Courtesy and Idleness: Gender Differences in Team Work and Team Competition*

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Abstract

Does gender play a role in the context of team work? Our results based on a real-effort experiment suggest that performance depends on the composition of the team. We find that female and male performance differ most in mixed teams with revenue sharing between the team members where men put in significantly more effort than women. The data also indicate that women perform best when competing in pure female teams against male teams whereas men perform best when women are present or in a competitive environment.

Keywords: team incentives, gender, tournaments

JEL classification numbers: C72; C73; C91; D82.

1 Introduction

When setting up team work in a firm, the question arises of how to group workers into teams. Should they be of the same ability, gender, temperament or should they rather differ in some or all of these characteristics? The optimal composition of teams has only recently been studied by economists.[1] In this paper we report on a real-effort experiment to investigate whether gender is

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[1] Ferreira (2002) studies the optimal composition of a team when the principal can both choose the incentive contract and the degree of diversity among team members. His theory is tested in a companion paper (Adams and Ferreira, 2003), using the gender composition of corporate boards. Hehenkamp and Karboe (2004) analyze the optimal composition of a team with respect to ability in the presence of peer pressure.

of relevance for the optimal composition of a team. In order to address this question, we study the performance of mixed teams versus teams consisting of men or women only.

We hypothesize that gender matters for team composition because social relations are important in team work. For example, a person's effort choice can be affected by the relationship to those with whom he or she shares the returns from this effort. Also, free-riding incentives can be significantly reduced by peer pressure or by altruism and loyalty among group members.[2] Moreover, social norms and gender stereotypes may influence the behavior of men and women in teams.

In addition to team pay we study competition between teams where the team with the highest performance wins a bonus. It has been shown both in field and laboratory experiments that competition can increase the output of a team significantly.[3] We investigate whether men and women react differently to monetary incentives and how interactions between men and women affect their performance under the two different incentive contracts. For the experiment, teams consisting only of men and teams consisting only of women are formed. In one treatment, male teams compete with male teams, in another treatment female teams compete with female teams, and in a third treatment male and female teams compete with each other. Thereby, we are able to evaluate whether the gender composition of the competing team matters.

Our main results suggest that performance does not exclusively depend on the chosen incentive scheme (team pay versus team competition) but rather on the gender of the group members in conjunction with the chosen incentive scheme. Men exert higher effort when paired with women or in a competitive environment than when they are among themselves. Women perform best in pure female teams when competing against male teams and perform worst under revenue sharing in a mixed team.

The remainder of the paper is organized as follows: Section 2 deals with the design and experimental procedures. Section 3 presents and analyzes the results, and Section 4 concludes.

[2] The role of social pressure in team work is discussed by Kandel and Lazear (1992) and Huck, Kübler, and Weibull (2004). For loyalty and altruism in a model of team production see Ferreira (2002).

[3] See Nalbantian and Schotter (1997) who compare team competition to normal team work in an experiment where effort choice is related to monetary costs. Erev et al. (1993), and van Dijk et al. (2001) use real effort experiments, the former to study team competition, the latter to study team work compared to individual incentive schemes. None of the papers deals with issues of gender and optimal team composition.

2 Experimental design and procedure

In order to test for gender and incentive effects in an appropriate environment, participants had to work on a real task. They had to solve as many memory games as possible within 15 minutes. We used memory games posted on the web, consisting of ten pairs of cards.[4] At the start of the game, 20 cards with their faces down are showed. Two cards have to be clicked on. Then a "Check It"-button has to be pressed, and if the cards match, they are automatically removed. Otherwise, a "Pick again"-button has to be pressed and two more cards can be selected. The game ends when all pairs have been matched.

In the experiment, when a participant had solved a game completely, he or she raised her hand, we recorded the solved game on the personal record sheet and opened a new game for this participant. The website offers 10 different games (with pictures of dinosaurs, colors, bugs, animals, musical instruments, etc.). In order to prevent confusion from recalling games played previously, we opened a new game with different cards every time. In all sessions, we started with the same game (dinosaurs) and used the same order of games.

