimated probability of a corroborated friendship between two women from different introductory groups (0.04576939) gives 4.94 (see Table A1 in the Appendix for the figures).

<sup>10</sup> Table A3 in the Appendix additionally presents regression results on (stated and corroborated) acquaintances.

<sup>11</sup> We control for whether the two individuals involved in the relationship belong to the first or second cohort. There is only one case in which a student from the first wave cited a student from the second wave and the reported relationship was corroborated. We exclude this observation from our sample.

variables elicited in the initial questionnaire.<sup>12</sup> Because individuals report several relationships and therefore dyadic observations are not independent, we use multi-way clustering in all regressions.<sup>13</sup>

First, we observe that the coefficient on the different introductory group dummy is negatively significant in all specifications. Any type of relationship is more likely to occur between any two students that were assigned to the same introductory group (the percentage point increase lies between 7.10 and 26.9, depending on the type of relationship considered). This is unsurprising but reassures us that the data are telling a believable story. The introductory groups created unique opportunities for students to interact with each other and build their networks of university contacts.

Second, the coefficient on the mixed gender pair dummy is significantly negative in all specifications, suggesting that two men are more likely to cite each other than one man and one woman<sup>14</sup> Networks of university contacts show some patterns of homophily (we discuss these later in Section 5). Moreover, in the last three specifications, we can observe that female pairs are significantly more predictive than male pairs of the existence of a relationship, especially if the relationship is a friendship or is corroborated by the partner (female pairs are between 6.7 and 10.9 percentage points more likely than male pairs to display a relationship).

Finally, and most interestingly of all, the coefficient on the interaction of the different introductory group with the female pair dummy is significantly negative in the last three specifications, almost exactly equal in absolute value to the uninteracted coefficient on the female pair dummy. Female pairs are much more likely than male pairs to develop friendships - and this effect is entirely due to women who were in the same introductory group, with no difference at all for female pairs from different introductory groups. Overall, while two men who have been randomly assigned to the same introductory group are two-and-a-half times more likely both to report a subsequent friendship than two men who were in different groups, two women from the same group are around five times more likely to do so.

In summary, therefore, the field experiment shows that there is:

- persistence (and therefore path-dependence) in the way in which friendships are formed over time;
- assortative matching by gender, to a substantially greater degree for women than for men;

with the result that relationships between women formed in the introductory week are more likely to demonstrate stable persistence, and to a greater degree the stronger are the relationships.

However, assortative matching is an equilibrium phenomenon and cannot be used to infer preferences for homophily. Homophilic preferences are one possible explanation. Mengel (2020) finds no evidence for women, but some for men. But assortative matching by gender could result from everybody preferring to match with women, or everybody preferring to match with men, or everybody preferring to match with individuals who have some attribute that is unevenly distributed by gender. It could also be generated by some other mechanisms - which is why, to understand what underlies our field results, we have to go to the lab.

We now turn therefore to the laboratory experiment - which uses the same subjects - to see whether it can cast light on the factors underlying the gender differences in the formation of these links.

#### 4. Laboratory experiment

The lab experiment which people participated in is meant to reflect, in a stylized way, the initiation of social relationships through a trust game. In particular, we investigate to what extent women and men, in a second round of a trust game, behave differently with respect to people they interacted with in a first round of the game, and to newcomers in the second round. We detail here the two stages of the experiment, as well as the different treatments we implemented.

*Stage one – Trust game with one partner:* Each subject is endowed with 10 tokens, where 1 token corresponds to 0.1 EUR. Subjects then make a decision in the role of a sender  $S$  of how much of the endowment she wants to allocate to her partner, the receiver  $R$ . Each token sent is tripled by the experimenter. Subjects are then also put in the role of the receiver and decide what to return to her partner for each possible amount her partner could have sent, i.e. we make use of the strategy method to elicit the back transfer of receivers (Brandts and Charness, 2000). Subjects in our experiment thus play two trust games simultaneously with the same partner: one as sender and one as receiver. Payoffs ( $\pi_i$ ) for stage 1 are:

$$\text{for the sender: } \pi_S = E_S - x_S + x_R$$

$$\text{for the receiver: } \pi_R = 3x_S - x_R$$

where  $E_S$  denotes the endowment of the sender and  $x_i$  the transfers of the players in their respective roles  $i \in \{S, R\}$ .

