Overconfidence

Behavioral Economics

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Incorrect Beliefs

- In objective EU we assumed that everyone agreed on what the probabilities of different events were
- In subjective expected utility theory we asked only that the DM behaved consistent with *some* beliefs
- There is a third possibility: We know what the DM's beliefs *should* be, but they make 'mistakes'
- E.g. There are many robust examples of people being bad at statistical reasoning
  - Base rate neglect
  - Hot hands fallacy
  - Gamblers fallacy
- In this lecture we are going to concentrate on a different form of `incorrect beliefs'
  - Overconfidence

Outline

- Examples of overconfidence
  - Overprecision
  - Overplacement
  - Overestimation
- Possible causes of overconfidence
- Economic consequences of overconfidence
  - Excess Entry
  - Three Tier Tariffs

Types of Overconfidence

- Overprecision
- Overplacement
- Overestimation

Types of Overconfidence

- Overprecision
- Overplacement
- Overestimation

Overprecision

- The belief that you have more precise information about something that you actually do
- How long is the Nile in miles?
  - Provide a number x so that you are 90% sure that the Nile is LONGER than x
  - Provide a number y so that you are 90% sure that the Nile is SHORTER than y
- Calculate the HIT rate (across population or across questions)
  - Probability that correct answer is between x and y
- We would expect that the HIT rate should be 80%
- Generally the HIT rate is below 80%
  - In Soll and Klayman[2003] HIT rate 39%-66%
  - In your data HIT rate 62% (Nile) – 80% (Telegraph)

Types of Overconfidence

- Overprecision
- Overplacement
- Overestimation

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Overplacement

- The belief that you have a higher ranking that you actually do
  - 37% of one firm's professional engineers placed themselves among the top 5% of performers at the firm (Zenger, 1992)
  - 93% of a sample of American drivers and 69% of a sample of Swedish drivers reported that they were more skillful than the median driver in their own country (Svenson, 1981)
- Also apparent in test scores
- Dean and Ortoleva [2014] asked subject's 17 Raven's Matrix questions
  - Prediction for own score: 12
  - Prediction for average score: 11 (p=0.001)
- Your data
  - Prediction for own score: 5.5
  - Prediction for average score: 5.7

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Types of Overconfidence

- Overprecision
- Overplacement
- Overestimation

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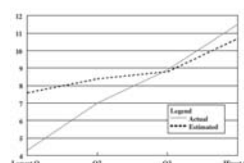
Overestimation

- The belief that you are better at something than you are
  - Estimated vs Actual Grades [Kennedy et al. 2002]



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Overestimation

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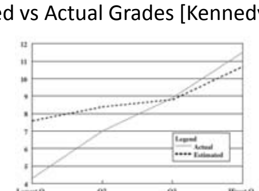

  - Your results:
    - Predicted 5.5   Actual 8.0

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Causes of Overconfidence

- Two classes of model

1. 'Rational Overconfidence'
   - Due to uncertainty about ability
   - Possibly coupled with mistakes in information processing
2. 'Irrational Overconfidence'
   - Due to deliberate biases to protect our ego
   - Do not recall events that make us look bad
   - Misinterpret signals telling us that we are rubbish

- Evidence that both effects may be important

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Overconfidence due to Information Processing

- Example: Moore and Healy [2008]
- Imagine that you are taking a quiz
- You think your performance depends on
  - S – how hard the test was
  - L_i – how good you are
  - Performance $X_i = S + L_i$
- Before seeing the test, you think
  - S is distributed normally with mean m and variance v_s
  - L_i is distributed normally with mean 0 and variance v_L
- After taking the test, but before learning the score, receive signal $Y_i = X_i + E_i$ of how well you did
  - E_i mean zero error term with variance v_E

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Overestimation

- What are beliefs about your own score after receiving signal Y_i?
- By Bayes rule: weighted average of signal and prior

$$E(X_i \mid Y_i) = \alpha m + (1-\alpha) Y_i$$

- Where

$$\alpha = \frac{v_L + v_E}{v_L + v_E + v_S}$$

- If Y_i is unbiased, then in expectation

$$E(X_i \mid Y_i) = \alpha m + (1-\alpha) X_i$$

- Prediction
  - Overestimation for hard tests
  - Underestimation for easy tests

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Overplacement

- What are beliefs about someone else's score after being told you scored X_i?
- By Bayes rule, expectation of the difficulty of the test

$$E(S \mid X_i) = \beta m + (1-\beta) X_i$$

- Where

$$\beta = \frac{v_L}{v_L + v_S}$$

- Because S is the expectation of others score

$$E(X_j \mid X_i) = \beta m + (1-\beta) X_i$$

- In expectation this is $E(X_j \mid X_i) = \beta m + (1-\beta) S$
- Belief about other's scores is between the mean and own score
- Prediction
  - Overplacement for easy tests
  - Underplacement for hard tests

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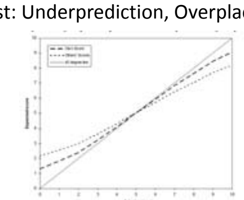
Overconfidence due to Information Processing: Predictions

- On average, across all tests, no overprediction or overestimation.
- In a *particular test*, depends on the difficulty:
  - Hard test: Overprediction, Underplacement
  - Easy test: Underprediction, Overplacement



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Overconfidence due to Information Processing: Predictions

- There are studies that do find both overconfidence and underconfidence
  - e.g. Stankov and Crawford [1997]
- And over and underplacement
  - Kruger [1999]
- Is this related to task difficulty?

