UNREALISTIC OPTIMISM ABOUT EXOGENOUS EVENTS:

An experimental test[1]

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ABSTRACT

An experiment is designed to test if individuals show (unrealistic) optimism when determining their subjective probabilities about exogenous circumstances. Subjects in the control group make an informed guess about a number, under a payment scheme that rewards close guesses. In the treatment group, subjects' payments depend on the actual number as well as on the closeness of the guess, and they are thus given an incentive to guess optimistically. The data suggests that there is an optimistic bias.

Keywords: optimism, unrealistic optimism, wishful thinking, wish fulfilment.

JEL codes: C91, D81, D84

1. Introduction

Unrealistic optimism refers to the phenomenon that people systematically overestimate the probability that good things will happen to them and underestimate the probability that bad things will happen. Weinstein (1980) found unrealistic optimism in subjects' estimates of the probabilities of a number of future life events in that subjects judged the risk of positive events occurring to them as larger than for the average person, and the risk of negative events smaller. Several subsequent psychological studies confirm the view that people exhibit unrealistic optimism (see the survey of the literature in Wenglert & Rosén, 2000).

There are other interesting and related forms of judgement bias: overconfidence which implies an over-estimation of one's own ability, and self-serving bias which is a tendency to evaluate evidence or make judgements in a way that benefits oneself. It follows that self-serving bias can accommodate both optimism and overconfidence.[3] Such judgement biases can be expected to affect decisions taken without precise knowledge of probabilities, for example in the financial area. They have proven useful in explaining financial market data, see e.g. de Meza & Southey (1996) for optimism in investment decisions, and Barber & Odean (2001) for overconfidence and trading activity.

A couple of economic experiments study the existence of optimism and related phenomena. Forsythe, Rietz & Ross (1999) study wish fulfilment, defined as the

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[3] The discovery by Svenson (1981) that more than half of survey respondents see themselves as more competent drivers than average can be seen as an example of both over-confidence and self-serving bias, but less obviously of optimism (other than of one's own judgement).

"tendency to overestimate the probability of desirable events" (page 89). They find evidence of it in the form of a bias in traders' portfolio holdings in actual election stock markets, and a bias in prices in laboratory markets with induced preferences. Babcock, Loewenstein, Issacharoff & Camerer (1995) found evidence of a self-serving bias in perceptions of fairness in an experiment where subjects were given roles as plaintiffs and defendants in a legal dispute over a claim for damages. Kaplan & Ruffle (2001) argue that strategic behavior may affect the measure of self-serving bias. They use a design without scope for strategic behavior but with incentives that would encourage self-serving beliefs about the rationality of others. In their data there is little evidence of a self-serving bias.

The experiment presented in this paper differs from previous ones in that it uses a setting where subjects' payoffs are determined independently of the characteristics, preferences and market decisions of other subjects. The challenge when designing experiments on judgement biases is to separate subjects' subjective probabilities of uncertain events or circumstances from their preferences over these. The approach in the present experiment is to have subjects make an informed guess about a pre-determined number. In the treatment groups subjects are paid according to both how close the guess came to the actual number and how high the value guessed at was, in the control groups subjects are paid only according to the closeness of the guess. A systematic difference between guesses is taken as an indication of unrealistic optimism (or pessimism, depending on the sign of the difference).

The outline of the paper is as follows. First the experimental design is introduced and the expected results described. Then the results are presented, followed by a conclusion.

2. Experimental design

The experiment was run at Stockholm University in two rounds, the first in May of 2001 and the second in February of 2003. All participants were students in Economics, in 2001 in the introductory course and in 2003 in the intermediate course. The two experiments presented the subjects with the same kind of decision to make, but the procedure and the incentive structure differed slightly between the two rounds as will be described below.

