How Does Overconfidence Affect Individual Decision Making

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Introduction

A large number of firms entering the industry are not able to maintain their competitiveness even in the short run and fail. There are also many business project failures which seem to be a result of managerial incompetence. However, managerial overconfidence may be one of the major reasons for these failures instead. In their paper "Overconfidence and Excess Entry: An Experimental Approach" Colin Camerer and Dan Lovallo focus on overconfidence as reason for business failure. They describe an experiment, the results of which provide an interesting insight about the significance of overconfidence for human behavior, and in particular, about its effect on managerial decision making process.

There are "Psychological studies which show that most people are overconfident about their own relative abilities, and unreasonably optimistic about their futures" (Camerer and Lovallo p.306). Camerer and Lovallo's experiment confirms the results of these studies and emphasizes their implication in explaining economic phenomena, such as excessive entry.

Our experiment has been initially prompted by, and is in a sense, a follow-up of Camerer and Lovallo's work. We conduct an experiment addressing the same phenomena

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studied by Camerer and Lovallo. However, in designing our experiment, besides for the significance of overconfidence in shaping human behavior, we have also attempted to test for the significance of several other factors which may potentially affect individuals' overconfidence. These factors are:

- gender
- previous relevant experience / background
- time, i.e. the evolution of the overconfidence trend *with* time and *over* time spans of different lengths

According to the theory "optimistic over-entry will persist if the performance feedback is relatively noisy, infrequent, or slow" (Camerer and Lovalo p.306). We believe that overconfidence is higher *before* the relative skills are measured than *after.* Namely, that the individuals adjust their expectations downwards even before the actual results of their performances are known.

In our view, overconfidence may also be higher for males than for females. We are also concerned with the significance of the length of the time span over which one's beliefs about her overconfidence are formed as well. Our initial expectations are that the further in time one's ability is tested, the more confident she is about her relative performance.

Experimental Design

The experiment has been conducted with a group of students on the preparatory semester at CERGE-EI. They have been accepted to the preparatory semester of the CERGE-EI Ph.D. program in Economics. A successful completion of the preparatory semester guarantees admission to the full course of studies. The students in the prep

semester predominantly have a strong background in either economics or mathematics. However, almost all of them come from transitional economies in Central and Eastern Europe, and former Soviet Union and few of the students are acquainted with the requirements of a U.S. style Ph.D. program. At the very beginning of the preparatory semester they are required to sit a placement test in mathematics that will determine their level of proficiency in mathematics. Based on the results of the test, some of them may be exempted from the course. These results ensure that the students finally accepted to the program cover the minimum requirements for mathematical skills.

Students in the preparatory semester come from the top of their classes and some of them already have had some working experience or have earned some higher academic degree (MA/ PhD). With expectations based on their previous experience, they anticipate relatively high own performance in the prep semester at CERGE-EI compared to their peers. These expectations translate into overconfidence in their successful placement on the test and future performance in the course. This situation induces competitive behavior in the group which makes it an appropriate sample for the purpose of our experiment, namely to test the significance and evolution of the overconfidence effect on individuals' expectations about their skill-based performance in a competitive environment. For this purpose we use the placement test in mathematics to test the students' relative self-assessment and how it adjusts in the context of overconfidence before and after the test.

The present experiment has been conducted in two stages. With the cooperation of the professors at CERGE-EI we have asked the preparatory class at the end of two of their lectures to fill out our questionnaire. The first round of the experiment was conducted a couple of days before the placement test in mathematics, while the second one was done

just before the grades from the test were announced. We tried to match the individual answers from both questionnaires in order to track the potential changes in individual overconfidence. We gave the students the option to remain anonymous by choosing an alias name when filling out both questionnaires. We have explicitly asked the students to remember their "nickname" in order to use it for the second round of the experiment. The period between the placement test and the announcement of the results, or the time during which the students could adjust their expectations was five days.

We asked the students in both questionnaires to mark their gender and academic background (economics or mathematics) in order to test for a possible relationship between gender and overconfidence on one hand, and related background and overconfidence on the other hand. In the first questionnaire we have also included three questions to control for the consistency of the answers on background and relative own skill evaluation. We asked the preparatory class in both questionnaires to predict their performance on the placement test and the average result for the class. We also have asked them to predict their future performance on the final in mathematics. The questions from the two rounds are presented in the attachment at the end of this paper. The results from the two questionnaires are analyzed and compared with the actual performance on the placement test.