Afterwards, we ask subjects to state their beliefs about the back transfer of their partner in the role of the receiver. We incentivize this step in the following way. If the guess of the back transfer is precisely the amount back transferred, subjects

<sup>12</sup> We follow Fafchamps and Gubert (2007) and enter regressors in a symmetric fashion so that the effect of individual characteristics is the same on the relationship between  $i$  and  $j$  and on the relationship between  $j$  and  $i$ .

<sup>13</sup> In Table A4 of the Appendix we use Probit estimations instead of OLS estimations. Results are essentially unchanged. One coefficient though cannot be estimated with the Probit estimation because there is no occurrence of two women from different introductory groups reporting each other as acquaintances.

<sup>14</sup> A similar regression with the female pair dummy being the excluded category also shows that two women are more likely to cite each other than one man and one woman.



earn 8 additional tokens. If the guess is inaccurate by two (four) points, subjects receive 4 (2) additional tokens. Finally all guesses that vary by more than 4 points gain no additional tokens for the subject. In other words, the closer a subject's guess of the back transfer is to what was actually returned, the greater the additional payoff she earns.<sup>15</sup>

*Stage two – Trust game with an old and a new partner:* The details of the second stage are not anticipated by subjects (they were not deceived: they had not been told anything about what to expect after the first round). Subjects can play again with the previous partner and/or a new partner, i.e., they are matched in (overlapping) groups of three. Each subject first decides in the role of the sender whether she wants to keep her single stage 2 endowment of 10 tokens or whether she wants to allocate tokens to the old and/or the new partner. Both transfers are tripled by the experimenter. In the role of receiver, subjects choose how much they want to return to the old partner as sender, or the new partner as sender for each possible amount her partners could have sent. Payoffs  $\pi_i$  in stage 2 are:

$$\text{for the sender: } \pi_S = E_S - x_{S_{Old}} - x_{S_{New}} + x_{R_{Old}} + x_{R_{New}}$$

$$\text{for the old receiver: } \pi_{R_{Old}} = 3x_{S_{Old}} - x_{R_{Old}}$$

$$\text{for the new receiver: } \pi_{R_{New}} = 3x_{S_{New}} - x_{R_{New}}$$

where  $E_S$  denotes the endowment of the sender and  $x_i$  the transfers of the players, with

$i \in \{S_{Old}, S_{New}, R_{Old}, R_{New}\}$ . We again ask subjects about their beliefs regarding the back transfers of their old partner as receiver and their new partner as receiver. The incentives used for the belief elicitation are the same as in stage 1.

#### Treatments:

In addition to the baseline we describe above, we consider two treatments and their interaction. The purpose of these treatments is to explore whether men and women respond differently to the framing of the choice in a way that emphasizes it as a commitment, and whether subjects respond differently to partners of different gender.

Each subject played stages one and two in only one of the treatments i.e., we follow a between-subject design.

**1. Baseline** – In stage 1 of the experiment subjects simultaneously play two trust games, first in the role of a sender and thereafter as a receiver. In stage 2, this trust game is extended by a randomly assigned anonymous new partner. No additional information about the partners was given to the subjects.

**2. Salience** – In the salience treatment subjects are asked to state whether they want to send any tokens to the old and/or the new partner before being asked how many tokens they wish to transfer to each. If they answer “yes”, the amount they send has to lie above a threshold of 1. Since subjects are allowed to send zero token in the baseline treatment and can only send integer values of tokens, this choice in no way impacts on their action sets. All it does is to increase the salience of the distinction between sending something and sending nothing, and is therefore a pure framing treatment. The game played in the baseline experiment and in the salience treatment have identical payoffs.

