Forecasts of Relative Performance in Tournaments: Evidence from the Field

Tinbergen Institute
November 17th 2006

Young-Joon Park
UCSD

Luís Santos-Pinto
UNL

Motivation

- Tournaments are a frequently used incentive schemes in organizations.
- Economic theory tells us that expectations of relative performance in tournaments are one of the main determinants of effort or investment choices.
- However, very few studies in Economics investigate whether forecasts of relative performance are rational or not.

Field Experiment

- We perform three field experiments: two poker tournaments and one chess tournament.
- In poker performance depends on luck and in chess performance depends on skill.
- We introduce a new measure of beliefs of realtive performance.

	Task	Measure	Incentives	Bias	Learning
Camerer and Lovallo (1999)	Test of skill (logic)	Choice Entry or no entry	Yes Choice outcome	Excess entry	No
Clark and Friesen (2003)	max f(x,y) Decoding	Forecast	Yes Quadratic scoring rule	Mixed results	No
Ferraro (2003)	Micro Quizzes	Forecast	No	Overest.	No
Moore (2002) Moore and Kim (2003)	Easy test Hard test	Choice rank in test >50 or luck	Yes Choice outcome	Overest. Underest.	_
Hoelzl and Rustichini (2005)	Easy Test Hard Test	Choice rank in test >50 or luck	Yes Choice outcome	Overest. Underest.	_

Rationality/Learning Hypotheses

H1: Forecasts/bets are unbiased.

H2: Forecasts/bets are not random guesses/choices.

H3: Experience with tournaments improves forecast accuracy.

H4: Unskilled-unaware.

H5: Forecasts are efficient.

H6: Interval forecasts are not excessively narrow.

Forecasting Problem: Theory

- Suppose that an individual's beliefs of relative performance are a continuous random variable X.
- Let beliefs have density $g(x)$, continuous and with support in $[a,b]$, with $0 \leq a < b \leq 1$.
- Suppose this individual has initial wealth $\overline{w}$ and utility of wealth $U(w)$.
- Let f represent a point forecast, with f in $[0,1]$.

Forecasting Problem: Theory

- This individual's perceived wealth--a continuous version of the discrete quadratic scoring rule used in the survey--is given by

$$w = \overline{w} + [w_0 - (x - f)^2],$$

where $w_0 \geq 1$.

- The optimal point forecast of this individual is given by

$$\max_{f \in [0,1]} \int_a^b U(\overline{w} + w_0 - (x - f)^2) g(x) dx$$

Forecasting Problem: Theory

- The first-order condition to the point forecast problem is given by

$$\int_a^b U'(\overline{w} + w_0 - (x - f^*)^2)(x - f^*)g(x)dx = 0$$

- The second-order condition is given by

$$\int_a^b [2U''(\overline{w} + w_0 - (x - f^*)^2)(x - f^*)^2 - U'(\overline{w} + w_0 - (x - f^*)^2)]g(x)dx < 0$$

Forecasting Problem: Theory

- **Proposition 1**: If an individual is risk neutral, then $f^* = E(X)$.
- **Proposition 2**: If an individual's beliefs of relative performance are unimodal and symmetric, then $f^* = E(X)$.
- These results identify two necessary conditions for an individual's optimal forecast to differ from his mean belief:
  - (1) risk averse or risk seeking preferences
  - (2) asymmetric beliefs.

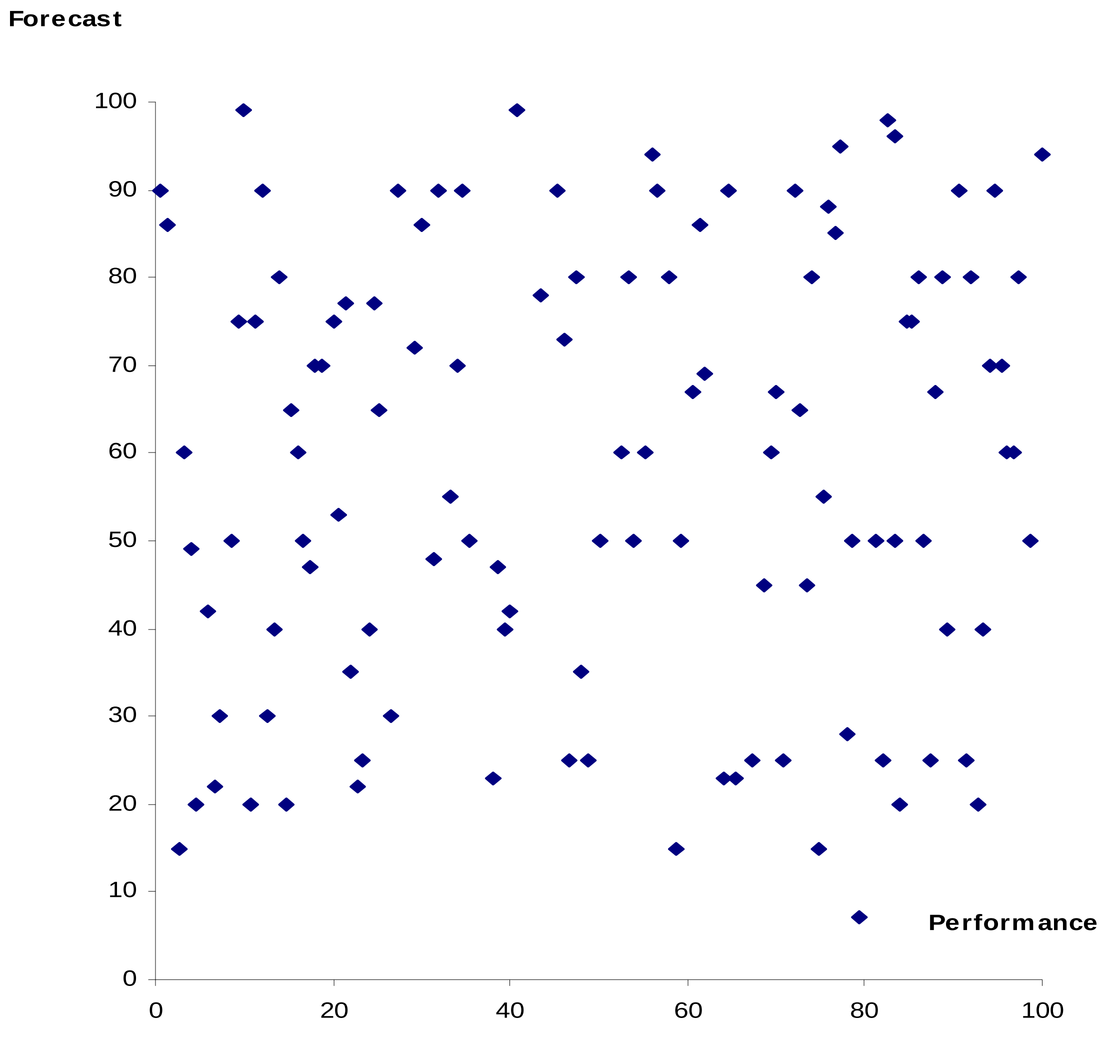
Forecasting Problem: Question

- Of all the individuals participating in this poker/chess tournament what percentage do you think will be eliminated before you?

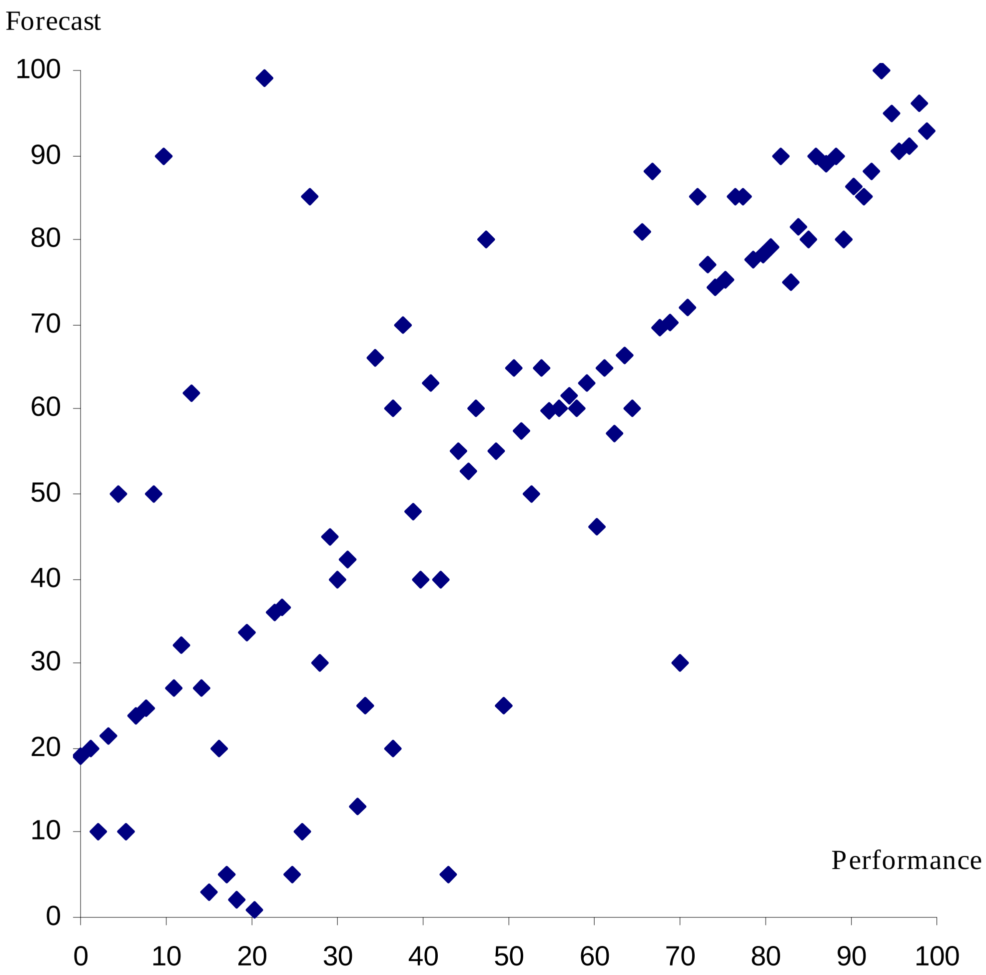
- We will pay you for your prediction as follows:

  $20 if the prediction is less than 1% away from your position
  $19 if it is more than 1% and less than 2% away from your position
  $16 if it is more than 2% and less than 3% away from your position
  $11 if it is more than 3% and less than 4% away from your position
  $ 4 if it is more than 4% and less than 5% away from your position
  $ 0 otherwise.

Poker Players' Forecasts



Chess Players' Forecasts



Findings for Forecasts

	UCSD’s Winter Poker Classic	UCSD’s Spring Poker Classic	Sintra’s Chess Open
Bias?	MFE = 10.02 n=122 t = 3.02	MFE = 7.13 n=116 t = 2.03	MFE = 6.98 n=60 t = 2.31
Random guesses?	Yes MAE=29.66	Yes MAE=31.34	No MAE=17.03
Does experience improve accuracy?	No	No	No
Unskilled-unaware?	_	_	Yes
Forecasts are efficient?	_	_	No
Absence of overconfidence?	_	_	No (Hit rate 35%)

Findings for Forecasts: Discussion

- Overestimation bias is present in poker as well as chess.
- However, size of biases is not as large as the ones often reported in psychology literature. (Why? Monetary incentives?)
- Is this good news for advocates of rational expectations? Maybe.
- Since chess players are very experienced and have good information about relative skill the bias is somewhat surprising.

Findings for Forecasts: Discussion

- Poker players' forecasts are random guesses but chess players' forecasts are not. Why?

	Poker	Chess
Average number of tournaments played before	5	40
Skill Versus luck	Luck is more important than skill	Skill is more important than luck
Information about quality of competition	No measure of relative skill available	Elo is a good measure of relative skill

Findings for Forecasts: Discussion

- Camerer and Lovallo (1999), Clark and Friesen (2003), Ferraro (2003), and Moore and Cain (2005) all find that repeated trials do not improve forecasts.
- Consistent with previous literature we also find that experience does not improve forecasts.
- We find support for the "**unskilled-unaware hypothesis**": experience together with high Elo rating improves chess players' forecasts of relative skill.