We varied the composition of the teams, each consisting of two members, with respect to gender. In addition, two different incentive schemes were used (revenue sharing vs. team competition). We ran six different treatments in 10 sessions. Each session had 12 participants. Overall, we collected 120 independent observations: pure male teams with revenue sharing (2 sessions), pure female teams with revenue sharing (2 sessions), mixed teams with revenue sharing (2 sessions), competition where female teams compete with each other (1 session), competition where male teams compete with each other (1 session) and competition of female against male teams (2 sessions).

Payoffs in the revenue sharing treatments (RS) were computed by adding the number of solved games of the two team members (called "points" in the instructions), dividing the sum by two and paying out the resulting number in Euros to each team member. In the team competition treatments (TC), the number of solved games by both team members was computed. Then, the number of solved games of a team was compared to the number of solved games by a randomly selected second team. The team that had solved more games received a bonus of 4 points (=Euros), and for the losing team we subtracted 4 points from the number of games solved jointly. Each team member then received points equal to the number of games solved in the team plus or minus

[4] The website can be found at http://www.funbrain.com/match/.

the bonus, divided by two. If both teams had solved the same number of games, no points were subtracted or added.

The participants in each session were seated in two groups of six persons at opposing walls of the computer lab. They were informed that they had been randomly matched with a person sitting at the same side of the room. These two participants formed a team. In the sessions with teams consisting only of men or women, we made sure that only male or female participants were seated on either side of the room. Thus, the information that they were randomly paired with a participant from their side of the room implied that it was a person of their own gender. In the treatment with mixed teams, both men and women were seated on each side of the room. Thus, participants did not know whether they were paired with man or a woman. In the treatments with team competition, we invited either only men or only women to the experiment (for competition between men or women only), or we invited six men and six women and placed them at opposite sides of the room (for competition between male and female teams). We never explicitly mentioned gender in front of the participants, because we wanted to test whether gender is important even if participants are not made aware of it directly. We told participants only that the competing team consists of participants placed at the opposite side of the room. Since participants could see each other in the lab, although gender was not explicitly discussed, they could figure out the gender composition of both, the own and the competing group.

At the end of the experiment all participants were informed about the number of games solved by their team and, in the team competition treatments, whether their team received a bonus, no bonus or whether their team payoff was decreased by 4 points. There was a show-up fee of 3 Euros. Average earnings in the experiment which lasted about 40 minutes were 8.14 Euros (including the show-up fee).

3 Results

Our results are organized around three research questions, which are: (1) Do different payoff schemes affect performance and how do women and men react to these payoff schemes?, (2) Are there gender differences in performance?, (3) Do male and female performance depend on the composition of the team? We will answer them in order. For our data set, the dependent variable is the number of games solved by a participant. Since our independent variables gender and incentive contract can each take only two values, the statistical analysis of the data is performed on the basis of the two-sample t-Test (henceforth: t-test) as well as the non-parametric Mann-Whitney U-Test (henceforth: MWU).

3.1 Do different payoff schemes affect male/ female performance?

First we compare overall performance in both treatments (RS and TC). According to Table 1 the average result in treatment TC (5.32) is slightly higher than the average in treatment RS (5.03). This is also true for each subgroup. Males as well as females solve on average more memory games in the TC than in the RS treatment (men: 5.67 vs. 5.33; women: 4.96 vs. 4.72). However, these differences are not significant.[5] Although the chosen payment scheme does not significantly influence the average individual performance, the switch from revenue sharing to team competition does increase the variance of outcomes (see Figure 1). The null hypothesis of no differences in variance between both treatments is rejected in favor of the alternative hypothesis of a higher variation in the TC treatment at 5% level (Variance Ratio F-test, $p = 0.039$).[6]

Table 1: Descriptive statistics: Number of Solved Games

	RS				TC			
	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std.Dev.
Men	5.33	3	7	0.956	5.67	3	8	1.274
Women	4.72	2	7	1.210	4.96	2	7	1.488
All	5.03	2	7	1.126	5.32	2	8	1.417

[5] $p > 0.2$ for each subgroup (males, females) as well as for the pooled data, regardless of the statistical test used.