**3. Revealed gender** – In the revealed gender treatment subjects receive information about their two stage 2 partners' gender and age as well as the year their partners started their studies. This information is provided before stage 2. Information other than gender was provided to limit experimenter demand effects that could arise from making it too obvious that we are interested in the gender dimension.

**4. Revealed gender plus salience** – This treatment combines both of the others.

## 5. Results from the laboratory

Given the finding that women who have interacted previously with other women are more likely to report subsequent corroborated friendships with them, the main interest of our laboratory experiment is to see whether our male and female subjects behave differently towards their old partners when, in the second round, they are given the opportunity to send some part of their endowment to a new partner.

Table 3 shows the effect of gender on the amount sent by subjects to their old partner.

Columns I and II show that there is a weakly significant negative effect of gender on the average amounts sent to the old partner, and essentially no effect when controlling for the different treatments. None of these treatments have a significant effect on the average amounts sent, either on their own or interacted with the gender of the subject<sup>16</sup> However, this does not mean that gender does not matter - far from it.

It turns out that gender matters a lot when interacted with the behavior of the old partner. Columns III to VI control for two measures of the partner's behavior - the amount that the partner sent in the first round, and the proportion of the amount sent to the partner that was returned by the partner. This latter variable is called the “partner's return rate”, and partners with a higher than median return rate are called “high reciprocators” while those with a lower than median return rate are called “low reciprocators”.

<sup>15</sup> In the empirical analysis, we exploit the full information by using, as a *beliefs measure*, the slope of the linear approximation of subjects' reported amounts. In the Appendix, we use as robustness check the *actual belief measure*, that is the amount subjects believe will be returned to them, given the amount they have actually sent to their partner. Results are essentially similar.

<sup>16</sup> Columns V and VI suggest that the salience treatment increases the amount sent to the old partner, though only for men. Table 4 suggests this effect is not very robust to alternative ways for measuring the former partner's degree of reciprocity.

**Table 3**  
Women are more likely to play with their old partner.

Dependent Variable:	Amount Sent to Old Partner					
	I	II	III	IV	V	VI
<b>Independent Variables:</b>						
Woman	-0.558+ (0.285)	0.418 (0.870)	1.566 (0.972)	1.737+ (0.950)	3.573** (1.363)	3.977** (1.307)
Salience Treatment		1.004 (0.716)	0.918 (0.640)	1.000 (0.625)	1.046+ (0.623)	1.228* (0.570)
Salience Treatment*Woman		-1.334 (1.034)	-1.275 (0.926)	-1.586+ (0.907)	-1.635+ (0.905)	-1.662* (0.829)
Revealed Gender Treatment		0.863 (0.729)	1.000 (0.653)	1.034 (0.637)	0.962 (0.637)	1.147* (0.582)
Revealed Gender Treatment*Woman		-0.653 (1.011)	-0.587 (0.908)	-0.629 (0.886)	-0.587 (0.885)	-0.695 (0.810)
Salience*Revealed Gender Treatment		-1.190 (0.863)	-1.156 (0.771)	-1.233 (0.753)	-1.166 (0.752)	-1.181+ (0.688)
Salience*Revealed Gender Treatment*Woman		0.583 (1.265)	0.526 (1.132)	0.770 (1.106)	0.657 (1.105)	0.824 (1.011)
Partner's Return Rate			5.589*** (0.757)	4.675*** (0.772)	4.597*** (0.770)	3.093*** (0.734)
Partner's Return Rate*Woman			-2.620* (1.195)	-2.313* (1.169)	-2.208+ (1.167)	-1.377 (1.114)
Partner's Amount Sent			0.145* (0.0560)	0.144** (0.0547)	0.137* (0.0547)	0.122* (0.0500)
Partner's Amount Sent*Woman			-0.0297 (0.0849)	-0.0288 (0.0828)	-0.0138 (0.0830)	-0.0377 (0.0768)
Amount Sent in First Stage				0.182*** (0.0439)	0.185*** (0.0437)	0.155*** (0.0402)
Risk Aversion					0.205+ (0.117)	0.192+ (0.107)
Risk Aversion*Woman					-0.333+ (0.177)	-0.272+ (0.162)
Beliefs						1.842*** (0.248)
Beliefs*Woman						-0.884* (0.381)
R <sup>2</sup>	0.0112	0.0266	0.232	0.270	0.279	0.401
Observations	341	341	341	341	341	341