Betting Problem

- A new measure of beliefs of relative performance:
  - choice between bets whose payments are contingent on relative performance.

Betting Problem

- Consider the ten lotteries below. Choose one of the lotteries:

- $ 2.00 for sure
- $ 2.22 if you are eliminated after 10% of players and $0 otherwise
- $ 2.50 if you are eliminated after 20% of players and $0 otherwise
- $ 2.86 if you are eliminated after 30% of players and $0 otherwise
- $ 3.33 if you are eliminated after 40% of players and $0 otherwise
- $ 4.00 if you are eliminated after 50% of players and $0 otherwise
- $ 5.00 if you are eliminated after 60% of players and $0 otherwise
- $ 6.66 if you are eliminated after 70% of players and $0 otherwise
- $10.00 if you are eliminated after 80% of players and $0 otherwise
- $20.00 if you are eliminated after 90% of players and $0 otherwise

Betting Problem: Theory

- Suppose that an individual's beliefs of relative performance are a continuous random variable X.

- Let beliefs have density $g(x)$, continuous and with support in $[a,b]$, with $0 \leq a < b \leq 1$.

- Suppose this individual has initial wealth w_0 and utility of wealth $U(w)$.

- Let c represent a bet, with c in $[0,1]$.

Betting Problem: Theory

- This individual's perceived wealth--a continuous version of the discrete bets used in the survey--is given by

$$w = \begin{cases} \overline{w} + \dfrac{w_0}{1-c}, & \text{if } x \geq c \\ \overline{w}, & \text{if } x < c \end{cases}$$

where $w_0 \geq 0$.

- The optimal bet of this individual is the solution to

$$\max_{c \in [0,1]} \; G(c)U(\overline{w}) + (1 - G(c))U\left(\overline{w} + \frac{w}{1-c}\right)$$

Betting Problem: Theory

- **Proposition 3**: If an individual is risk neutral and his beliefs of relative performance are

  (i) uniform with support $[a,1]$, then his optimal bet is any c in $[a,1]$

  (ii) uniform with support $[a,b]$, b < 1, then $c^* = a < E(X)$

  (iii) unimodal and symmetric, then $a < c^* < \text{Mode}(X) = E(X)$

  (iv) unimodal and positively skewed, then $a \leq c^* \leq \text{Mode}(X) < E(X)$

Betting Problem: Theory

- For (ii), (iii), and (iv) we have that $c^* < E(X) = f^*$.
- The intuition for this result is that the betting problem, by comparison with the forecasting problem, creates an asymmetry between overestimation and underestimation of relative performance.
- In the forecasting problem, the cost of 10% overestimation is the same as 10% underestimation. By contrast, in the betting problem, the cost of 10% overestimation is larger than the cost of 10% underestimation.

Findings for Bets

	UCSD's Spring Poker Classic	Sintra's Chess Open
Bias?	MBE=16.79 n=129 $t_{5\%} = 6.56$	MBE=5.81 n=57 $t_{10\%} = 1.35$
Random choices?	Yes	No
Comparison with forecasts:		
- Sign	Same	Same
- Magnitude	Higher	Same

Findings for Bets: Discussion

- Findings for bets are consistent with findings for forecasts.
- Poker players' betting behavior suggests that poker players are risk seeking toward (small) gains.
- However, we do not have a measure of risk preferences in poker.
- We do have a measure of risk preferences in chess!

Findings for Bets: Discussion

- We asked chess players to choose between sure payment of 1 euro and 9 different lotteries all with the expected value of 1 euro but with different risks.
- Of the 57 chess players who answered the question 12 chose the sure thing and 10 chose the most risky lottery.
- We find that the mean forecast error of the 12 risk averse chess players is 3.21 while their mean bet error is -5.87 percentiles. This is consistent with the theoretical predictions.

THANK YOU