Results

In the first part of the experiment, conducted before the placement test, we had 47 participants and for the second part conducted after the placement we had 31 observations. A total of 53 students took the placement test. The descriptive statistics for the three samples is presented in the table below:

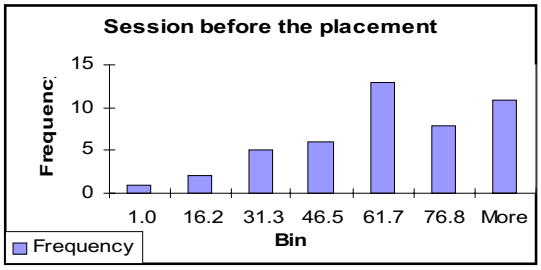
Table 1. Descriptive Statistics.

Type of the session	***Mean***	***Median***	***Max***	***Min***	***Variance***	***Number of participants***
Before placement (own score)	57.39362	60	92	1	570.1732	47
Before placement (average score)	50.67347	50	90	25	250.9328	47
After placement (own score)	29.8871	30	75	0	460.7952	31
After placement (average score)	35.63636	32	60	0	174.3011	31
Placement results	38.77358	33	91	0	938.2939	53

It can be seen from the Table 1 that the individuals' behavior is different before and after the test. Before the exam the mean of own performance is 57.39 and is higher than the mean of the average score which is 50.67. Therefore, individuals truly believe that they are better than the average person in the class, or in other words they are overconfident. However, the results from the second round are reversed. Here the participants' "score" themselves lower than the average person in the class (where 29.88 stands for own score and 35.63 stands for the class average). It is clear that they have lost their overconfidence after they took the placement test, even before seeing their actual results. This result is observed from the histograms for the distribution of the grades in Figure 1 (a-d). This implies that simply sitting the Placement test, or one's trying her own abilities, even without knowing the results, may have a strong signaling effect on one's assessment of own ablates.

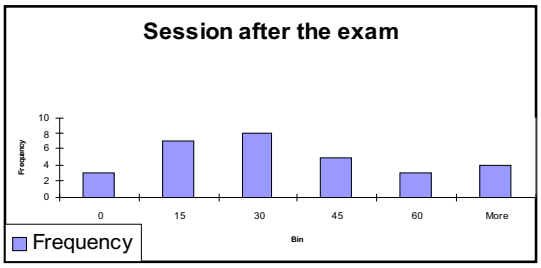
The distribution of the results for the experiment conducted before the placement test is skewed to the right. In other words the majority of the participants believe that they will score very high, i.e. they are overconfident.

Figure 1.a. Distribution of Own Predictions Before Placement



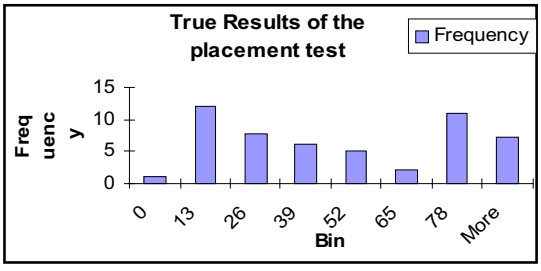
The same histogram for the round conducted after the exam shows that the majority of the participants have shifted their expectations to the left, in other words, they have reversed their behavior.

Figure 1.b. Distribution of Own Predictions After Placement



The histogram for the true results on the placement test has two peaks in the distribution of the students' performance on the test. The scores are on the two extremes: students either scored very high or very low.

