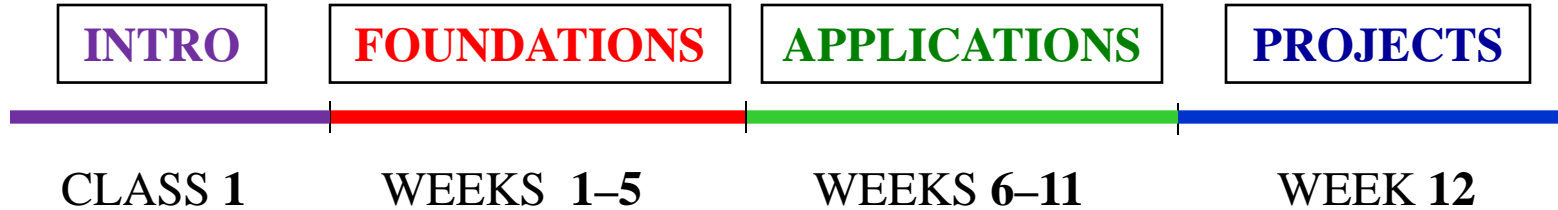


**Game Theory
for
Strategic Advantage**

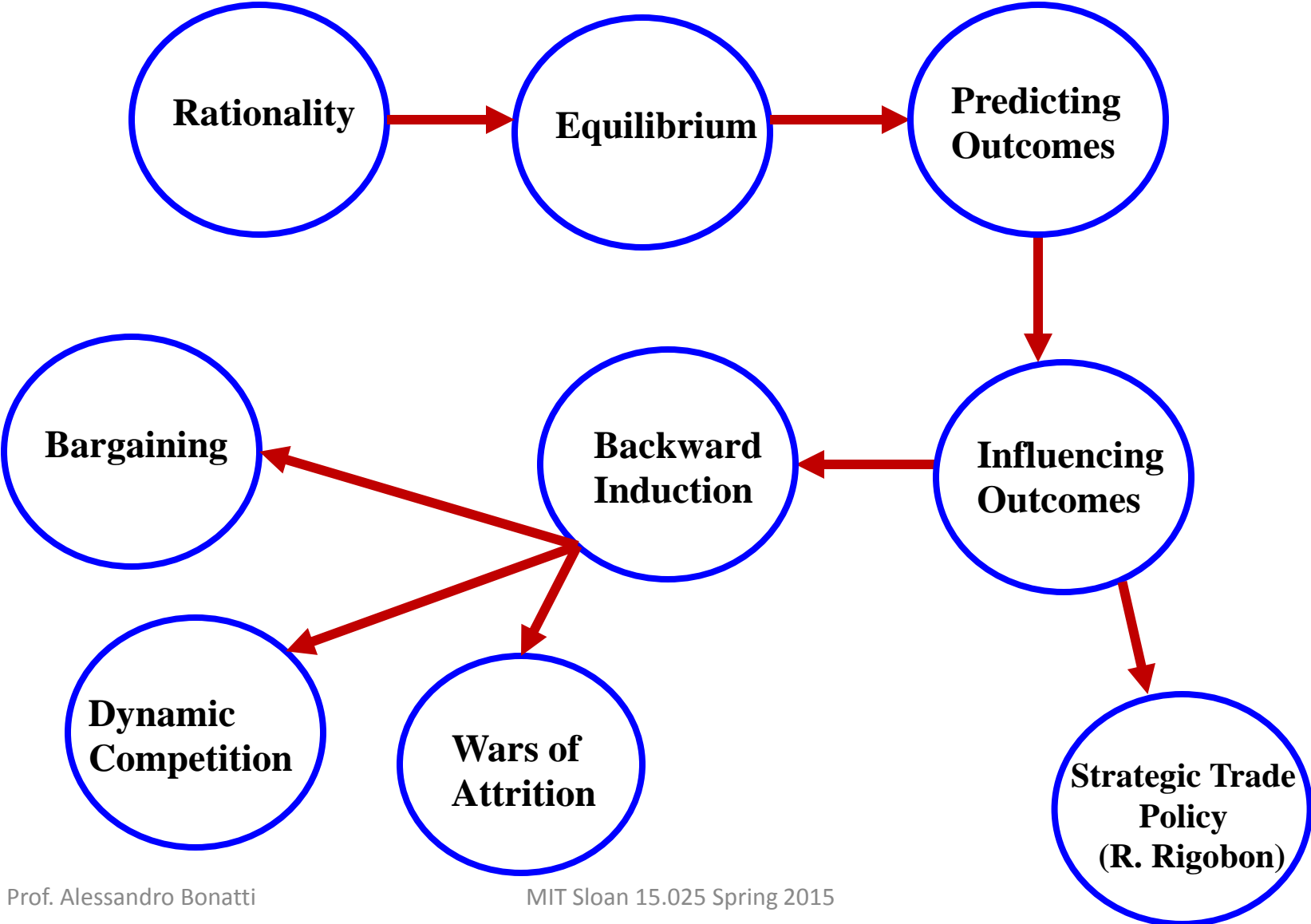
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**Alessandro Bonatti
MIT Sloan**

