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**Gender at work:
Productivity and incentives**

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Gender at Work: Productivity and Incentives

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Abstract

This paper analyses the relationship between workers' gender and monetary incentives in an experimental setting based on a double-tournament scheme. The participants must choose between a piece-rate payment or a performance prize. The results show that women tend to shy away from competition, and are less sensitive than men to the monetary incentives of the tournament. In addition the tournament scheme induces males, but not women, to signal their ability and to select the contract which is more profitable for them.

Keywords: gender, incentives, work, experiment.

JEL Classification codes: C91, J16, J41

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1. Introduction

The economic literature finds women to differ from men with respect to several behavioral attitudes. A major result is diversity in risky contexts, where women are found to be more risk averse than men (Arch, 1993; Powell and Ansic, 1997; Hinz et al., 1997; Fehr-Duda et al., 2006 and Eckel and Grossman, 2008); however on this result the experimental evidence is actually mixed, and shows, for instance, that when payments are high women are willing to take as much risk as men (Holt and Laury, 2002), a result which is similar to those of other authors (Master and Meier, 1988; Harbaugh et al., 2002; Atkinson et al., 2003; Moore and Eckel, 2003). Powell and Ansic (1997) and Solnik (2001) find evidence for the genders to have different motivations and/or social preferences at the basis of their decisions (see also Croson and Gneezy, 2009 for an extensive survey): in particular women appear to prefer social goals rather than maximising their payoff *tout court*. Moreover, when interacting with each other, people's expectations about the behavior of the counterpart are affected by his/her gender; so for example Dion et al. (1997) find that saleswomen are perceived as less professional than men; Atkinson et al. (2003), while finding that gender does not affect the managing style of a fund manager, show that the gender of the manager affects the choices of the investors; similarly Eckel (2008) highlights that employers evaluate CV and recommendation letters also accounting for the gender of the writer. Last, but not least, among others Eckel and Grossman (2002) find that men are expected to be more risk-taking than women.

All these results induce the reader to expect women from a market-oriented, competitive and "patriarchal"¹ society to be less competitive than men: actually the willingness to take less risks, a more conservative behavior and the adherence to cultural stereotypes should produce such difference between the two genders. In fact Gneezy et al. (2003), Gneezy and Rustichini (2004) and Price (2008) observe that when people operate in mixed-gender groups, competition increases the performance of the male subjects², while that of females does not change; however also females' performance increases when the group of competitors is of the same (female) gender. This findings appear not to hold when the competition involves teams instead of individuals: Ivanova-Stenzel and Kübler (2008) find that, when the competition is between same-gender groups, men perform significantly better than females³, but when mixed-gender teams compete against each other no gender effect is detectable⁴ and "the composition of the team has no significant effect on the performance of each gender for a given incentive scheme"⁵. In addition, competition entails the possibility of incurring in losses which can be either relative or absolute or both⁶, and women tend to be loss averse (Brooks and Zank, 2005). Niederle and Vesterlund (2007) find that men tend to enter tournaments more often than women because of two factors: first men are more overconfident than women (see also Bengtsson et al., 2005) and, second, males and

¹ I.e. non matriarchal (see Gneezy et al., 2009).

² See also Günther et al. (2008), who find the same results, but highlight that this happens only when the task is culturally viewed as a "male task". When this is culturally neutral (i.e. it is not perceived as "male" or "female"), competition increases the performance of both genders. Apparently women do not dislike competition *per se*, but dislike to compete against men.

³ However there could be some nurture effect that explains this result: Booth and Nolen (2009) find that women educated in female schools (where they are used to compete only against other females) are as competitive as men when examined in the framework of a field quasi-experiment, but men are more competitive than women educated in mixed-gender schools, where they are used to face also people of the opposite sex.

⁴ This means that in this case either competition is less important as a motivation, or the benefits from competing are offset by the composition of the team. In either case this may explain why men tend to dislike team-based competition compared to individual competition (Dargnies, 2009).

⁵ Ivanova-Stenzel and Kübler (2008), p. 17.

⁶ Here I am referring to a comparison between piece-rate payments and tournament schemes (see further in the paper).

females actually differ in their preferences for performing in a competition⁷; consistently with these results, also Kleinjans (2009) and Fletschener et al. (forthcoming) find that women tend to “shy away” from competition. The experimental setting of Niederle and Vesterlund (2007) offers two payment schemes to the participants: these have to perform a given task (namely solving mazes) under either a non competitive or a competitive (called tournament) rule. In the first case they get a piece-rate payment for each maze that they solve; in the second case, only the best performer of each group gets paid a given sum for each solved maze, the unit payment under this rule is much higher than the unit payment under the piece-rate scheme; as a consequence high-ability players have incentive to choose the tournament.

However, after entering a competition which involves the repetition of a task (game) and under some conditions, men and women tend to show no gender-related difference in their performance, although initially females perform significantly worse than males (Vandergrift and Yavas, 2009)⁸; in any case the authors also find that this convergence of performances is conditional to the treatment, i.e. it does not occur, if some rules of the game change. Actually the female subjects in the experiment of Schwieren and Weichselbaumer (2009) perform significantly worse than males in a competitive environment (and try to deal with the problem by cheating the experimenter).

The extant literature provides a number of explanations about why women and men tend to evaluate competition differently; in particular the difference is likely to be not only genetic. Brown and Taylor (2000) and Croson and Gneezy (2009) conclude that females are more sensitive than men to the context in which they operate; in other words the behavior of males tends to be more stable than that of women across different environments and situations. This may depend on several causes, for instance women are more vulnerable to stress (Li et al., 2006), have a lower valuation of earnings than men (Kanazawa, 2005; Walker, 2006), prefer to spend time in child caring (see for example Joy, 2006), prefer activities involving social values rather than competition (Sirard et al., 2006), have different expectations than men regarding working conditions (Sousa-Poza and Sousa-Poza, 2007), are differently sensitive than men to reference points (Rizzo and Zeckhauser, 2007 and Da Costa et al., 2008), have different preferences than men for the same jobs (Rosenbloom et al., 2008), have different beliefs than men about the strategic behavior of the others (Castillo and Cross, 2008 and Aguiar et al., 2009), are more sensitive than men to the stakes of the game (Antonovics et al., 2009)⁹ and, at least at young ages, are more subject to hormonal cycles (Buser, 2009). In addition different gender-specific traits of personality can help to explain differences in behavior (Semykina and Linz, 2007). Some authors (Gjerberg, 2002; Atkinson et al., 2003) argue that the stereotypes of a specific culture can be partially responsible of the difference of behavior between males and females in some specific contexts. And last but not least, Gneezy et al. (2009) find that women from matrilineal societies are more competitive than men from the same societies providing strong support for the context-specific hypothesis. However to investigate on which are the biological/environmental explanations of the detected gender differences is not among the aims of this work.

⁷ Nekby et al., (2008) show that (over)confidence pays off in terms of the results in competitive races, however this result is not conclusive, as in some environments an excess of confidence can be detrimental for performance (Biais et al., 2005 and Sjögren Lindquist and Säve-Söderbergh, 2009).

⁸ See also Cotton et al. (2010).

⁹ However O’Toole (2009) finds evidence against this result: the performance of male and female competitors in a marathon running is equally affected by a change in the value of the prize.

This paper employs a double tournament setting to study 1) whether men and women differ in their preferences for competition, 2) whether people who reveal a preference for competing in a tournament actually perform better than those who prefer a non-competitive framework, and 3) whether in a non-competitive setting people, who actually choose to play a tournament, perform better than individuals who reveal a distaste for competition. In order to investigate these three points, I run an experiment in which the subjects must perform a boring task; the remuneration for the task is either piece-rate or based on the ranking in a tournament (basically the two rules mirror Niederle and Vesterlund, 2007). People can choose which “contract” they prefer by participating to a sealed-envelope auction, where the two payment schemes are auctioned. Then the work starts (see the next section for further details). The results of the paper reveal that: 1) women actually tend to shy away from competition, 2) women are much less sensitive than men to the incentives of competition, 3) women tend to work hard either if incentives are present or not; 4) men are very sensitive to the payment scheme and 5) the preference of males for a given payment scheme is a signal of their performance in the job (although I can not assess if this is due to ability or effort of both).