Figure 1.c. Distribution of True Results From Placement

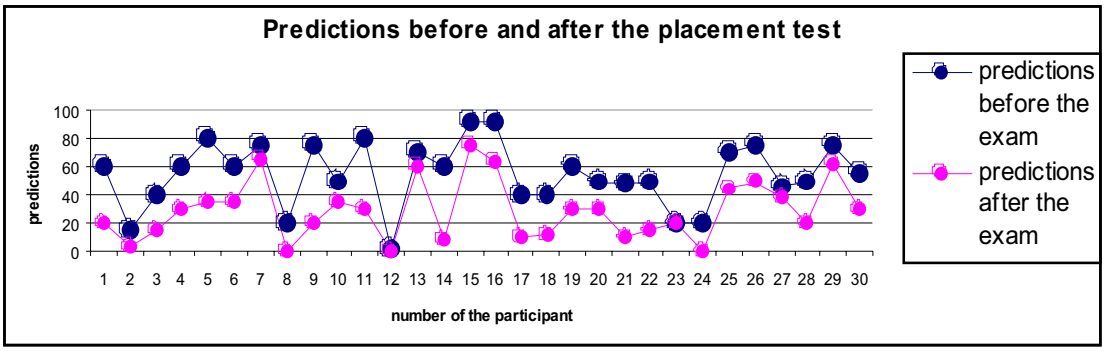


The histogram for the own predictions for the final grade in mathematics shows even more confidence then they had before the placement. So, people become even more

confident, when they take into account time factor. We used a z-test procedure to test for the equality of the means. First, we conducted a z-test between the first round sample and the true results. After that we used the same test for the sample of the true results and the second round sample. The z-test allows for testing the differences in the means between two samples of different size. We stated the null hypothesis for the equality of the two means for both tests at 5% level of significance. We rejected the hypothesis for the equality of the true mean and the mean predicted before the placement test. However, we accepted the analogous hypothesis for the mean predicted after the placement test.

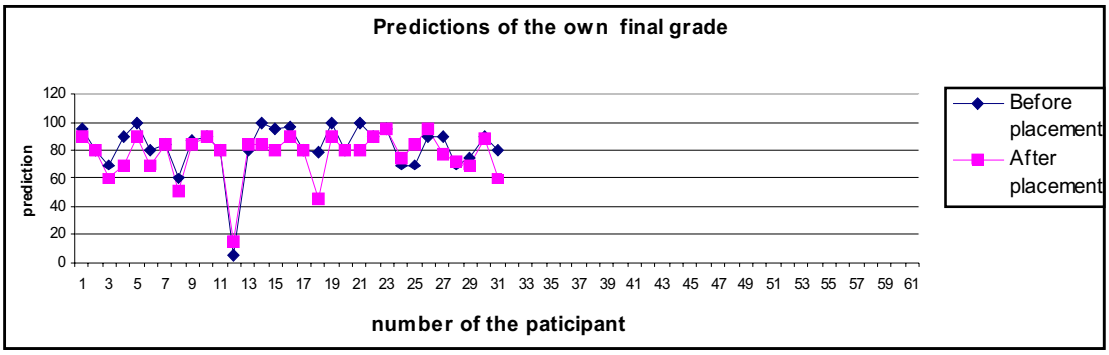
To summarize the results above, we plotted the graph for the participants' predictions of their own scores before they took the placement test, after it and their predictions about their grade on the final result. We matched the results for each person. While being overconfident before the exam they believed that they would perform very well and score high, however after the test they reevaluated their abilities. As a result, the subjects adapted to the new environment, lost their overconfidence and converged their expectations to the real data.

Figure 2. The Participants' Predictions of Their Own Scores.



However, when subjects take into account time factor, they again become overconfident. Figure 3 depicts the participants' prediction of their own score on final exam. It can be seen that subjects' overconfidence has not changed for both rounds. Even presuming that they have not performed well on the placement test, they still believe that they will succeed on final exam.

Figure 3. The Participants' Predictions of Their Own Final Grades.



In order to test the hypothesis that there is a correlation between the gender of the participant and her prediction of her own score and the average score, we calculated the relevant correlation coefficients. For both rounds (conducted before and after the placement) we rejected the hypothesis that there is any significant influence of gender on the participants' predictions since the correlation coefficients are very low (less than 0.2). We also found that the correlation between the participants' background and their predictions of their own scores are rather high in both rounds (about 0.5). The last result can be easily explained by the number of students in the sample who have a background in mathematics and who are naturally more confident when taking an exam in mathematics.