[6] The statistical significance of this result on subgroup level is maintained only for the male subgroup.

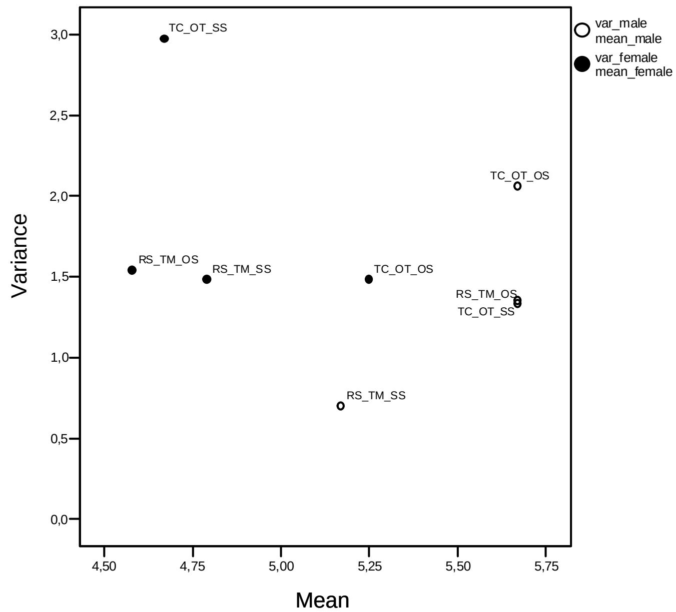

Figure 1: Mean-variance scatterplot of male and female performance. We distinguish between team members being of the same sex (TM_SS), of the opposite sex (TM_OS) and the members of the other team being of the same sex (OT_SS) or of the opposite sex (OT_OS). E.g., RS_TM_SS means that the data come from a revenue sharing treatment where the team member was of the same sex; empty dots stand for women, full dots for men.

Observation 1: The choice of payoff scheme (revenue sharing vs. team competition) does not significantly influence individual performance. However, competition significantly increases the variance of the observed outcomes.

The result that the incentive scheme alone has no clear-cut effect on performance allows us to focus on gender effects and in particular on the interaction of gender with the chosen incentive scheme. Of course, the sensitivity of performance to incentives depends on the chosen task. For our purpose of investigating gender effects we have succeeded in identifying a task in which performance is not very sensitive to monetary incentives alone, but rather to the incentive scheme in conjunction with gender (as will be shown below).

A number of studies find a positive effect of competition on performance, see, e.g., Nalbantian and Schotter (1997), van Dijk et al. (2001), Gneezy et al. (2003), and Erev et al. (1993). However, each of these studies differs from ours in several respects. In van Dijk et al. (2001) and Gneezy et al. (2003), for example, single individuals compete instead of teams as in our case. Nalbantian and Schotter (1997) do not use a real effort task but rather have participants pick a number for their effort choice, where higher numbers are associated with a higher monetary cost. Erev et al. (1993) consider team competition in a real effort environment as we do, but participants were able to observe the performance of the competing team as well as of the other members of their own team constantly during the experiment. Thus, they had the possibility to increase effort in response to the performance of others, which might enhance the effectiveness of competition. Also, they did not study the composition of teams in terms of gender as a possible determinant of performance.

The outcomes of team competition show a greater variance than the outcomes of revenue sharing, which is in line with the findings of Nalbantian and Schotter (2003) as well as van Dijk et al. (2001). In a competitive environment, the optimal strategy depends on the ability of one's competitors. Thus, different beliefs might lead to different optimal strategies in the case of competition, which explains the increased variance in the number of solved games compared to revenue sharing.

The increased variance of payoffs under team competition in the presence of diffeent degrees of risk aversion of men and women (as evidenced in the psychology literature (Byrnes, Miller and Schafer, 1999) and in the economics literature (Eckel and Grossman, forthcoming)) could affect individual performance. However, according to the first part of Observation 1, men and women do not seem to react in a significantly different way to changes in the payoff scheme. This finding is consistent with the result of Gneezy et al. (2003), who do not find any evidence that risk aversion influences male and female performance in the context of tournaments.