The 2001 sessions were run during the seminar sessions of the course, in six groups with around 25 students in each. Altogether 143 students participated while two chose not to. The procedure was as follows. At the beginning of class the students were offered to participate in an experiment in which they could make some money. One of two different instruction sheets was distributed and also read out loud.[4] The task was to guess the number of green balls in a container. The container was made of transparent plastic and filled with white and green Styrofoam balls.[5] The number of green versus white balls differed between seminar groups. The container was passed round the room from student to student and care was taken to prevent anyone from keeping the container for very long. It would hardly have been possible to

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[4] Translations of the instruction sheets are found in the appendix.
[5] The container was cylindrical, 18 by 14 centimetres and the diameter of the balls was 3 centimetres. It held about 80 balls altogether.

count the balls exactly anyway, but the idea was that subjects should be able to make a reasonable guess about the number of green balls in the jar. In each seminar group one of the following two methods of payment were offered:

> Neutral treatment: The person whose guess comes closest to the actual number of green balls gets 200 kronor, the second best guesser gets 99 kronor and the third best 50 kronor.[6] If two people make the best guess they share 299 kronor, three or more share 349 kronor.

> Biased treatment: The payment in kronor to each person is the number of green balls minus the "guessing fault", measured as the difference in absolute terms between the guess and the number of balls.

After the container had been passed round the room, students were asked to fill in their forms with their guesses. Participants were asked to write their names on their forms, and any non-participants were asked to just hand in a blank form. When forms were collected, which was after about 10 minutes, the experiment was completed except for payments. For this purpose the jar was left in the classroom until the break, when it was opened and the green balls counted publicly. Cash payments were made to the three best guessers (in the neutral treatment), or to each according to the number of green balls and their guess (in the biased treatment).

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[6] 10 kronor was approximately 1 $US at the time of the experiment.

The 2003 session maintained the basic procedure of handing round the container with green and white balls and paying subjects according to their guesses in one of two ways. However, two aspects of the procedure from the 2001 session appeared unnecessary: the different numbers of green balls in the different seminar groups and the lower expected payment in the neutral treatment. Thus the following procedure was used for the 2003 session.

(i)   There was only one large session with 95 subjects

(ii)   One and the same container was passed round among these subjects

(iii)   The incentive payments in the neutral treatment were increased. Five people were paid and the prizes were 500, 400, 300, 200 and 100 kronor.

(iv)   In the biased treatment five subjects were randomly selected to receive money, and their payments were ten times those of the 2001 session.

Since all subjects made their decisions in the same room there was the potential problem that subjects sitting near one another could influence each other's guesses. To minimize this effect subjects were of course asked to be completely quiet during the experiment and not show their written decisions to any one else. To ensure that between-subject effects would not contaminate the data, instructions sheets were alternated so that each subject sat next to someone who participated in the other treatment. Thus if some subjects influenced the guesses of nearby subjects, the influence should affect both treatments equally and would not give rise to treatment effects.

Average incentives in the neutral 2001 session were about 10 kronor per person. In the other sessions (including the neutral 2003 session) earnings averaged about 30 kronor per person, with a range from zero to 500.

3. Predictions

The decision that each of the subjects made in this experiment can be seen as consisting of two parts: firstly to estimate the probabilities of different values for the number of green balls and secondly to decide on the guessed number. The subjects would use the visual impression gained when the jar with green and white balls was passed around, the information about the payment structure plus any other information that may be relevant (e.g. beliefs about the decisions of other subjects). The observed outcome of this process is the guessed numbers and the idea of the experiment is to draw conclusions from this data about the first stage in the decision process, i.e. the estimation of probabilities.

The incentive structure in the unbiased treatment is that of a tournament (see Lazear & Rosen, 1981). Consider a simplified version of the guessing task in the neutral treatment, one where two subjects guess at one of three numbers, *A*, *B* or *C*, and where there is one prize *P*. The closest guess wins and if both guess the same number they share the prize. For a player who knows the actual number with certainty it is a (weakly) dominant strategy to guess that number. However, for a player who assigns a positive probability to more than one number, the supposed guesses of the other player may affect the guess. A simple example is if player one thinks that numbers *A* and *B* occur with probabilities 0.6 and 0.4, but is sure that

player two will guess number A. The expected payoff for player one of guessing number A is then $0.6 \cdot P/2 + 0.4 \cdot 0 = 0.3P$, while the expected payoff of guessing number B is $0.6 \cdot P + 0.4 \cdot 0 = 0.4P$. In this example player one would be better off guessing the less likely number.

Could such tournament incentives have a systematic effect on subjects' guesses in the unbiased treatment? Several factors, partly to do with the design of the experiment, speak against that. If some subjects picked unlikely numbers the variance of guesses might be affected but there should be no directional bias. Also, the payment structure in the unbiased treatment specifies that if two (or three) players guess closest, they share the sum of first and second (and third) prize. This reduces the loss from having to share the winning prize. Furthermore, it is difficult to imagine how to second-guess the guesses of others in this particular experimental situation. The tournament incentive structure in the neutral treatment should thus give subjects the incentive to guess correctly.