Additional Experiment

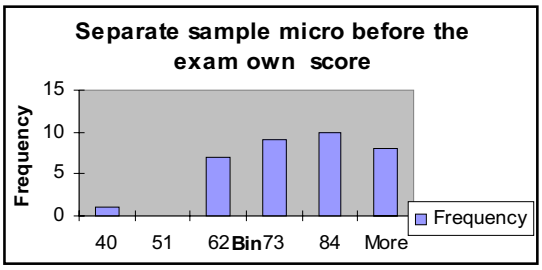
Our original experiment was conducted based on a placement test in mathematics. One of the questions asked in the questionnaire was how students would predict their own score on the final exam in math. We had seen that overconfidence is present when students take into account the time factor. After we completed both rounds of the experiment, we decided to prolong our study on overconfidence behavior and see whether it's persistent overtime. We designed a new experiment, now based on a microeconomics final exam. We had several motivations for that. First and the most important one, was our concern that probably students tend to have different attitude towards different subjects. In fact, during the first experiment 28 participants (about 60%) identified themselves as economists and 20 as mathematicians. So we had an open question whether there is opposite influence of factors such as time and subject on the students' self-confidence. We suppose that students possibly tend to overestimate their abilities while taking an exam in their own filed. However, this does not preclude the fact that students could have a more realistic view on their own abilities after having some time (in our case its two months) to rank themselves among their classmates.

Our second experiment was conducted at CERGE-EI almost two month after the first round. We chose the end of the preparatory semester, just before the beginning of the final exams. The design of the experiment was basically the same as before with the only difference that now the subject of our research was not mathematics but microeconomics. As before two sessions were conducted: one before the final exam in micro and another after the exam, but before the announcement of the results from the exam. In our first experiment we asked the participants to predict their own and the class-average score on

the final exam on mathematics. Now, we asked the participants to predict their own and average scores both on microeconomics and for mathematics final exams. We expected that students would tend to lower their expectations about final exam in math just before the examination comparatively to the prediction that they had at the very beginning of the prep semester. We also expected students to show the same overconfident behavior, predicting results in microeconomics final, as they did with math placement test. This would demonstrate that there is no influence from the type of examination on students' overconfidence behavior.

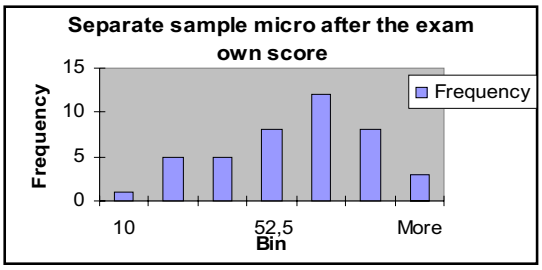
The distribution of the results for the experiment conducted before the placement test is again skewed to the right (see Figure 4 a.). In other words the majority of the participants believe that they will score very high, i.e. they are overconfident, proving our hypothesis that overconfidence is a persistent characteristic in human behavior.

Figure 4.a. Separate Sample: Prediction Own Score Before Exam



We observe again a readjustment of the expectations after the exam, the results becoming less optimistic in Figure 4.b.

Figure 4.b. Separate Sample: Prediction Own Score After Exam



The same observation as above holds for the average scores expectations, though it's not so drastic. People tend to moderate their prediction with more weight shifted towards the mean of the distribution (see Figures 4.c-4.d.).

Figure 4.c. Separate Sample: Prediction Average Score Before Exam

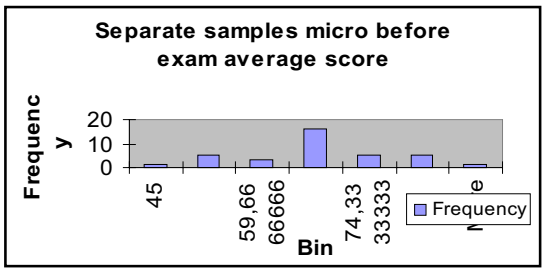
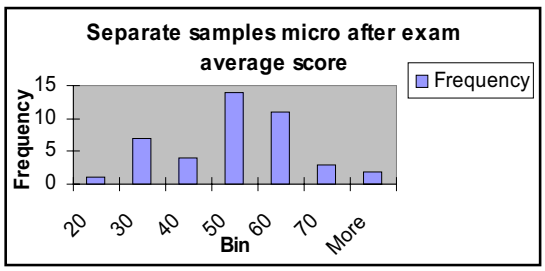


Figure 4.d. Separate Sample: Prediction Average Score After Exam



The conclusions from our second experiment coincide with our initial results. Students tend to be overconfident and place themselves above their peers on exams. However, after taking the actual exam and thus receiving a signal about their own abilities, student reevaluate down their own performance and the average one (see Figure

5.a.-5.b.). The two evaluations move closer to each other in figure 5.c., demonstrating that initial overconfidence has ebbed and adjustment of expectations took place.