3.2 Does gender influence performance?

If men and women are equally skillful and incentives are the same for both groups, the average number of games solved should not be significantly different.[7] However, the observed outcomes reveal a strong gender effect on performance (MWU and t-test: $p = 0.004$) indicating that males solved significantly more games than females. In addition, this result holds for both payoff schemes and can be (weakly) statistically corroborated in both treatments separately (t-test, RS: $p = 0.02$, TC: $p = 0.083$).[8]

[7] Note that various psychological experiments on the Memory game have shown that the subjects' ability to use the computer mouse does not significantly influence the results.

[8] The corresponding p-values for the MWU are: $p = 0.015$ for RS and $p = 0.111$ for TC, revealing only a significant difference for the revenue sharing treatment.

Observation 2: Men perform significantly better than women.

Differences in performance between women and men depend on the specific task.[9] Our memory task reveals a clear asymmetry in that men solve on average more games than women. This allows us to study team work in the presence of team members with different abilities.

Several experiments by psychologists show that women outperform men in the memory game (see, e.g., Tottenham et al., 2003, McBurney et al., 1997). However, no monetary incentives were used in the psychology experiments, and performance in these studies was measured differently.[10] The difference to our findings can be be due to the interaction of gender with other features of the situation such as monetary incentives, e.g. women might be overall less motivated than men in a situation where they get paid according to performance. While our data are not sufficient to fully explain the observed difference, we will address the relationship between incentives and gender in the next section.

3.3 Performance in mixed teams with revenue sharing

A number of factors can affect behavior of men and women depending on whether they face a team member of the same or of the opposite sex. From an economic perspective, the expected number of games solved by the other team member should not affect performance. Thus, even if men or women believe that the other gender differs in ability, this should not affect choices. But when working together in a team, motivations such as solidarity, courtesy, competitivenss or indifference towards the same or the opposite gender can come into play. Also, the social norms that men should support women and that women need to be helped might change a subject's motivation to contribute when participating in a mixed team compared to a single-sex male or female team.

As shown in Figure 2 in the case of revenue sharing there are no significant differences between male and female performance within single-sex teams (5.17 vs. 4.79). However, in mixed teams men solve on average 5.67 games, as compared to 4.58 for women. The $p-$value of the t-test is 0.037, so the difference is significant at the 5% level.[11] The considerable difference in effort of

[9] In Gneezy et al. (2003) where subjects had to solve mazes, men also performed better than women. In Niederle and Vesterlund (2005) no gender difference can be found for the task of adding numbers.

[10] Only one game is solved and performance refers either to the "efficiency measure" defined as the total number of trials divided by total time (Tottenham et al., 2003) or to the "memory score" defined as the total number of times any card was turned over (McBurney et al., 1997).

[11] The corresponding value for MWU is $p = 0.033$.

men and women in mixed teams is due to the significant increase of male performance relative to single-sex male teams (MWU, $p = 0.052$, one-tailed). Women not only refuse to increase their effort when paired with men, but the number of solved games slightly decreases on average (4.79 vs. 4.58 in favor of purely female teams).

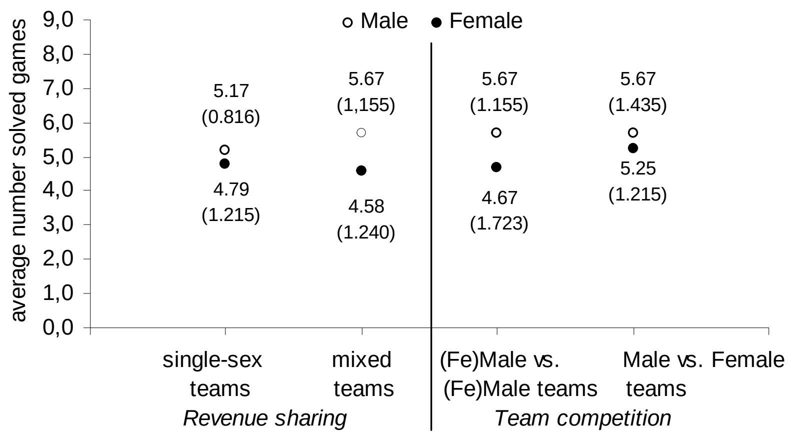

Figure 2: Average performance of men and women in all treatments (std. deviations in brackets)

This leads to:

Observation 3: With revenue sharing (RS), the performance of men and women does not significantly differ in the case of single-sex teams. However, in mixed teams men perform significantly better than women.