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Moore and Healy - Results

Participants' overestimation of their own performances, measured at the interim phase, over the six trial blocks for the three different quiz difficulties. (Standard deviations in parentheses.)

	Block Number						
	1	2	3	4	5	6	Overall
Easy	-0.40 (1.07)	-0.20 (0.79)	-0.29 (0.83)	-0.10 (0.78)	-0.10 (0.82)	-0.22 (1.20)	-0.22 (0.93)
Medium	-0.13 (1.65)	0.01 (1.14)	0.05 (1.25)	-0.05 (1.16)	-0.15 (1.33)	0.31 (0.94)	0.01 (1.27)
Hard	1.15 (1.63)	0.69 (1.62)	0.87 (1.61)	0.71 (1.22)	0.69 (1.37)	0.63 (1.49)	0.79 (1.50)

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Moore and Healy - Results

Participants' overplacement of their own performances, measured at the interim phase, over the six trial blocks for the three different quiz difficulties. (Standard deviations in parentheses.)

	Block Number						
	1	2	3	4	5	6	Overall
Easy	0.56 (2.70)	0.55 (2.45)	0.08 (2.84)	0.59 (2.13)	0.75 (2.44)	0.36 (2.89)	0.48 (2.59)
Medium	-0.25 (3.82)	-0.23 (4.14)	-0.10 (4.03)	0.41 (3.46)	0.22 (3.99)	0.15 (4.10)	0.04 (3.91)
Hard	-1.46 (2.54)	-1.47 (2.45)	-1.52 (2.51)	-1.19 (2.19)	-1.10 (2.17)	-1.39 (2.51)	-1.36 (2.39)

Other Examples of 'Rational' Overconfidence:

- It may be rational for more than 50% of people to say that they are better than average!

Other Examples of 'Rational' Overconfidence:

- Benoit and Dubra [2011]
- 3 possible driver skill levels (equally likely):
  - High (prob of accident 1/20)
  - Medium (prob of accident 9/16)
  - Low (prob of accident 47/80)
- Driver does not know skill level, only whether or not they crashed
- Overall 40% of drivers crash
- What is the belief of those that do not crash
  - P(high|no crash)= 19/36
  - P(med|no crash)=35/144
  - P(low|no crash)=11/48
- So for 60% of the drivers
  - Most likely outcome is they are better than average
  - More than 50% chance they are better than average

Is All Overconfidence Rational?

- Burks et al [2013] study whether the Beniot and Dubra explanation works in a large sample
- They show that the Bayesian model implies that for any stated quantile k, the modal share must be from quantile k
  - i.e. looking at people who say they are in the middle 20%, most must be in the middle 20%

Is All Overconfidence Rational?

	Numeracy test					IQ test				
	s_1	s_2	s_3	s_4	s_5	s_1	s_2	s_3	s_4	s_5
t_5	0.0	0.0	0.1	0.27	**0.62**	0.004	0.016	0.121	0.271	**0.579**
t_4	0.004	0.009	0.091	**0.298**	0.59	0.0	0.014	0.168	**0.355**	0.461
t_3	0.0	0.0125	**0.181**	0.362	0.443	0.006	0.031	**0.262**	0.375	0.325
t_2	0.004	**0.0**	0.272	0.377	0.345	0.0	**0.04**	0.39	0.363	0.204
t_1	**0.02**	0.02	0.401	0.376	0.175	**0.033**	0.11	0.42	0.322	0.104

- Also, overconfidence related to personality factors
  - Below median in social dominance: 33% think they are in the top 20%
  - Above median: 55% think they are in the top 20%
  - In both cases, 20% are in the top 20%

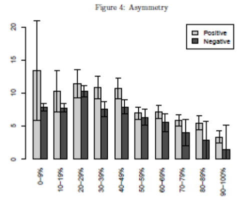
Is All Overconfidence Rational?

- Mobius et al [2013] study how people respond to signals about how they have done in a test
- All subjects take the test
- Elicit beliefs about the probability they are in the top half of performers
  - Elicit p such that they are indifferent between a p probability of winning $10 and winning $10 if they are in the top half of performers
- Provide 4 signals about whether they are in the top half of performers that are 75% accurate
  - i.e. if you are in the top half of performers, get a signal that says that you are in the top half 75% of the time and that you are in the bottom half 25% of the time
- Elicit beliefs after each signal

Is All Overconfidence Rational?