Figure 5.a. Overconfidence: Own Score Before And After Exam

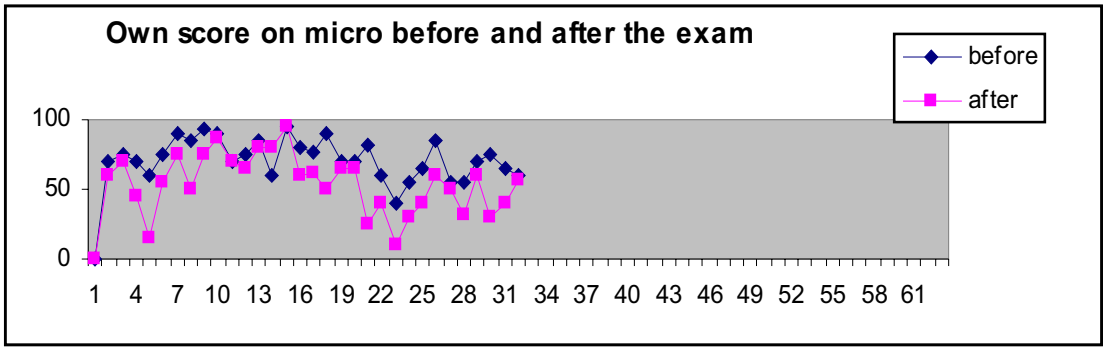


Figure 5.b. Overconfidence: Own And Average Score Before Exam

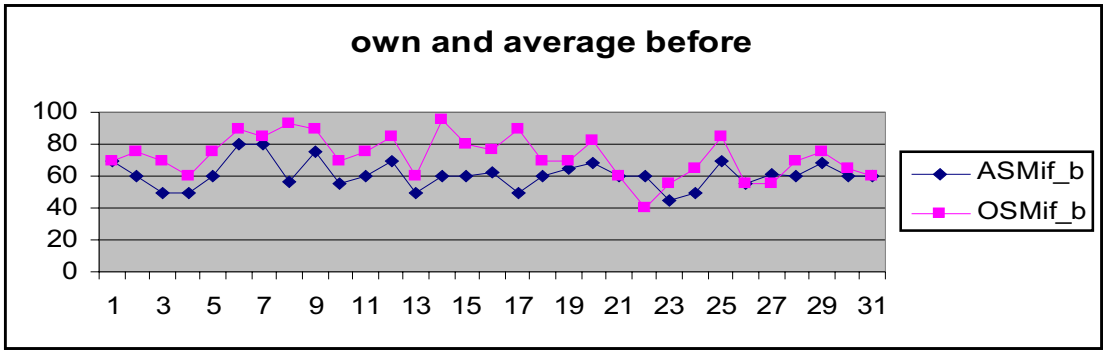
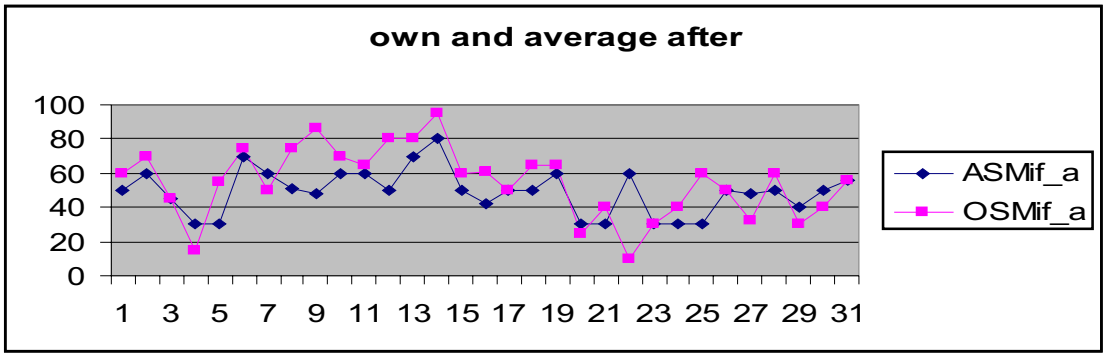