The behavior of men and women can be explained by adherence to gender roles. When paired together in a team, men adopt the active role while women are more passive than in situations where only women are present. This finding is consistent with psychological experiments on helping behavior. They show that women are overall more likely to receive help than men. Furthermore, men display chivalry and helping behavior towards strangers (as in our experiment) while women typically care for friends and intimate relations.[12]

In the economics literature, Eckel and Grossman (2001) find that men are *chivalrous* when playing ultimatum games in that they are more likely to accept offers from women. Dufwenberg and Muren (2002) observe that women receive higher donations than men in dictator games. These two observations are similar to our finding that men behave nicely towards women when working together in a team. Eckel and Grossman (2001) also find that in ultimatum games, women almost

[12] For an overview and a meta-analysis of this literature see Eagly and Crowley (1986).

never reject offers made by women, which they call *solidarity*. Solidarity or loyalty among women can explain our finding that women exert higher effort when the benefits are shared with another woman rather than with a man.

To sum up, our results reveal a significant gender difference in performance in mixed teams which is not present in single-sex teams. This difference in behavior in mixed teams is consistent both with the results from other experiments and with common gender stereotypes.

3.4 Gender effects in team competition

Economic theory predicts that own ability and the ability of one's opponents in a tournament affect the optimal effort choice. Thus, men who think (correctly) that they are on average better in solving memory games than women might be tempted to reduce their contribution when competing against a female team. Also female (less able) teams may lower their effort when competing against male teams, suspecting that their team will lose anyway. A similar effect could be generated by the stereotype that women perform poorly in a competitive environment. On the other hand, solidarity among women might increase women's performance when competing against men.

By introducing competition among single-sex teams, we observe a gender gap in mean performance when the competing teams are of the same sex (5.67 vs. 4.67 in favor of the men), but this difference is not significant ($p > 0.10$ regardless of the statistical test used). Furthermore, as shown in Figure 2 the gender gap almost disappears when male and female teams compete against each other (the average number of solved games is 5.67 and 5.25, respectively). There is a noticeable although statistically insignificant rise in women's average performance from 4.67 (competition of female against female teams) to 5.25 (competition of female against male teams).

Observation 4: With team competition, the performance of male and female teams does not significantly differ, neither when competing amongst themselves nor when competing against each other. There is a tendency for women to increase their effort when competing against men.

The hypothesis that all teams will lower their performance when male and female teams compete is not supported by the data. Rather, we observe that women perform best when competing against men, which is consistent with the hypothesis that there is a certain degree of solidarity among women.[13]

[13] Gneezy et al. (2003) find for incentive schmes based on individual performanc that women perform better when

Erev et al. (1993) observe (for mixed teams) that the performance enhancing effect of competition diminishes as the difference in ability between the competing groups increase. This is consistent with the predictions of the theory in asymmetric tournaments. In our case of single-sex teams, the performance of the on average more able male teams is independent of the gender of the competing team, and women even increase their performance slightly when competing against men. We observe an average performance of 5.46 solved games in the treatment with competition between women and men. This is higher than the average performance with competition among men or women only, which is 5.17. Thus, the (negative) incentive effect based on differences in ability might be overcompensated by gender effects in our experiment.