- Key finding: subjects respond differently to positive and negative news

Figure 4: Asymmetry



- Those that receive 2 positive and 2 negative signals increase their beliefs by 4.8% on average

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Effects of Overconfidence

- Entry into a market
- Pricing of contracts

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Effects of Overconfidence

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Excess Entry

- Many new businesses fail
  - Between 1963 and 1982 62% of new manufacturing businesses closed within 5 years and 80% within 10 years
- Has lead people to ask if there is 'excess entry'
  - Too many new firms joining the market
- Overconfidence could lead to excess entry
  - Overestimation
  - Overplacement
- Camerer and Lovallo [1999] examine this in an experimental setting

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Experiment

- Everyone receives $10
- Players can choose to stay out of the market (and earn 0)
- If they enter the market, their earnings will depend on the number of other entrants, their 'rank' and market capacity

TABLE 1—RANK-BASED PAYOFFS

Rank	Payoff for successful entrants as a function of "c" 2	4	6	8
1	33	20	14	11
2	17	15	12	10
3		10	10	8
4		5	7	7
5			5	6
6			2	4
7				3
8				2

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Experiment

- Rank determined either by chance or by skill
  - Each subject played 12 round of each condition
- Rank not determined until after the entry game
- Two subject pools
  - Standard recruitment
  - Subjects told ability at trivia could improve earnings

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Results

Table 5—Average Difference in Expected Profits per Entrant Between Random and Skill Conditions

Measure	Experiment 1	Experiment 2	Experiment 3	Experiment 4	Experiment 5	Experiment 6	Experiment 7	Experiment 8	Total
$\Pi_r - \Pi_s$	1.635 (1.98)	0.477 (1.41)	−1.19 (1.72)	0.24 (2.41)	1.62 (1.32)	2.49 (1.27)	3.16 (1.61)	1.80 (1.20)	1.31 (2.04)
# of S's with $\Pi_r - \Pi_s < 0$ (percent)	10/12 (83)	10/13 (77)	3/11 (27)	7/14 (50)	12/13 (92)	12/13 (92)	13/13 (100)	11/12 (92)	78/101 (77)
# of S's with $\Pi_s < 0$ (percent)	0/12 (0)	0/13 (0)	0/12 (0)	2/15 (13)	12/15 (80)	15/16 (94)	12/14 (86)	11/14 (79)	52/111 (47)

- Much more entry in the `skill' treatment that in the random treatment
  - Expected profit $1.31 higher in the random treatment (p<0.0001)
- Evidence of reference group neglect
  - Difference in industry profits $27.10 in the 'selected' group (experiments 5-8)
  - $9.18 in 'non-selected' group (experiments 1-4)

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Effects of Overconfidence

- Entry into a market
- Pricing of contracts

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Selling to Overconfident Consumers [Grubb 2009]

- Imagine you are Verizon
  - Fixed cost per consumer of $50
  - Variable cost 5c per minute
- Consumer values minutes at 45c per minute up to a satiation point, 0c after
- Period 1: sign contract
- Period 2: use minutes
- Satiation point unknown at time of contract signing
  - 1/3 100 mins
  - 1/3 400 mins
  - 1/3 700 mins

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Optimal Contract for a Rational Consumer

- Assume that you are a monopoly
- Optimal Contract is a 2 part tariff
  - Marginal cost pricing (5c per minute)
  - Extract all the surplus using up front fee
- Expected value of 5c per minute is $160
  - 1/3 40c x 100+
  - 1/3 40c x 400+
  - 1/3 40c x 700
- Charge $160 up front fee

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Optimal Contract for an Overconfident Consumer

- In real life we often see 3 part tariffs
  - Fixed fee up front
  - Low costs up to a certain point
  - High costs after that point
- Can 3 part tariffs be explained by overconfident consumers?

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Optimal Contract for an Overconfident Consumer

- Consider a consumer who believes with probability 1 that their future demand with be 400
- An example of overprecision
- Optimal contract
  - Charge 0c for the first 400 minutes
  - 45c thereafter
  - Extract all surplus with an up front fee
- 3 part tariff!

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Optimal Contract for an Overconfident Consumer

- Why is this optimal?
- Consider minutes 100-400
  - Reducing the price from 5c to 0 costs the firm $15 if consumer has satiation levels 400 or 700
  - $10 in expectation
  - Value to the consumer is $15 because they assume that they will always use these minutes
  - Can increase up front charge by $15 at the cost of $10
- Consider minutes 400-700
  - Increasing price from 5c to 45c is $120 if consumer has satiation level 700
  - $40 in expectation
  - Cost to the consumer is 0 because they assume they will never use these minutes
- Can charge $180 up front

Summary

- Psychologists/Economists have identified (at least) 3 different types of overconfidence
  - Overprecision
  - Overplacement
  - Overestimation
- Further research has shown these effect to be more nuanced
  - Evidence of under confidence
  - Some effects can be the result of rational signal processing under uncertainty
- Evidence of overconfidence bias remains
  - E.g. asymmetric responses to good and bad information
- These biases have potentially important economic consequences
  - Excess Entry
  - Pricing strategies of firms