Outline of the Course



Foundations and Basic Applications

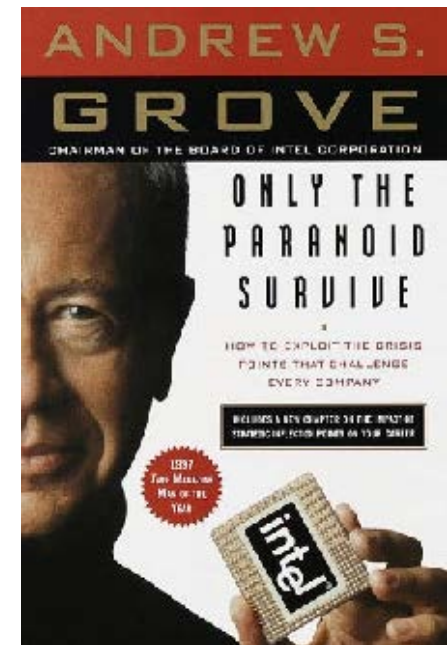


Class 2 Game Plan

- (My and my opponents') **rationality**
- **Dominated** strategies
- **Rationalizable** strategies
- **Applications** to
 - political competition
 - product positioning

Rationality?

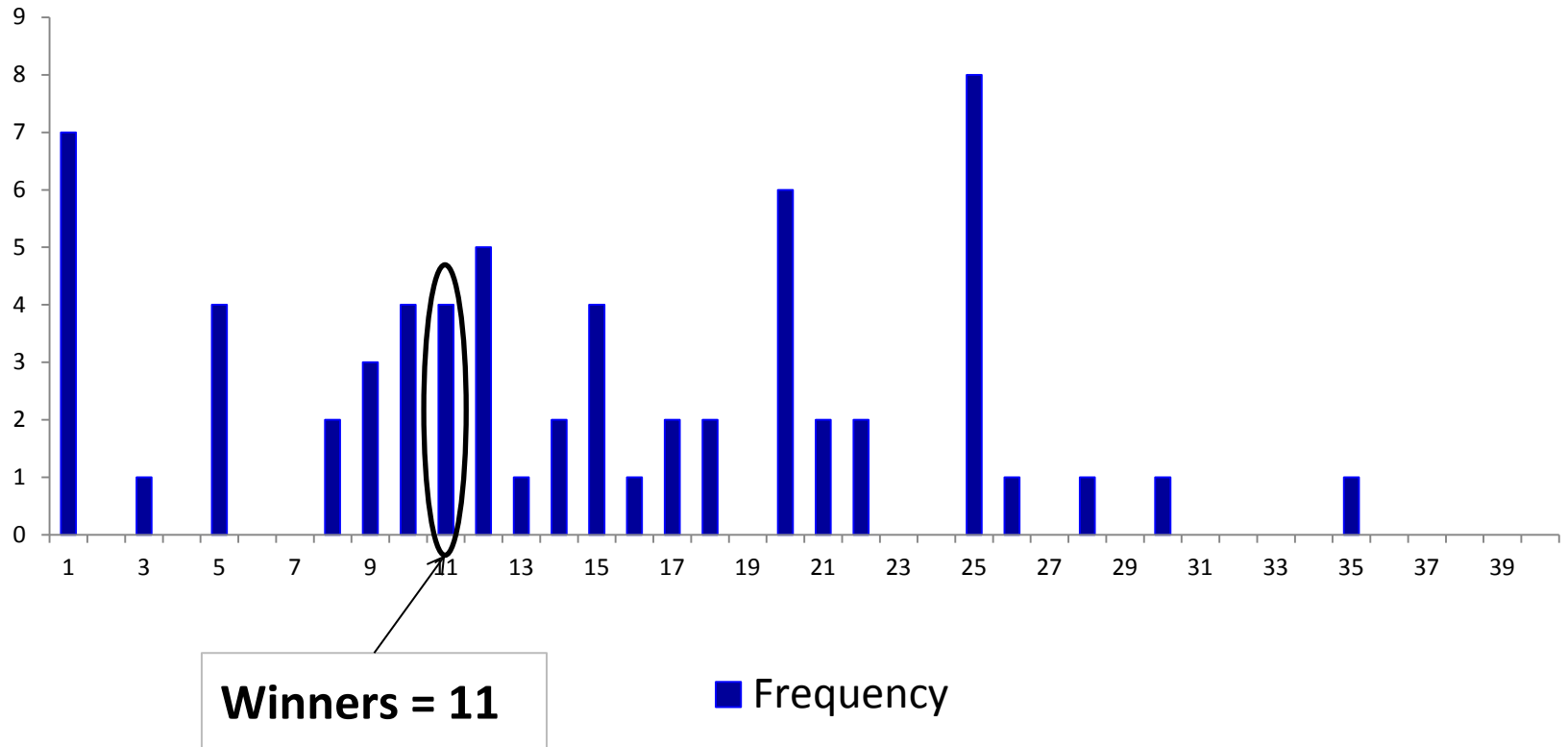
- Most of economics assumes “rational” decision-makers:
“Do the best you can given how you perceive the game and how you evaluate its various possible outcomes.”
- In theory...but in practice?
- *“Only the Paranoid Survive”*
- Andy Grove, Intel Co-founder
- “How you perceive the game” includes
“perceptions of perceptions”!



Our First Game: the Beauty Contest

- Each one of you, $i = 1, 2, 3, \dots, N$ faced the following situation
 - You chose an integer $0 \leq a_i \leq 40$
 - We computed $a^* = 0.75 \times \sum_i a_i / N$,
where $N = \#$ of students (= 75% of avg.)
 - Students closest to a^* won a prize.
- How did you play?

Beauty Contest: Results



Rationality and Strategies

- What does **rationality** imply?
- Would you ever guess a number 31-40?
- How could 75% of the average be >30 ?
- Choosing 31-40 is dominated by choosing 30
- Are you willing to bet your classmates are rational too?
- Very few students chose > 30 !

Put Yourself in Others' Shoes

When I am getting ready to reason with a man, I spend one-third of my time thinking about myself and what I am going to say, and two-thirds about him and what he is going to say.