2. Experimental design and procedure

The experiment involved a total of 71 undergraduate students (38 males and 33 females), who played a two-stage game. Firstly they were informed about the task to perform: they were given a paper list of fictitious names, identification numbers and marks of hypothetical exams, and they were asked to recopy these data on a file using the pc that each of them had in front of her/him. Each line of the list contained a name, an id number and a mark. This list was the same for all the participants. The screen of the pc showed a grid: each line of the list on the paper form had to be recopied in a line of the grid on the screen; the structure of the tables on the paper form and on the screen was the same. The subjects would have been paid a certain amount of money for each line (name, id number and mark) copied correctly; in case of mistake the pc programme signalled the error, that they had to correct before filling in the following line (the programme automatically prevented them to proceed in case of mistake). The subjects were told that the duration of the task was 45 minutes, after which the programme would have automatically interrupted the work. At this point all the participants were allowed to practice the task for five minutes.

At the end of the period of practice, the participants were presented two possible remuneration schemes: a piece-rate and a tournament. Under the first rule, each of them would have received 0.15€ for each line copied correctly in the 45 minutes; under the tournament scheme, the payment would have depended on the relative position of each player in a ranking based on his/her performance. In particular, considering the distribution of the individual performances (i.e. the number of copied lines) the players falling in the highest third of the distribution would have obtained 0.25€ per copied line, whereas the other two thirds would have been paid 0.10€ per line. The structure of the payments is such that the median value per line in the tournament is equal to the payment per line in the piece-rate scheme. Let us refer to the tournament scheme as “contract A” and to piece-rate scheme as “contract B”. The “job market” offered 71 positions (one for each experimental subject), of which one half submitted to contract A and one half to contract B. The subjects were invited to bid for their preferred contract (either A or B), knowing that, for each of the two contracts, in order to win the auction the bids had to fall in the highest quartile of the distribution of the bids. The other participants would have had randomly assigned a contract (either A or B) with probability 50%, independently of their preference. The players expressed their bids as a percentage of their final payment, and could bid any amount between 0% and 100%. At the end of the experiment the net payment for each participant was thus calculated as $(1 - \text{bid}) * \text{gross payment}$. As usual in auctions, only the winners had to pay their bids, whereas those who were randomly assigned a contract paid nothing. This mechanism allows for evaluating the intensity of the preference of each player for a given contract.

After the contracts had been either bought through the auction or randomly assigned, each participant was informed about her/his own contract and the work began. With this experiment it is thus possible to test if players of a given gender prefer to engage in competition more than the players of the other sex, if competition does enhance performance, if those who would have preferred to engage in competition, but were assigned contract B, are more performing than those who chose B and were assigned B, and eventually if the performance of those who would prefer contract B but were assigned contract A is different from the performance of those who chose and were assigned contract A. Basically these last two points provide some indication about the signalling value of the choice in the auction: if competition is chosen by more able people, these should perform better than those who choose to avoid competition also in a non competitive environment.

The main advantage of this design with respect to Niederle and Vesterlund (2007) is that we can observe also the behavior of those people who would have liked to compete, but play under the piece-rate contract and vice versa. The fact that some players did not obtain their preferred contract allows for testing whether the preference for a given payment scheme reveals some information about the future performance of the subject. This is testable by comparing the actual performance of those who obtained the preferred contract to the performance of the players who were assigned the contract that they did not choose.

3. Results

First of all I analyze the gender-specific preferences for competition: I look at the average bid for the preferred contract (either A or B), and then separately at the bids for participating the tournament or for accepting the piece-rate payment rule. These results are summarized in Table I, which shows that on average males and females bade the same amount¹⁰ for the preferred contract (the difference is not significant). However it is interesting to notice that males tend to bid more for participating the tournament than for accepting the piece-rate scheme, whilst females do exactly the opposite: they bade more to “buy” contract B than to “buy” contract A. In addition (although this differences are not significant), women bade more than men for contract B than for contract A. These results are in line with the extant literature, as our female participants seem to be less in favour of competition than men (despite the lack of significance of the differences between the two means). It is also worthy to notice that 37 players (of which 21 men) bade for contract A, and 34 (of which 12 males) for contract B. This means that more women than men bade for contract B, and this difference is significant at 95% level.

Table II summarizes the results of the work performed by subjects; namely the number of lines copied from the paper forms to the grid on the pc is analyzed as for the two contracts and the gender. At first, I consider the contract under which the subjects actually worked, without differentiating them according to their preferences; in other words some of the subjects who played under contract A actually bade for contract B and vice versa. This implies that I am analyzing the effect of competition *per se*, without paying attention to the preference revealed by subjects. I find two interesting results: first there is no significant difference in performance between males and females under contract A, but under contract B female participants perform better than males. Second, while women’s performance does not change with the incentive to perform better (the difference between the average number of lines copied under the two schemes is virtually zero in this sub-sample), men perform significantly worse if the payment is piece-rate rather than related to the position in the rank; in addition, while men perform slightly better than women under contract A (but the difference is not significant), they perform worse than women (and this time the difference is significant) under contract B. This suggests that competition is an incentive for men, but not for women and apparently females tried to do for their best irrespectively of the incentive scheme.

Now let us turn to the analysis of performance according to the preferred contract (i.e. the contract for which the player bade), instead of the assigned contract. In other words players are now grouped according to the type of contract they bade for, irrespectively of the contract they were actually assigned. The results of this analysis are summarized in Table III. Here we can notice that, on average, players who preferred contract A performed better than those who bade for contract B. However this result is determined by the male component of the whole sample: while men who revealed to prefer the tournament scheme to the piece-rate payment performed significantly better than those who bade for for the piece-rate rule, there is virtually no difference in the female sub-sample. This means that while males who chose contract A either signalled their higher relative ability or responded to the incentives of competition, females actually did neither of these two things.

In order to disentangle the two possible explanations for the male sub-group, I compute the correlation between the bid for each type of contract and the actual performance of the player. We observe that, for the whole sample, there is no significant correlation between these two variables; in particular the correlation is 0.21 between bids for

¹⁰ Remember that this amount is expressed as a percentage of the final payment.

contract A and number of lines copied, and 0.25 (surprisingly positive!) when contract B is considered, and however none of these correlations is significant at any conventional level. The picture changes if we divide the sample according to the gender of the players: considering only males, we observe that the correlation between the number of copied lines and the bid for participating to the tournament scheme is equal to 0.61 and it is significant at 99% level; for the female sub-group the correlation (-0.17) is negative (!), although not significant. Considering now the correlation between the performance and the preference for contract B we obtain -0.16 (non significant) for males and 0.33 (non significant) for females. These figures suggest two observations: first, the more a man bade for working in the competitive environment, the more performing he was independently of the contract actually assigned; this means that bids are a reliable signal for the actual ability (or effort) of male subjects (despite the possible presence of overconfidence¹¹). Second, although the correlations for the female sub-sample are never significant, the sign is the opposite of the expected one. Indeed low-ability players are expected to prefer the piece-rate scheme, and high-ability players to prefer the tournament; if this is the case, the correlation between the bid and the performance should be positive if the subject bids for contract A and negative in the other case (which is exactly what we observe for males). Of course the presence of some overconfidence can lead to results weaker than expected, but the observed reversal of the expected sign is a very strong result, especially because it holds for women, whom the extant literature tends to find less overconfident than men. My female subjects display the opposite behavior; this suggests that, while men are able to select the group which is the most profitable for them, women are not (and probably they select themselves in a perverse way).

The results summarized in Table III and in the previous paragraph raise the doubt that the results observed in Tables II and III may depend on the ability of males to self-select according to their actual capacity, rather than on the fact that they respond to incentives, whereas women do not. In order to test for this, I analyze the performance controlling for both the revealed preference and the contract actually obtained. Tables IV and V compare subjects' performances, given both their preferred contract and that which they were actually assigned. These tables allow for disentangling the "incentive effect" due to the payment scheme and the "signalling effect" expressed by subjects during the auction. The figures presented in the tables suggest that a signalling component is present, especially for males. When the preferred contract is A, there is no significant difference in subjects' performance as for the contract actually assigned; this suggests that those who would have preferred to enter the tournament exert the same (from a statistical point of view) effort in accomplishing their task, no matter their contract; it is also interesting to notice that women who chose to enter the tournament perform better under contract B than under the preferred contract (however this difference is not significant at any conventional level). When contract B is preferred, the players who participate the tournament display a better performance than those who actually got contract B: however the differences are small and not significant. More interestingly, among those who preferred contract B to contract A, women perform better than men always and the difference is significant.

This reinforces the previous conclusion that women are less sensitive to the incentive of competition than men are: they either do not change their productivity in response to the incentive, or do not perceive it as a stimulus to self-select properly according to their actual skills (in practice it is likely that they do not adjust their requests of wage for their actual

¹¹ However notice that the results shown here indicate that, on average, overconfidence is a minor problem, as men who bade for participating to the tournament are, if anything, at least not worse than males who bade for the non competitive contract.

skills), or both. However the most relevant results are those displayed in the lower half of Table V. Here we can notice that people who bade for contract A, but were actually assigned contract B, perform much better than players who bade for contract B and did obtain it. This result is in favour of a strong signalling effect: people who actually bade for participating the tournament are those who effectively display a better performance. However this result is much more robust for men than for women: the difference for women is in fact only marginally significant, and, in addition and as already known, women under contract B work harder than men under the same payment scheme. Summarising: males' preference for competition is a signal of their actual productivity (due either to their ability, or to their effort, or to both), whereas the preferences expressed by females are weaker (if present) indicators of their actual performance.

4. Conclusions

A conclusion that we can retrieve from the analysis of the presented results is that men are both more sensitive to incentives and more prone to signal their ability than women are; moreover women tend to accomplish the assigned task as well as they can, (almost) independently of the incentive scheme. These results can help to explain the wage gap between genders: on the one hand women do not care too much for incentives and work hard also when these are absent; of course this induces employers to incentivate (i.e. pay) them less, as the net marginal gain for the employer is much lower for a female than for a male worker¹². On the other hand women appear to be less prone (or less interested) to signal their possible performance asking for incentives, hence it is likely that they bargain less than men with the employer. Last but not least our results tend to confirm that women really shy away from competition; according to my data a possible explanation is that they do not perceive competition as a valuable incentive to put more effort in their job. Of course this is only a possible explanation of the wage gender gap, and it is complementary to others such as discrimination, sexism, culture, preferences for child-caring etc.

As usual the conclusions of an experiment are difficult to be generalized. In our case I have also to mention the fact that 45 minutes of work in an experimental laboratory do not mirror an entire career. However the framework used here can represent well the procedure of selection of young candidates for a position (for example by the means of ability tests) or the situation of fixed term workers, when both signalling and performance under a given scheme play a significant role. However if other studies will find the same results as mine, allowing for a generalization of them, the gender gap in wages would be explained (to an extent to be quantified by further studies) also by the fact that an employer earns a lower marginal return of incentives over women than over men. However, according to this paper and *ceteris paribus*, a female worker is a cheap substitute for a male worker, hence firms should hire women rather than men. Eventually, the recent paper by Gürtler and Kräkel (in press) suggests an additional remark: their model shows that the employer benefits from tournaments as these allow for extracting rents from the workers; however this seems not to hold when the workers are female. In other words: the empirical evidence presented in this paper suggests that the employer extracts the maximum possible rent from women also when the incentives of a tournament are absent. Once more women appear to be cheaper workers than men.

¹² Let p_m be the average productivity of men and p_f that of women; let a be the unit benefit for the employer, and let s be the amount of the incentive paid to the worker. Let p_i' , $i=m,f$ be the average productivity of category i after the introduction of the incentive. The profit for the employer be π before the introduction of the incentive and π' afterwards. We can write: $\pi_m = ap_m$ and $\pi_f = ap_f$ as well as $\pi_m' = ap_m' - s$ and $\pi_f' = ap_f' - s$. From these we can calculate the variations in the employer's profit in the case of each gender: $\Delta\pi_m = a(p_m' - p_m) - s$ and $\Delta\pi_f = a(p_f' - p_f) - s$, i.e. $\Delta\pi_m = a\Delta p_m - s$ and $\Delta\pi_f = a\Delta p_f - s$. Now, since the results of my experiment suggest that $\Delta p_m > 0$, whereas $\Delta p_f = 0$, it is clear that $\Delta\pi_m > \Delta\pi_f$, which means that the employer has incentive to stimulate men, but not women.

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Table I. Bids over the two types of contracts.

| Bid for: | Average bid | | | Significance ¹ |
|---|--------------|-------|---------|---------------------------|
| | Whole sample | Males | Females | |
| the preferred contract (either A or B) | 7.37 | 7.21 | 7.50 | ° |
| contract A | 6.59 | 7.57 | 5.31 | ° |
| contract B | 8.21 | 6.58 | 9.09 | ° |
| Significance ² | ° | ° | ° | |

¹ The significance refers to the difference between the male and the female sub-samples. (figures in each row).

² This significance refers to the difference between the sub-samples working under the two different contracts (figures in each column).

Note: significance levels: *** (99%); ** (95%); * (90%) ° (less than 90%)

Table II. Performance given the assigned contract.

| | Average number of recopied lines | | | Significance ¹ |
|---|----------------------------------|-------|---------|---------------------------|
| | Whole sample | Males | Females | |
| Lines copied under assigned contract A | 95.36 | 98.65 | 92.42 | ° |
| assigned contract B | 87.29 | 81.69 | 92.00 | * |
| Significance ² | ° | ** | ° | |

¹ The significance refers to the difference between the male and the female sub-samples. (figures in each row).

² This significance refers to the difference between the sub-samples working under the two different contracts (figures in each column).

Note: significance levels: *** (99%); ** (95%); * (90%) ° (less than 90%)

Table III. Performance given the preferred contract.

| | Average number of recopied lines | | | Significance ¹ |
|--|----------------------------------|-------|---------|---------------------------|
| | Whole sample | Males | Females | |
| Lines copied under preferred contract A | 97.22 | 99.90 | 93.69 | ° |
| preferred contract B | 85.03 | 73.83 | 91.14 | ** |
| Significance ² | *** | *** | ° | |

¹ The significance refers to the difference between the male and the female sub-samples. (figures in each row).

² This significance refers to the difference between the sub-samples working under the two different contracts (figures in each column).

Note: significance levels: *** (99%); ** (95%); * (90%) ° (less than 90%)

Table IV. Performance given the preferred and the assigned contracts.

| Preferred contract | Assigned contract | Average number of recopied lines | | | Significance ¹ |
|---------------------------|-------------------|----------------------------------|--------|---------|---------------------------|
| | | Whole sample | Males | Females | |
| A | A | 96.38 | 101.47 | 89.45 | ° |
| A | B | 99.18 | 96.00 | 103.00 | * |
| Significance ² | | ° | ° | ° | |
| B | A | 92.70 | 77.50 | 96.50 | * |
| B | B | 81.83 | 73.10 | 88.07 | ** |
| Significance ² | | * | ° | ° | |

¹ The significance refers to the difference between the male and the female sub-samples. (figures in each row).

² This significance refers to the difference between the sub-samples working under the two different contracts (figures in each column).

Note: significance levels: *** (99%); ** (95%); * (90%) ° (less than 90%)

Table V. Performance given the preferred and the assigned contracts.

| Preferred contract | Assigned contract | Average number of recopied lines | | | Significance ¹ |
|---------------------------|-------------------|----------------------------------|--------|---------|---------------------------|
| | | Whole sample | Males | Females | |
| A | A | 96.38 | 101.47 | 89.45 | ° |
| B | A | 92.70 | 77.50 | 96.50 | * |
| Significance ² | | ° | * | ° | |
| A | B | 99.18 | 96.00 | 103.00 | ° |
| B | B | 81.83 | 73.10 | 88.07 | ** |
| Significance ² | | *** | *** | * | |

¹ The significance refers to the difference between the male and the female sub-samples. (figures in each row).

² This significance refers to the difference between the sub-samples working under the two different contracts (figures in each column).

Note: significance levels: *** (99%); ** (95%); * (90%) ° (less than 90%)

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