Note: OLS estimations, standard errors in parentheses. *Salience treatment*, *Revealed Gender Treatment*, and *Salience\*Revealed Gender Treatment* are dummy variables being 1 if subjects were assigned to the corresponding treatments and 0 otherwise; *Partner's Return Rate* is the old partner's return rate in the first stage; *Partner's Amount Sent* is the old partner's amount sent in the first stage; *Amount Sent in First Stage* if the subject's amount sent in the first stage; *Risk Aversion* is the switching point from the Holt & Laury test; *Beliefs* is the slope of the linear approximation of amounts believed to be sent back to subjects from their old partner in the second stage. Significance levels: +  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

The amount sent by the partner in the first round has a positive effect on the amount sent to the partner in the second round, though the effect does not differ by gender. The partner's return rate has a large positive effect but one that is only about half as strong for women as it is for men (the difference being significant at the 5% level in columns III and IV).

This finding needs to be interpreted in the light of the positive coefficient on the uninteracted gender variable. This suggests that women are sending more than men to partners who are low reciprocators, and less than men to partners who are high reciprocators. Fig. 2 confirms this: it compares the amounts sent by men and women for two separate groups: those who faced low reciprocators and those who faced high reciprocators. Women in the former group send more than men (a difference significant at under 2%) while women in the latter group sent less than men (a difference significant at around 0.1%).

This phenomenon is particularly visible in the data when we control in Column IV for the amount sent by the subjects in the first round, which we interpret as an individual trait. Women's willingness to send more to former partners even when they had low return rates is even more striking when we note that women were reluctant to send much in the first round, and amounts sent in the first round are a good predictor of amounts sent to the old partner in the second round.

It is even more pronounced when we control in Column V for the risk aversion of the subject, even though the measures of risk aversion are only weakly significant at the 10% level for men and is of negligible magnitude for women. We interpret this to mean that since men are less risk averse than women we would expect them to send more to old partners independently of the amount received, so the fact that they send less is even more striking.

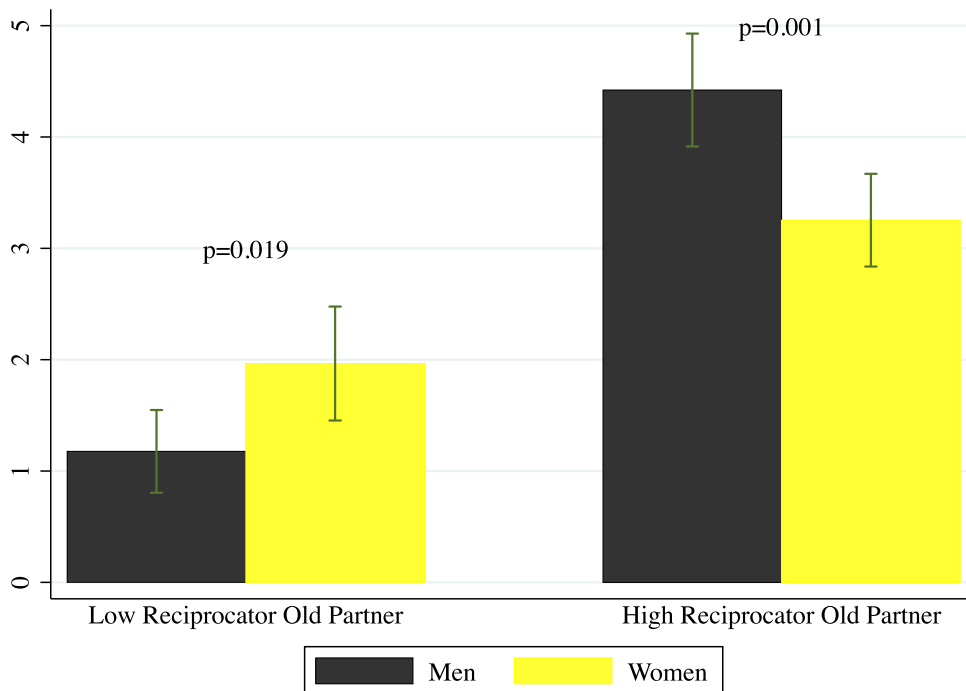
As things stand, we cannot interpret these gender differences in response to partners' behavior as reflecting different preferences of women compared to those of men. They could easily be due to different beliefs about the likely consequences of sending different amounts to their partners. We test for this possibility in Column VI, which controls for the subject's