Abraham Lincoln

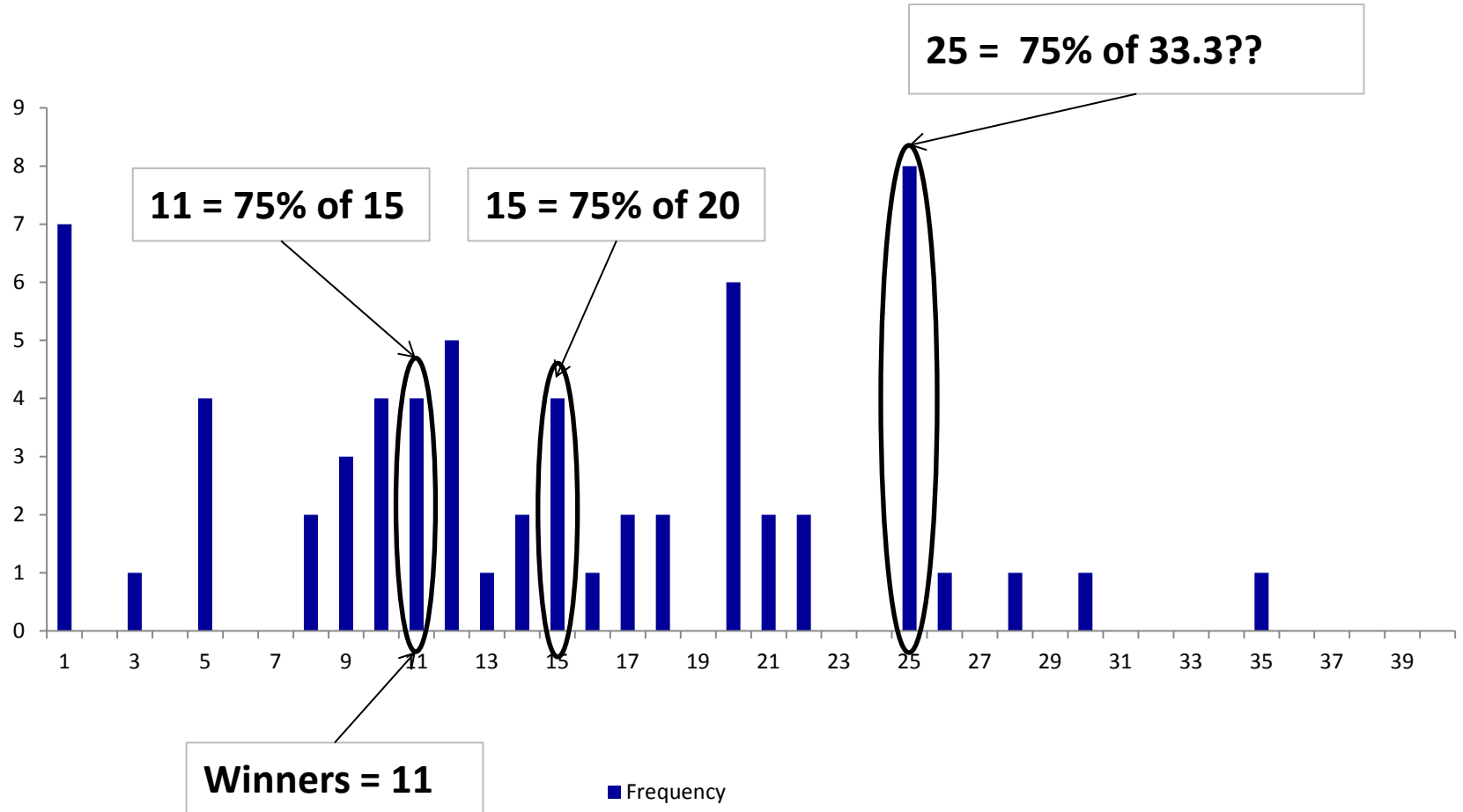
Rationality and Strategies

- What does **rationality** imply?
- Choosing 31-40 is dominated by choosing 30
- If your classmates are rational too:
 - they won't pick 31-40;
 - for you, picking numbers 23-30 is then dominated by 22
- How far would (knowledge of) rationality take us?