Figure 5.c. Overconfidence: Own And Average Score After Exam



Conclusion

The main finding of the paper is that people's overconfidence is higher *before* the relative skills are measured than *after*. Indeed, after their skills are measured, the subjects converge from overconfidence close to their real rank. However, we also found that the further in time one's ability is tested, the more confident she is about her relative performance which suggests that excess entry may be due to wrong estimation of one's relative skills. Contrary to our expectations, the results of the experiment also imply that overconfidence does not differ with gender, but there is a significant correlation between level of overconfidence and the person's previous relevant background record. The last result may, however, be characteristic to the specific sample of students choosing to come to CERGE-EI to attend the Preparatory semester – those female students who attend have already attained a certain level of education which is higher than the average, and this may have an impact on their confidence in their own abilities relative to the rest of the sample. In our second experiment we proved the results from our initial round and demonstrated that overconfidence could be a persistent phenomenon in people's behavior despite the eventual readjustment of expectations

References

Camerer, Colin and Lovallo, Dan. "Overconfidence and Excess Entry: An Experimental Approach." *The American Economic Review*, March 1999, 89 (1), pp.306 – 318.

Appendix

Questionnaire #1:

Your "name": _____

(If you are uncomfortable to write your real name, feel free to select a "nickname" that you can easily remember)

Please read each question carefully before you answer it.

1. You are:

female ☐ male ☐

2. You identify yourself as:

(If you do not identify yourself as one or the other, check the one that describes you best)

economist ☐ mathematician ☐

3. Evaluate your knowledge in Economics from 1 to 6 **where 1 is the lowest and 6 is the highest.**

1	**2**	**3**	**4**	**5**	**6**
☐	☐	☐	☐	☐	☐

4. Evaluate your mathematical skills from 1 to 6 **where 1 is the lowest and 6 is the highest.**

1	**2**	**3**	**4**	**5**	**6**
☐	☐	☐	☐	☐	☐

5. On the ***placement test*** you can earn a score from 0 to 100. What is **your prediction** of the **average score** on the ***placement test*** this coming Wednesday? Please write the number in the box below:

6. On the ***placement test in mathematics*** you can earn a score from 0 to 100. What is **your prediction** of **your own score** on the ***placement test*** this coming Wednesday? Please write the number in the box below:

7. Evaluate your performance as a student in the most recent program you were enrolled in.

Top 5%	**Top 10%**	**Top 30%**	**Top 50%**	**Below**
☐	☐	☐	☐	☐

8. On the ***final exam in mathematics*** you can earn a score from 0 to 100. What is **your prediction** of **your own score** on the ***final exam***? Please write the number in the box below:

****
****

Questionnaire # 2:

Your "name": _____

(Remember the questionnaire from last Monday? Please, fill above the same "name" you used on Monday. If you feel are uncomfortable to write your real name, feel free to select a "nickname" that you can easily remember)

Please read each question carefully before you answer it.

1. You are:

female ☐ male ☐

2. You identify yourself as:

(If you do not identify yourself as one or the other, check the one that describes you best)

economist ☐ mathematician ☐

3. On the ***placement test*** you can earn a score from 0 to 100. What is **your prediction** of the **average score** on the ***placement test in mathematics*** that took place last Wednesday? Please write the number in the box below:

4. On the ***placement test in mathematics*** you can earn a score from 0 to 100. What is **your prediction** of **your own score** on the ***placement test in mathematics*** that took place last Wednesday? Please write the number in the box below:

5. On the ***final exam in mathematics*** you can earn a score from 0 to 100. What is **your prediction** of the **average score** on the ***final exam***? Please write the number in the box below:

6. On the ***final exam in mathematics*** you can earn a score from 0 to 100. What is **your prediction** of **your own score** on the ***final exam***? Please write the number in the box below: