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### Do differing pay schemes help close the gender gap in overconfidence?

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#### Abstract

We conducted an experiment to compare how overconfidence is influenced by performance-based and fixed payment schemes. Participants in the experiment were students prior to taking a final exam in Introduction to Microeconomics. We find that most participants were overconfident regarding their success on the exam, overestimating the number of questions they would answer correctly. When a fixed pay scheme was used, men were more overconfident than women. Performance-based pay increased the overconfidence of women, and decreased the overconfidence of men. As a result, no gender difference in overconfidence was found when pay is based on performance.

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## I. Introduction

People are overconfident about their own abilities on a variety of tasks, as numerous studies find.<sup>1</sup> However notable gender differences have been found, with men tending to be more overconfident than women (see also Barber and Odean 2001 and Endres 2006 and Nekby, Thoursie and Vahtrik 2008). Regarding mathematics abilities, Dahlbom et al., (2011) asked high school students in Sweden what grade they would get on a mathematics test a week later. The answers were compared to the test scores, and boys were found to be overconfident while girls were under-confident. Similar results were found for adult students on a test in macroeconomics (Jakobsson 2012).

Our aim in this paper is to examine how overconfidence and different compensation schemes interact when men and women are asked to estimate their own abilities. For this purpose, we conducted an experiment comparing how adults' overconfidence is influenced by performance-based and fixed payment schemes. The experiment was conducted under conditions of stress, immediately before a final exam in Introduction to Microeconomics. Participants were asked to estimate the number of questions they would answer correctly, and were considered "overconfident" if their response was higher than the number of test questions they actually answered correctly.

Classic economic theory predicts that workers will exert high effort only when their pay is contingent on performance (see also Slichter 1928 and Lazear 2000). In the present context, performance-based pay should lead to better performance (meaning less overconfidence) than a fixed payment scheme. However, experimental evidence from studies of payment schemes indicates that performance does not always improve when pay is increased;<sup>2</sup> on occasion, it even declines.

The current study differs from earlier studies in that it was conducted under conditions of stress in a real life situation. Moreover, we tested the effect of different payment schemes on the gender gap in overconfidence. The results show that most participants in all payment schemes are overconfident regarding their success on the exam. Men were found to be more overconfident than women under a fixed pay scheme. However, when participants were paid for precision, the gender gap disappears.

## II. Experimental Design

The 336 participants in the experiment were first-year economics students at the College of Management in Israel (average age 23.4; ages 19-38; 197 men and 139 women). All students were in the first semester of their studies and the experiment was carried out during the final exam of Introduction to Microeconomics. The exam consisted of 20 multiple-choice questions and lasted for three hours. The students received an extension of 15 minutes to compensate for the time used by the experiment but could choose to use the entire 15 minutes for the exam and disregard the experiment, although all students chose to participate. Together with their exam booklets, the students received an explanation sheet that included the research question which they answered before opening the booklet. Their answers were collected after approximately five minutes. The research question was:

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<sup>1</sup> See Della Vigna (2009) for a review.

<sup>2</sup> See Ariely *et al.*, (2009) for a review.

**Table II**  
Mean (STDV) by gender <sup>a</sup>

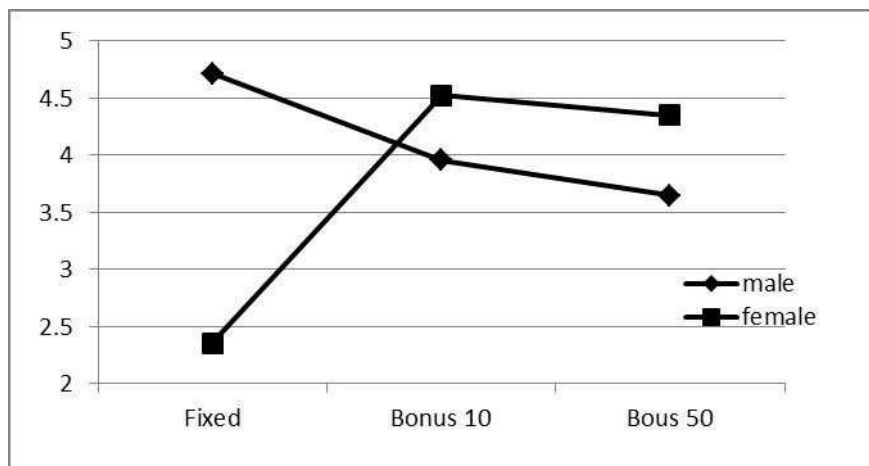
Variable	Female	Male
<b>Correct</b>	10.75 (3.96)	11.35 (4.05)
<b>Estimate</b>	14.77 (2.07)	15.38 (2.42)
<b>Estimate minus Correct</b>	4.02 (3.79)	4.02 (3.96)
<b>Age</b>	22.71 (1.74)	23.87 (1.92)
<b>Math 4-5<sup>b</sup></b>	0.76	0.60
<b>Bonus 10</b>	0.41	0.36
<b>Bonus 50</b>	0.39	0.39
<b>Best</b>	0.43	0.50
<b>N</b>	<b>139</b>	<b>197</b>

Note:

<sup>a</sup> Standard deviations appear in parentheses.