4 Conclusions

Which incentive scheme and which gender of team members should be chosen to maximize performance? This paper has attempted to shed light on the problem of group incentives and productivity by investigating whether gender is of relevance for the optimal composition of a team. The results of our real effort experiment suggest that gender plays a role in the context of team work and is an important aspect for the optimal composition of teams. In particular, we find that performance does not simply depend on the chosen incentive scheme (revenue sharing versus team competition), but rather on the gender of the group members in conjunction with the chosen incentive scheme. Men perform worst when the benefits are shared with another man in a cooperative environment. Either the presence of women or competition or both lead to a significant increase in male performance.[14]. The case is quite different for women. They tend to reduce their effort when paired with men in case of team pay, and perform best when competing against men.[15] Therefore, given the chosen memory task and team work, if only men are employed it would be the best to introduce competition among teams or to change the composition of the workforce by hiring also women. If both men and women are employed, the productivity can be increased by forming male

competing against women than against men. However, a number of studies by psychologists based on game-playing by children show that girls are more competitive when playing against boys than against girls (see Moely et al. (1979) and the studies cited therein).

[14]The null hypothesis is that men perform better or equally well under revenue sharing when only men are present compared to the situation where either women or competition are present (MWU, $p = 0.032$).

[15]The null hypothesis is that women perform better or equally well under revenue sharing with mixed teams compared to competition of female against male teams (MWU, $p = 0.093$).

and female teams and introducing competition between them.

References

[1] Adams, R.B. and Ferreira, D. (2003). Diversity and incentives: Evidence from corporate boards. Stockholm School of Economics. Mimeo.

[2] Byrnes, J.P., Miller, D.C., and Schafer, W.D. (1999). Gender differences in risk taking: a meta-analysis, Psychological Bulletin 125(3), 367-383 .

[3] Dufwenberg, M. and Muren, A. (2002). Discrimination by gender and social distance. Stockholm University. Mimeo.

[4] Eagly, A.E. and Crowley, M. (1986). Gender and helping behavior: A meta-analytic review of the social psychological literature. Psychological Bulletin 100(3), 283-308.

[5] Eckel, C. C. and Grossman, P.J. (2001). Chivalry and solidarity in ultimatum games. Economic Inquiry, 39, 171-188.

[6] Eckel, C. C. and Grossman, P.J. (forthcoming). Differences in the economic decisions of men and women: experimental evidence. In: Handbook of Results in Experimental Economics. Edited by C. Plott and V. L. Smith. New York: North Holland.

[7] Erev, I., Bornstein, G., and Galili, R. (1993). Constructive intergroup competition as a solution to the free rider problem: a field experiment. Journal of Experimental Social Psychology, 29, 463-478.

[8] Ferreira, D. (2002). Group loyalty and incentive pay. U. of Chicago. Mimeo

[9] Gneezy, U., Niederle, M., and Rusticchini, A. (2003). Performance in competitive environments: gender differences. Quarterly Journal of Economics, CXVIII, 1049-1074.

[10] Hehenkamp, B. and Kaarboe, O. (2004). Who should receive weaker incentives? Peer pressure in teams. Mimeo.

[11] Huck, S., Kübler, D., and Weibull, J. (2004). Social norms and economic incentives in firms. University of Tilburg Working Paper Series. Mimeo.

[12] Kandel, E. and Lazear, E. (1992). Peer pressure and partnerships. Journal of Political Economy, 100, 801-817.

[13] McBurney, D. H., Gaulin, S. J. C., Devineni, T., and Adams, C.(1997). Superior spatial memory of women: stronger evidence for the gathering hypothesis. Evolution and Human Behavior, 18, 165-174.

[14] Moely, B.E., Skarin, K., and Weil, S. (1979). Sex differences in competition-cooperation behavior of children at two age levels. Sex Roles 5/3: 329-342.

[15] Nalbantian, H. R. and Schotter, A. (1997). Productivity under group incentives: an experimental study. American Economic Review, 87, 314-341.

[16] Niederle, M. and Vesterlund, L. (2005). Do women shy away from competition? Mimeo.

[17] Tottenham, L. R., Saucier, D., Elias, L., and Gutwin, C. (2003). Female advantage for spatial location memory in both static and dynamic environments. Brain and Cognition, 53, 381-383.

[18] van Dijk, F., Sonnemans, J., and van Winden, F. (2001). Incentive systems in a real effort experiment. European Economic Review, 45, 187-214.