The payment structure in the biased treatment does not reward only guesses that are close to actual numbers. Here the payment is determined by the number of actual balls minus the absolute value of the guessing fault.[7] In our example let the numbers A and B be 40 and 50. At probabilities 0.6 for A and 0.4 for B the expected payment when guessing A is $0.6 \cdot 40 + 0.4 \cdot 40 = 40$ and when guessing B it is $0.6 \cdot 30 + 0.4 \cdot 50 = 38$. If the probabilities are instead 0.4 for A and 0.6 for B the

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[7] In the 2001 session this is the payment to each subject, while in the 2003 session 10 percent of the subjects get 10 times that amount.

expected payments become $0.4 \cdot 40 + 0.6 \cdot 40 = 40$ when guessing *A* and $0.4 \cdot 30 + 0.6 \cdot 50 = 42$ when guessing *B*. Thus two things have changed: the expected payment is highest when guessing the more likely number (as it should be), but in addition the actual value of the expected payment is higher for both numbers. This is "a good thing" and since an optimist overestimates the probability of good things, optimists should choose the second probability distribution, with more probability mass on higher numbers, more often. This would also imply that optimists guessed higher numbers.

Thus the null hypothesis is that guesses should be no different between the biased and the neutral treatments, while a positive difference would suggest optimism and a negative pessimism. When analysing the data the fact that guesses could differ because the actual number of green balls differed will be taken into account, and also the possibility of a gender difference.

4. Results

The separate distributions of the guesses for the 2001 and 2003 sessions, together with the total of the guesses in the two sessions, are shown in *Figure 1*. The mean guesses and the actual numbers are shown in *Table 1*.

Table 1: Mean and median of Guess and Actual numbers by Session and in Total

	Session 2001	*Session 2003*	*Total*
Mean Guess	42.2	38.6	40.8
Mean Actual	42.4	41	41.8
Median Guess	37	37	37
Median Actual	38	41	41

The table shows that guesses are slightly lower than actual numbers, particularly in the 2003 session, but on average guesses seem quite close to actual numbers. The data by session and in total is described in *Figure 1*. The distributions from the 2001 and 2003 sessions are not significantly different (*P*-value 0.29 in a Kolmogorov-Smirnov test for equality of distribution functions).

Subjects presumably based their guesses on their private information, i.e. the number of green balls that they had been able to count as the container was passed round. This indicates that the guessed number of green balls is a "count variable" and that a regression model based on the Poisson distribution should be used. To avoid the overestimation of the significance of variables that will occur if the conditional variance is not identical with the conditional mean (as it is in the Poisson regression model), we will use the Negative binomial regression model (see Long, 1997, chapter 8). Since subjects' guesses might be affected by their impressions of the relative number of green versus white balls, the effects of each of the actual numbers of green balls will be controlled for, as will the gender of the guesser.

Regression results are shown in *Table 2* for the two sessions separately and together. Because of collinearity with the treatment variable (the actual value was the same for the treatment group and the control group only in the 2003 session) one of the actual numbers has to be dropped in the *Total* regression and three have to be dropped in the *Session 2001* regression. Since most of the dummy variables for actual number have effects that are small and not significant it does not seem important which ones of these are dropped. In the *Total* regression, Actual38 is dropped. In both regressions Actual51, which has a strongly significant effect in the regression for both sessions jointly, and Actual41, which is 0 in Session 2001 and 1 in Session 2003, are retained.

Table 2: Negative binomial regression of Guess by Session and in Total
     (z-values in parentheses)

Variable	*Session 2001* 143 obs.	*Session 2003* 95 obs.	*Total* 238 obs.
Constant	3.48 (45.71)	3.57 (45.69)	3.49 (34.80)
Opt1	0.16 (1.79)	0.15 (1.62)	0.15 (1.88)
Fem1	0.01 (0.22)	0.01 (0.12)	0.01 (0.23)
Actual51	0.52 (5.91)	--	0.51 (4.55)
Actual45	- 0.07 (- 0.76)	--	- 0.06 (- 0.68)
Actual32	--	--	- 0.01 (- 0.06)
Actual41	--	--	0.08 (1.03)

The treatment variable Opt1 is significant at the 10 percent level in the *Session 2001* and *Total* regressions (and close to that in the *Session 2003* regression). The

coefficient is about the same in all three regressions. Thus the biased treatment increases the guessed number by approximately the same amount in all three cases. The effect of gender is small and not significant in any of the regressions. Of the actual numbers it is only the largest number Actual51 that is significant and its effect is positive and quite large.

The results of estimation with the treatment variable Opt1 and the Actual51 and Actual41 dummy variables are shown in *Table 3*. The table also includes the results of an OLS regression with the data from both sessions.

Table 3: Negative binomial regression (NBRM) of Guess by Session and in Total (z-values in parentheses), plus OLS regression of Guess using Total data (t-values in parentheses)

Variable	NBRM Session 2001 143 obs.	NBRM Session 2003 95 obs.	NBRM Total 238 obs.	OLS Total 238 obs.
Constant	3.49 (48.20)	3.57 (53.91)	3.48 (57.29)	32.18 (11.16)
Opt1	0.14 (1.65)	0.15 (1.62)	0.14 (2.38)	5.35 (1.85)
Actual51	0.53 (5.97)	--	0.53 (6.40)	22.97 (5.73)
Actual41	--	--	0.10 (1.70)	3.72 (1.34)

The p-value of Opt1 in the *NBRM Total* regression is 0.017, making the treatment variable highly significant.[8] This suggests that there is an optimism effect. The coefficients from the *OLS Total* regression are helpful in judging the size of this effect: subjects in the biased treatment guess on average that the number of green

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[8] In the 2001 regression the treatment variable has *P*-value 0.100 and in the 2003 regression 0.105.

balls is higher by five. This means that the optimism bias increases the guess by about 12 percent.

The Actual41 variable is significant at the 10 percent level, meaning that subjects in the 2003 session guess higher numbers than in the 2001 session. This could be due to the number of balls—41 being the second highest number—or it could be a session effect. The Actual51 dummy variable is highly significant and the coefficient is quite large. The observations with 51 green balls are from two seminar groups and the average guesses are very similar in these two groups, 55.8 in one and 54.7 in the other. Estimating the model without the observations from the two Actual51 groups yields very similar results as before, as is shown in *Table 4*.

Table 4: Negative binomial regression (NBRM) of Guess in Session 2001 and in Total (z-values in parentheses), plus OLS regression of Guess using Total data (t-values in parentheses), everywhere excluding the 45 observations for which Actual51=1.

Variable	NBRM Session 2001 98 obs.	NBRM Total 193 obs.	OLS Total 193 obs.
Constant	3.49 (49.86)	3.48 (56.48)	32.18 (12.15)
Opt1	0.14 (1.70)	0.14 (2.35)	5.35 (2.02)
Actual41	--	0.10 (1.67)	3.72 (1.46)

In the 2001 regression the treatment variable now has a *P*-value of 0.089, in the *NBRM Total* regression 0.019 (and in the OLS regression 0.045). It seems not

unlikely that the actual numbers of green balls affect guesses, at least for the highest numbers.

5. Conclusion

The experiment presented here differed from previous experiments on optimism and other judgement biases in that the circumstance subject to judgement was an exogenous and predetermined event (the number of green Styrofoam balls in a jar) rather than a condition determined as a part of the experiment. The data generated by the experiment indicates that there is an optimism bias.

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AN ECONOMIC EXPERIMENT

You are hereby invited to participate in an experiment about decision-making. A container with white and green balls will shortly be circulated in this room (during about 5 minutes). The procedure of the experiment is that you guess the number of green balls in the container and fill out this form, which will be collected immediately afterwards. During your next break I will return, we will count the number of balls in the jar (which has remained here), and the three persons who guessed most closely above or below the actual number of balls will be paid cash according to the following:

> *Closest guess: 200 kronor*
> *Second closest guess: 99 kronor*
> *Third closest guess: 50 kronor*

If two people make the closest guess, these two will share 299 kronor, if three or more guess closest these share 349 kronor. For those who receive more than 100 kronor we will pay income tax at a rate of 30 percent. The payments are thus net of taxes.