**Table 4**  
Women are more likely to play with low reciprocator old partners.

Dependent variable:	Amount sent to old partner			
	I	II	III	IV
<b>Independent Variables:</b>				
Woman	0.224 (0.923)	0.115 (0.906)	1.928 (1.344)	2.732* (1.361)
Low Reciprocal Partner	3.039*** (0.352)	2.641*** (0.358)	2.596*** (0.358)	1.872*** (0.346)
Low Reciprocal Partner*Woman	1.727** (0.529)	1.563** (0.518)	1.493** (0.519)	1.071* (0.500)
Partner's Amount Sent	0.118* (0.0549)	0.119* (0.0537)	0.113* (0.0537)	0.104* (0.0495)
Partner's Amount Sent*Woman	0.0103 (0.0831)	0.00987 (0.0813)	0.00364 (0.0815)	0.0240 (0.0758)
<b>Controls:</b>				
All Treatments & All Treatments*Woman	Yes	Yes	Yes	Yes
Amount Sent in First Stage		Yes	Yes	Yes
Risk Aversion & Risk Aversion*Woman			Yes	Yes
Beliefs & Beliefs*Woman				Yes
R <sup>2</sup>	0.271	0.305	0.313	0.422
Observations	341	341	341	341

Note: OLS estimations, standard errors in parentheses. *Low Reciprocator Partner* is a dummy variable being 1 if the old partner's return rate in the first stage is less than the median and 0 otherwise; *Partner's Amount Sent* is the old partner's amount sent in the first stage; *Amount Sent in First Stage* is the amount sent by the subject in the first stage; *Risk Aversion* is the switching point from the Holt & Laury test; *Beliefs* is the slope of the linear approximation of amounts believed to be sent back to subjects from their old partner in the second stage. Significance levels: +  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .



**Fig. 2.** Women are less responsive to their old partner's behavior.

reported beliefs about the amounts they expect to receive. The impact of partner's return rate does seem indeed to work *in part* by influencing how optimistic subjects are about the amounts they will get back in the second round, but this is not the whole story. Column VI shows that women are also less likely to act on these beliefs, which shows that the main driver of women's lesser flexibility is not simply that women have different beliefs from those of men. In sum, if women not only respond less than men to how they were treated in the past, they also respond less to what they believe about

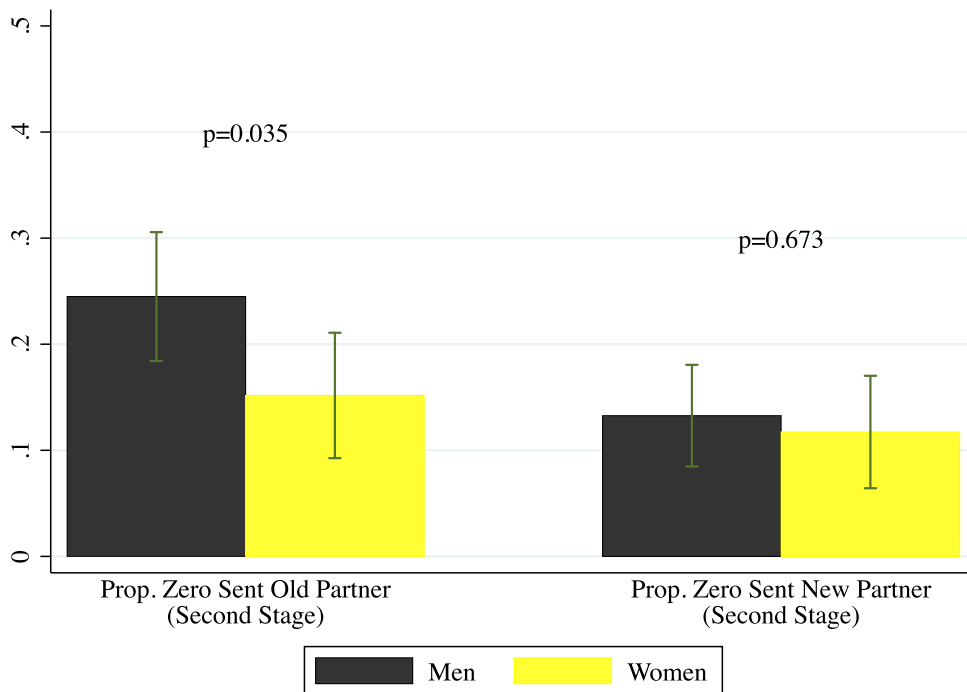


Fig. 3. Women send zero less often than men.

future reciprocity. It is worth noting also that including beliefs does not entirely remove the gender difference in the effect of the partner's return rate, though it loses statistical significance.

Next, we may ask whether women's lower responsiveness to their old partner's previous return rate is economically costly to them. Here, a simple back-of-the-envelope calculation shows that if the average woman responded to her partner's previous return rate like the average man, then her profits from the trusting decision would be 4.1 percent higher when she faces a low reciprocator and 7.1 percent higher when she faces a high reciprocator.<sup>17</sup>

Table 4 tests the robustness of specifications III to VI in Table 3 by replacing the variable "Partner's Return Rate" by a dummy variable for low reciprocator partners. This variable is massively negative and significant, and the interaction with the gender dummy is positive and significant at well over half the absolute value of the uninteracted coefficient. It remains significant at the 5% level even when controlling for subjects' beliefs about the amounts they expect to receive (column IV), though the coefficient's magnitude declines by around 30%, suggesting that gender differences in beliefs are indeed playing a role as well. In short, the amount sent by women is less than half as sensitive to the presence of a former partner who is a low reciprocator.

Another piece of evidence in line with women having a greater tolerance of low reciprocators among their old partners is that they send substantially fewer zeroes to their old partners than do men. Fig. 3 illustrates.

The Appendix contains a number of alternative specifications designed to explore robustness. Tables A5 and A6 reproduce Table 3 using Tobit and Poisson regressions respectively, and reveal qualitatively similar results. So do Table A7 and Table A8 which respectively reproduce Table 3 and Table 4 with other risk aversion and beliefs measures.<sup>18</sup>

Finally, we examine directly whether subjects show a preference for gender homophily when they are aware of the gender of the partner. In order to do so we must restrict the sample to those subjects who are in the revealed gender treatment and who are facing one man and one woman. Table 5 illustrates, using both the amount sent and the probability of sending zero as dependent variables that there is no evidence for homophily preferences, neither in general, nor for women, as the interacted variable shows.

In summary, although one of the most important predictors of the amount sent to an old partner is the return rate on sending to that partner in the first round, men and women respond very differently to that return rate. Women are much

<sup>17</sup> In this counterfactual, women would decrease the amount sent to a low reciprocator by 0.738 tokens and increase the amount sent to a high reciprocator by 1.230 tokens. Based on raw correlations between women's amount sent to their old partner and their profit from the trusting decision, the returns to these adjustments would be 0.358 and 0.750 tokens respectively.

<sup>18</sup> Our main estimations include the risk aversion measure from the Holt & Laury test and our robustness estimations use risk aversion measures from a 10-points scale question and from the Eckel & Grossman test. As for beliefs, our main estimations include the slope of the linear approximation of amounts believed to be sent back to subjects (elicited by the strategy method) and our robustness estimations use actual beliefs, that is the amount subjects believe will be returned to them, given the amount they have actually sent to their partner.