As Fig. 1 illustrates, when we separate the participants according to gender and incentives we find, consistent with earlier findings (Barber and Odean, 2001; Endres, 2006) that men in the fixed payment group exhibited higher overconfidence than women ( $t= 2.904$ ,  $p=.005$ ). However, surprisingly, men in the bonus groups exhibited less overconfidence than those in the fixed payment group, while the women's overconfidence increased. As a result, there is no significant difference in overconfidence between men and women in these groups (*Bonus 10*:  $t= 0.81$ ,  $p=.420$ ; *Bonus 50*:  $t= 0.98$ ,  $p=.328$ ).

**Figure 1** Mean overconfidence (*Estimate minus correct*), by gender and compensation.



In order to further examine the effects of gender and incentives on participants' estimates we run OLS regressions analysis, based on the following regression model:

$$(Estimate\ minus\ Correct)_i = \alpha_0 + \alpha_1 * Male_i + \alpha_2 * Bonus10_i + \alpha_3 * Bonus50_i + \alpha_4 * Bonus10_i * Male_i + \alpha_5 * Bonus50_i * Male_i + \alpha_6 * Math4-5_i + \alpha_7 * Best_i + e_i \quad (1)$$

This regression analysis tests the significance of the differences illustrated in Figures 1, while controlling for student quality using both the *Math 4-5* and *Best* variables.<sup>4</sup> The results of the regression are presented in Table 3. They indicate that men in the fixed payment group were more overconfident than women in the same group ( $H_0: \alpha_1=0$ ). In the bonus groups, we find no significant difference in overconfidence between genders (*Bonus10*,  $H_0: \alpha_1+\alpha_4=0$ ,  $F=0.22$ ,  $p=.638$ ; *Bonus50*,  $H_0: \alpha_1+\alpha_5=0$ ,  $F=0.24$ ,  $p=.626$ ). Women in both bonus groups showed significantly higher overconfidence than women in the fixed payment group (*Bonus10*,  $H_0: \alpha_2=0$ ; *Bonus50*,  $H_0: \alpha_3=0$ ). Thus, the findings indicate that the bonus increased women's overconfidence. No differences are found when comparing the two bonus groups ( $H_0: \alpha_2=\alpha_3$ ,  $F=0.43$ ,  $p=.514$ ).

Men in the bonus 50 group show significantly lower overconfidence than men in the fixed payment group ( $H_0: \alpha_3+\alpha_5=0$ ,  $F=3.66$ ,  $p=.056$ ), but no significant difference was found between the bonus 10 group and the fixed payment group ( $H_0: \alpha_2+\alpha_4=0$ ,  $F=1.44$ ,  $p=.231$ ). In addition, participants who studied math on a higher level in high school and those who passed the test exhibited less overconfidence<sup>5</sup>.

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<sup>4</sup> We did not control for age in the regressions because this variable had a very low standard deviation in our sample. All qualitative results remained similar when adding age to the regressions. The *Age* coefficient is not significant.

<sup>5</sup> We also asked the participants a similar research question immediately after the exam and find similar results to those described in this paper.

**Table III**Regression results for the effect of compensation type on students' overconfidence <sup>a</sup>

Variable	Dependent Variable Estimate minus Correct
<b>Constant</b>	5.448 (0.589)***
<b>Male</b>	2.168 (0.661)***
<b>Bonus 10</b>	1.784 (0.641)***
<b>Bonus 50</b>	1.439 (0.647)**
<b>Bonus 10 X Male</b>	-2.403 (0.822)***
<b>Bonus 50 X Male</b>	-2.049 (0.822)***
<b>Math 4-5</b>	-0.634 (0.344)*
<b>Best</b>	-5.186 (0.319)***
<b>R<sup>2</sup></b>	0.503
<b>N</b>	336

*Note:*<sup>a</sup> Standard errors appear in parentheses.\*\*\*= $p < 0.01$ ; \*\*= $p < 0.05$ ; \*= $p < 0.1$ .

#### IV. Conclusions

The present study attempts to determine how the method of compensation affects men's and women's overconfidence. The research was conducted under the conditions of natural stress caused by a final exam, and the task concerned the participants' self-evaluation in a real situation.

We find that offering a bonus had an opposite effect on overconfidence according to gender. When the payment for participation was not related to performance, men exhibited higher overconfidence than women, consistent with earlier findings. However, when performance-related payment was offered, women's overconfidence increased, while men's overconfidence decreased or did not change (in the bonus 10 group) so no difference was found between men and women in the bonus groups. For women, the methods of compensation in this study produced results opposite those expected according to classic economic theory. It was also found that women in the fixed payment group performed better. Therefore, the findings support the idea that performance-based compensation does not necessarily achieve the best results and may even worsen them.

Our findings indicate that fixed compensation is a better payment scheme for reducing overconfidence of women in situations requiring self-evaluation of personal abilities under stress while men, who tend to be more overconfident than women

evaluated their own skills more accurate when offered performance-based compensation.

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