It is important that you decide on your guess yourself without discussing with anyone else. We will read out the names of those who get paid, but your answer will remain anonymous in all other presentation of the experiment. (For the financial accounting of the experiment we will need the social security number and the address of those who get paid).

I believe that the number of green balls is:_____

Name:_____

➡➡➡➡➡➡➡ Hand in the form when you have filled it out to this point.

Actual number of green balls:_____

Sum paid out:_____

Signature (in ink):_____

Social security number (if more than 99 kronor):_____

Postal address:_____

Thank you for your participation!

Translations of the instruction sheet for the "Biased" treatment in Session 2001.

AN ECONOMIC EXPERIMENT

You are hereby invited to participate in an experiment about decision-making. A container with white and green balls will shortly be circulated in this room (during about 5 minutes). The procedure of the experiment is that you guess the number of green balls in the container and fill out this form, which will be collected immediately afterwards. During your next break I will return, we will count the number of balls in the jar (which has remained here), and you will be paid cash according to the following formula:

Number of kronor you get = number of green balls minus "the guessing fault"

The guessing fault is defined as the difference (measured in number of balls) between the actual number of balls and the number that you guessed.

It is important that you decide on your guess yourself without discussion with anyone else. Your answer will remain anonymous (the names of the participants is needed for the financial accounting for the experiment but will not be made public).

I believe that the number of green balls is:_____

Name:_____

➡➡➡➡➡➡➡ Hand in the form when you have filled it out to this point.

Actual number of green balls:_____

Sum paid out (number of green balls minus the guessing fault):_____

Signature (in ink):_____

Thank you for your participation!

Translations of the instruction sheet for the "Neutral" treatment in Session 2003.

AN ECONOMIC EXPERIMENT

You are hereby invited to participate in an experiment about decision-making. A container with white and green balls will shortly be circulated in this room (during about 5 minutes). The procedure of the experiment is that you guess the number of green balls in the container and fill out this form, which will be collected immediately afterwards. We will then count the number of balls in the jar (which has remained in this room), and pay in cash the five persons who guessed most closely according to the following:

Closest guess: 500 kronor
Second closest guess: 400 kronor
Third closest guess: 300 kronor
Fourth closest guess: 200 kronor
Fifth closest guess: 100 kronor

It does not matter if the guess is above or below the actual number. If two people make the closest guess these two will share 900 kronor, if three guess closest they share 1200 kronor etc. We will pay income tax at a rate of 30 percent and the payments are thus net of taxes.

It is important that you decide on your guess yourself without discussing with anyone else. We will read out the names of those who get paid, but your answer will remain anonymous in all other presentation of the experiment. For the financial accounting of the experiment we will need the social security number and the address of those who get paid.

I believe that the number of green balls is:_____

Name:_____

➡➡➡➡➡➡➡ Hand in the form when you have filled it out to this point.

Actual number of green balls:_____

Sum paid out if applicable:_____

Thank you for your participation!

Translations of the instruction sheet for the "Biased" treatment in Session 2003.

AN ECONOMIC EXPERIMENT

You are hereby invited to participate in an experiment about decision-making. A container with white and green balls will shortly be circulated in this room (during about 5 minutes). The procedure of the experiment is that you guess the number of green balls in the container and fill out this form, which will be collected immediately afterwards. We will then count the number of balls in the jar (which has remained in this room), and select five people randomly. If you are selected you will be paid cash according to the following formula:

Number of kronor you get =(number of green balls minus "the guessing fault")
times 10

The guessing fault is defined as the difference (measured in number of balls) between the actual number of balls and the number that you guessed. Example: If there are 7 green balls and you guess 11 and are selected you get *(7-4)10=30 kronor.*

It is important that you decide on your guess yourself without discussion with anyone else. We will read out them names of those selected randomly, but your answer will remain anonymous in all other presentation of the experiment. We pay tax at a rate of 30 percent and payments are thus net of taxes. For the financial accounting of the experiment we will need the social security number and the postal address of those who get paid.

I believe that the number of green balls is:_____

Name:_____

➡➡➡➡➡➡➡ Hand in the form when you have filled it out to this point.

Actual number of green balls:_____

Sum paid out if applicable,
(number of green balls minus the guessing fault) times 10:_____

Thank you for your participation!

Figure 1

Guess by Session and in Total