**Table 5**  
No intrinsic homophily preference in either amounts sent or probability of sending zero.

Dependent variable:	Amount sent	Amount sent	Zero sent	Zero sent
	I	II	III	IV
<b>Independent variables:</b>				
Woman	4.517* (1.942)	6.522** (2.288)	-0.382 (0.305)	-4.973 (5.139)
Old Partner is of Same Gender	-0.577 (0.557)	-0.777 (0.659)	0.0546 (0.0874)	0.250 (0.884)
Old Partner is of Same Gender*Woman	0.652 (0.805)	1.118 (0.918)	-0.181 (0.126)	-2.081 (2.274)
Partner's Return Rate	1.639 (1.376)	3.100+ (1.582)	-0.609** (0.216)	-5.488+ (2.929)
Partner's Return Rate*Woman	-0.164 (2.168)	-1.453 (2.455)	0.310 (0.340)	-6.660 (10.81)
Partner's Amount Sent	0.206* (0.0959)	0.285* (0.112)	-0.0291+ (0.0150)	-0.157 (0.182)
Partner's Amount Sent*Woman	-0.145 (0.142)	-0.171 (0.161)	-0.00590 (0.0223)	-0.294 (0.400)
Controls	Yes	Yes	Yes	Yes
Estimation	OLS	Tobit	OLS	Logit
R <sup>2</sup>	0.468		0.394	
LR Chi <sup>2</sup>		71.46		41.89
Observations	103	103	103	103

Note: Estimations based on the Revealed Gender Treatment sample. Standard errors in parentheses. *Old Partner is of Same Gender* is a dummy variable being 1 if the subject and the old partner are of same gender and 0 otherwise; *Partner's Return Rate* is the old partner's return rate in the first stage; *Partner's Amount Sent* is the old partner's amount sent in the first stage. Controls include the amount sent in the first stage, and risk aversion, beliefs and the salience treatment dummy and all their interactions with the woman dummy. Significance levels: +  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

more willing than men to send money to old partners who were low reciprocators, and much less willing than men to send money to old partners who were high reciprocators. Women appear to be more stable in their relationships in the lab, a pattern that we identified in the field data as well. While we cannot be sure that this behavioral tendency reflects an underlying preference for stability in interactions as such, it persists even when we controlled for differences in beliefs about the amounts subjects expect to receive in return. Given the anonymous nature of the interactions, it does not depend on other information about the partners, and can therefore be described as a systematic tendency that distinguishes the behavior of women in our sample from those of men.

Neither men nor women display an intrinsic preference for gender homophily. The assortative matching that results from their real-world interactions is therefore best explained as the equilibrium consequence of their different tendencies towards stability in their interactions.

*Alternative explanations.* While we believe that this explanation succeeds in bringing together our findings from the field and the lab, there are a number of potential alternative explanations. We cannot be certain that these alternative explanations are not playing a part in our results, but we find little positive evidence in favor of them, as the following summary shows.

- **Risk Aversion:** Women have been found to be more risk averse than men (Croson and Gneezy, 2009; Eckel and Grossman, 2008b). Since women have sometimes been found to exhibit more risk aversion than men, differences in risk preferences could drive differences in observed trust. Most papers find no effect of risk aversion on trust decisions (Eckel and Wilson, 2000; 2004; Ben-Ner and Halldorsson, 2010; Houser et al., 2010; Slonim and Guillen, 2010); exceptions are Schechter (2007) and Kanagaretnam et al. (2009). This evidence seems to suggest that risk aversion is unlikely to be the driver of the gender differences in trust we observe. In our regressions, we do control for risk aversion and find no evidence for a gender-differential role in the trusting decisions.
- **Higher information environments:** If women had a preference for higher-information environments, they would prefer to play with the old partner. Fiedler et al. (2011) find that a short round of virtual communication before playing a trust game affects both the choice of a partner and the amount of money sent back to a trustor. Our revealed gender treatment which also reveals the age and first year of studies also provides a higher-information environment, but reveals no significant effects (Table 3).
- **Overconfidence:** If women are less confident than men as has been argued in many papers (Niederle and Vesterlund, 2007), they might be tempted to play with the old partner rather than with the unknown partner (the new partner). Because we elicited beliefs, we can elaborate on this confidence by comparing subjects beliefs to actual amounts returned to them. First of all, everyone is overconfident in all stages and for all partners; in other words, all subjects state they will be returned more than they actually are. Therefore, our women are overconfident. Moreover, they are more overconfident than men in the first stage but not statistically significantly so (they believe they would receive

one more token than what they actually received, while the figure is only 0.5 for men). In the second stage, they are less overconfident than men (again not statistically significantly so). Importantly, they seem more overconfident towards new partners than towards old partners (0.724 difference between beliefs and actual amount returned for new partners versus 0.524 for old partners). Consequently, we do not see this as a compelling alternative to our explanation.

- **Inequality aversion:** Inequality aversion: Many studies have shown that women are more inequality-averse than men (reviewed in [Croson and Gneezy \(2009\)](#)). This might explain why women are less likely to send zero to their old partner. However, women are about equally likely to send zero to their old or new partner; it is men who are significantly more likely to send zero to their old partner, as compared to their new partner. Therefore, women seem more inequality-averse than men, but similarly towards old and new partners.

## 6. Can the lab results explain the field results?

The field results display clear path dependence in relationship formation, in the sense that pairs of individuals (of both same-gender and different-gender composition) were more likely to report a relationship if they had previously been in the same introductory group. We observe assortative behavior, in the sense that male-male and female-female pairs are substantially more likely to report a relationship than male-female pairs, and this is stronger for female-female than for male-male pairs. However, we find no evidence of an intrinsic preference for homophily. Can the observed homophily in the field be the result purely of the gender difference in conditional responses to partner behavior?

The results indicate that it can. Women are much less likely than men to return little or nothing to former partners who are low reciprocators. [Fig. 3](#) shows that, overall, women are only about 62% as likely to send zeroes to former partners. So if women are, on average, reciprocating less than men the investments in time and effort of their partners, and if men are more likely to break their ties with former partners who are low reciprocators, then over time women's links with women would be much more persistent than men's links with women, and somewhat more persistent than men's links with men. Heavily gendered friendship networks may therefore be the unintended consequence of choices made by subjects who are not even aware of the way their systematic tendency to respond in certain ways to the behavior of others may have this effect.

## 7. Conclusion

Are there differences in the way men and women create social networks? And if so, what could explain these differences? We provide evidence for the role of a systematic tendency for women to respond differently to the behavior of their social partners - a difference that is distinct from the impact of their economic constraints, which for well known reasons frequently differ from those of men.

Overall, a natural way to interpret our findings is in terms of the balance between stability and flexibility in the formation and maintenance of social links. Stability means continuing to interact with former partners without being influenced too much by their current or recent behavior. Flexibility means adapting your interactions to the current or recent behavior of the partner, and its likely benefit for you in the future. All subjects demonstrate a mix of stability and flexibility, but women seem to place the cursor closer to the stability end of the scale, and men to place it closer to the flexibility end of the scale. An interesting and apparently unintended consequence of this is that both men's and women's friendship networks display substantial homophily, with the degree of homophily even greater for women than it is for men.

We have shown that history matters in an intuitive way in the formation of friendship networks. This is unsurprising, but what is more interesting is that history matters in a different way for men and for women. Our laboratory findings seem to suggest that this is because of different weights placed on average by men and women on stability and flexibility in the construction of their networks of connections. There is obviously a good deal more work to be done before we can be sure that such gender difference in behavior are robust across diverse experimental settings. Nevertheless, if they prove to be so, they could provide an important explanation for a number of gender differences in social behavior in the world outside the laboratory.

## Declaration of Competing Interest

The authors have no relevant interests to declare.

## Supplementary material

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.jebo.2021.03.016](https://doi.org/10.1016/j.jebo.2021.03.016).

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