Psychology and Economics
(Lecture 2)

Xavier Gabaix

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1 $p-$beauty contest

In the *General Theory*, Keynes describes a newspaper beauty contest in which readers guess which published photos other readers will pick as the most beautiful.

> It is not a case of choosing those which, to the best of one's judgment, are really the prettiest, nor even those which average opinion genuinely thinks the prettiest. We have reached the third degree, where we devote our intelligences to anticipating what average opinion expects the average opinion to be. And there are some, I believe, who practice the fourth, fifth and higher degrees.

Your challenge was also to select a number that reflected your best guess of what other players would do (and vice versa).

1.1 Applying iterated weak dominance to the p-Beauty contest:

- The highest possible value of the mean is 100, so you can always do better by choosing a number at least as low as $(p)100$. So choosing above $(p)\,100 = 80$ is a dominated strategy.

- After this first round of dominance reasoning the highest possible value of the mean is 80, so you can always do better by choosing a number at least as low as $p80$. So choosing above $p\,(80) = 64$ is a dominated strategy.

- After this second round of dominance reasoning the highest possible value of the mean is 64, so you can always do better by choosing a number at least as low as $p\,(64)$. So choosing above $100p^3 = 51$ is a dominated strategy.

- And so on...

- More generally, after $N-1$ rounds of iterated dominance...

- The highest possible value of the mean is $p^{N-1}100$, so you can always do better by choosing a number at least as low as $pp^{N-1}100$. So choosing above p^N100 is a dominated strategy.

- As $N \to \infty$, the interval of undominated bids, $[0, p^N100]$ converges to a single point: 0.

1.2 The Nash equilibrium of the p-Beauty contest:

- At an equilibrium, no player has incentive to deviate.

- Let's consider symmetric, pure strategy equilibria. In other words equilibria in which all players make the same choice (symmetric) and there is no probabilistic mixing (pure strategy).

- Game theory notations:
  - s_i is the strategy of player i
  - $s_{-i} = (s_1, ..., s_{i-1}, s_{i+1}, ..., s_N)$ is the vector of strategies of all the players but i
  - here we consider a symmetric equilibrium and abuse notation by noting s_{-i} the strategy of any player but i

- If everyone else's choice is s_{-i}, then my best response will be $s_i = ps_{-i}$.

- Finally, note that symmetry implies that $s_i = s_{-i}$.

- So we have two equations and two unknowns.

- The only solution is $s_i = s_{-i} = 0$.

1.3 Does game theory work?

- Not in the short-run.

- Result from an experiment with $p = 2/3$.

- 2 min game: mean $= 23.9$

- (2/3)*(23.9)=15.9

- typical game: mean ≈ 30 (i.e. level 1 of reasoning $=$ best response to level 0 which is picking at random leads to 50)

- winning guess ≈ 20 (i.e. level 2 of reasoning).

2 Starting points for reasoning?

- Mean feasible answer.
- Past optimal answers.
- Focal points.
- Outcomes in analogous settings.
- Random guess.

3 Lessons from the p-Beauty Contest:

- Game theory postulates that everyone is homogeneous (players with the same options or choice sets should execute the same actions and get the same payoffs).

- But real players are heterogeneous.

  – different cognitive starting points

  – different types of thinking

  – different intensity of thinking

- In game theory it is impossible to consistently be "one-step ahead of the competition," since everyone anticipates everyone elses' moves.

- In the real world staying "one-step ahead of the competition" is a reasonable goal (which a few smart, sophisticated, and well-informed people will achieve). For example:

- Blindly applying game theory is almost never the most sophisticated strategy.

- However, game theory is still useful because it gives us information about some behavioral propensities.

- Successful strategies combine game theory and an understanding about the lack of sophistication of your opponents.

- Also think about how you should behave if *you* are the unsophisticated player.

4 IQ, Time, Learning, and Stakes

- CalTech students have a median math SAT of 800 and the average test score of the *applicants* to CalTech is higher than the average test score of the students who are *accepted* at Harvard.

- Nevertheless, CalTech students do not play much differently than students at other colleges. However, we know very little about how people without much education play such games.

- Time makes a small difference. More time reduces the mean slightly and reduces the standard deviation alot.

- Stakes make a small difference. High stakes reduce means slightly and reduce the standard deviation.

- Learning makes a large difference. “There are no interesting games in which subjects reach a predicted equilibrium immediately. And there are no games so complicated that subjects do not converge in the direction of equilibrium with enough experience in the lab.” (Camerer, 2002)

5 Multipliers and the effects of irrationality

- Suppose there are N =10 players
- 1 is irrational, and always plays $a = 50$.
- The other 9 are rational.
- What is the outcome of the game?
- Naive guess: it's the average of 50 (1/10) and the rational answer of rational guys, 0 (9/10), so it:

$$\frac{1}{10}50 + \frac{9}{10}0 = 5$$

- But in fact, Nash equilibrium with value s for rational players:

$$
\begin{aligned}
s^* &= p\left[\frac{N-1}{N}s^* + \frac{1}{N}a\right] \\
s^* &= \frac{p/N}{1-p\,(1-1/N)}a
\end{aligned}
$$

  Average is:

$$
\begin{aligned}
\mu &= \left[\frac{N-1}{N}s + \frac{1}{N}a\right] = \frac{s}{p} \\
&= \frac{1/N}{1-p\,(1-1/N)}a \\
&= \frac{0.1}{1-0.8\cdot 0.9}50 = 17.8
\end{aligned}
$$

- Multiplier effect: it's good to imitate the others. Even the rational guys don't play 0, but $17.8 \cdot 0.8 = 14$

- In situations with "strategic complementarity", irrationality can matter a lot.

6 What are the ingredients of a good experiment?

- motivated subjects (financial stakes or intrinsic motivation)

- clear instructions

- no confounds (alternative explanations)

- opportunities for learning and feedback

- debriefing

7 Adverse selection and buying a firm

- value of company to James is uniform [0,100]
- James knows its true value
- You don't know true value but company is worth 50% more to you than it is to James
- You make take-it-or-leave-it offer to James.
- What do you offer?

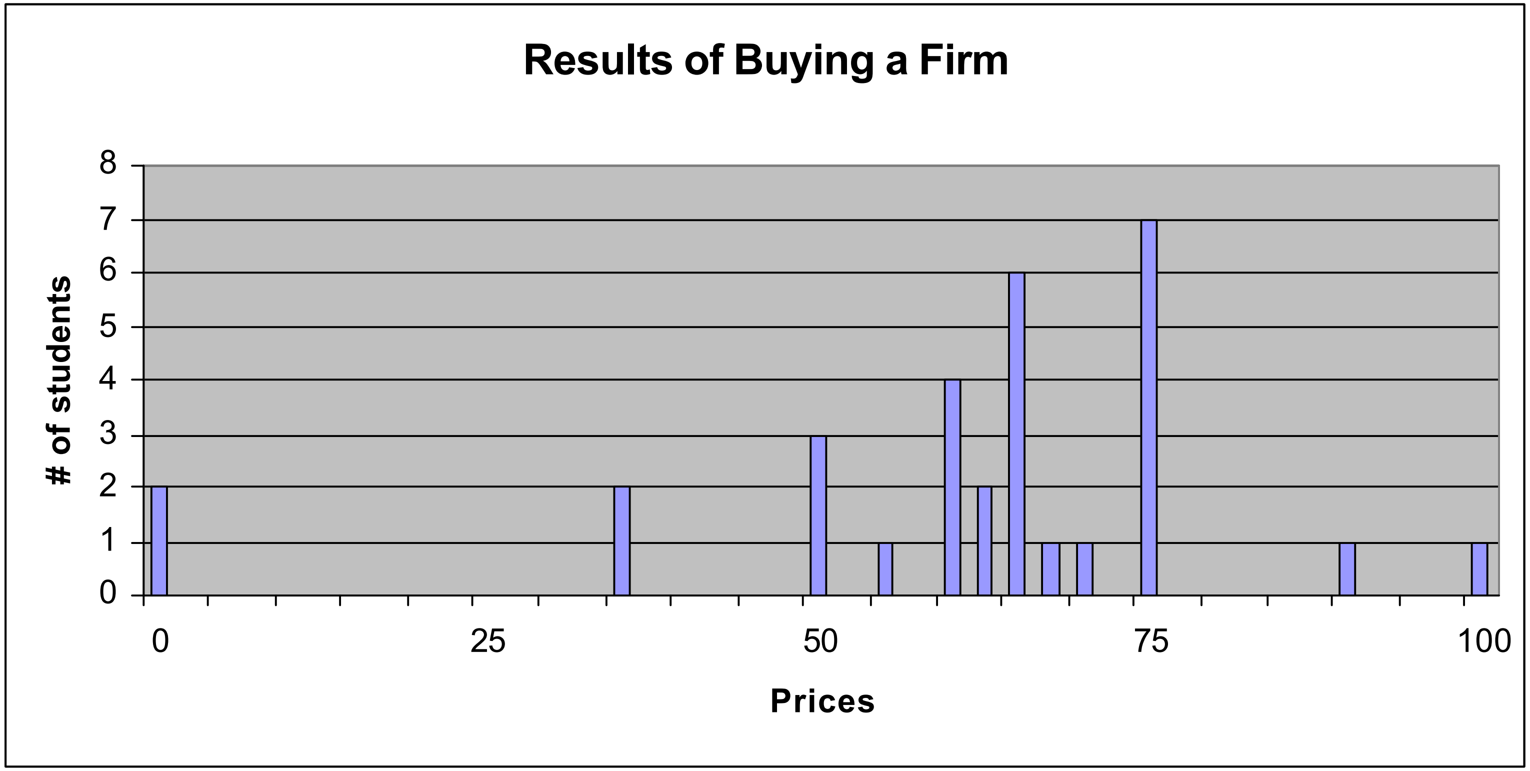

Figure 1:

Results: 80% chose between 50 and 75

Non-contingent thinking:

- Average value of company is 50

- So the average value to me is 75=(1.5)(50)

- So I'll bid somewhere between 50 and 75
(over 2/3 of subjects bid in this range)

More non-contingent thinking:

- It's worth more to me than James.
- So I should definitely buy it.
- So I'll bid 100

Contingent thinking:

- If James accepts offer b, then I know that the company is worth no more than b to James.

- Specifically, the value of the company to James must be uniformly distributed between 0 and b.

- So the expected value of the company to James is $b/2$.

- So the expected value to me is $(3/4)b = (1.5)(b/2)$.

- So when I bid b I should expect profits of $(3/4)b - b = -(1/4)b$.

- To maximize profits (minimize losses), set $b = 0$.

Adverse selection

- one party in a transaction knows things pertaining to the transaction that are unknown by the second party
  - annuities (buyer knows mortality risk)
  - life insurance (buyer knows mortality risk)
  - car insurance (buyer knows driving risk)
  - used car dealerships (seller knows car quality)
  - house sales (seller knows house quality)
- in these markets it's critical to think contingently
- if the used car dealership is like James's company, you should never buy a used car!

Bazerman and Samuelson (1983)

- MBA students bid on jars of coins
- Unknown to subjects each jar was worth \$8
- MBA's reported point estimates
- Sealed bid first price auctions
- Mean estimate: \$5.13
- Mean winning bid: \$10.01

8 Readings for next time

In The Winner's Curse by Richard Thaler, chapter The Winner's Curse.