Common Knowledge of Rationality

- What if we take this extra leap?
 - No rational player would choose 31—40
 - No rational player who believes everyone else is rational would choose 23—30
 - No rational player who believes that everyone believes that everyone else is rational would choose 17—22
- Do we stop here? No!
- “**1**” is (the only) **rationalizable** strategy
- **What went wrong with those who chose 1?**

Beauty Contest: Results



Our First Game: the Beauty Contest

J.M. Keynes, *General Theory*, 1936

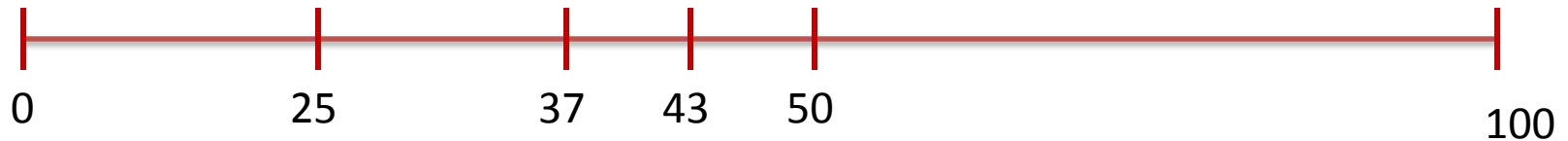
“It is not a case of choosing those [faces] that, to the best of one’s judgment, are really the prettiest, nor even those that average opinion genuinely thinks the prettiest. We have reached the third degree where we devote our intelligence to anticipating what average opinion expects the average opinion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

What Have We Learned So Far?

- You must account for your own and your opponents' rationality / sophistication

Our next game: Steve Ballmer's interview

- Guess the number (between 1 and 100)
- 5 attempts (with a decreasing prize)



- “Hide-and-Seek”
- Answer depends on depth of reasoning + goals

Common Knowledge of Rationality?

- A rational player will not play a dominated strategy
- Most of game theory further assumes that players' rationality is *common knowledge*
- Do you buy this assumption?
- How much does it buy us? (Beauty vs. Hide & Seek)
- When is **rationalizability** a good criterion?
- Classmates vs. competition in the long run

Class 2 Game Plan

- (My and my opponents') **rationality**
- **Dominated** strategies
- **Rationalizable** strategies
- **Applications** to
 - product positioning
 - political competition

Our next game: Politics

- Political candidates choose a platform (left to right)
- Voters are **evenly** spread out along an **ideology line**



- Simultaneous announcements of position (1 to 100)
- Voters go for closest candidate
- Play to win the election!

Median Voter Theorem (A. Downs, 1958)

- Taking the median voter's position is *dominant*
= you cannot lose



- Equal # of voters on either side!
- Primaries vs. general election?
- More applications:
 - Firm location (Hotelling, 1929)
 - Product positioning (Lancaster, 1966)

Similar game: Consumers as Voters

- Firms (beach vendors) choose a location
- Consumers are **evenly** spread out along a line (0 to 100)
- Prices are fixed (say, \$1)
- Consumers buy from closest vendor
- Firms locate to maximize sales!

Where Will You Stand?

Rationality Revisited

- If your competitor chooses spot # 85, where do you want to locate?
- Are there any dominated strategies?

1  100

- Now, are there any dominated strategies?

2  99

- Where do we end up?
- Product positioning in practice?

Apple, Samsung, and smartphone commoditization (WSJ)

- “Commoditization” is a long word but a simple concept.
- You know you’ve encountered it when you walk down the cereal aisle, and discover four different brands of corn flakes.
- Or when you’re shopping for a new television at Best Buy, and find yourself staring at 50 indistinguishable black sets, all playing the same Pixar film.
- It’s when there ceases to be any noticeable difference between competing products.

Rush to the Center?

*“...there ceases to be any noticeable difference between competing products, **except perhaps the price tag** [...] Meanwhile a slew of competitors, including Sony, LG, HTC, Huawei, and Lenovo, have launched well-received devices in the last year [...] **the result is falling prices.**”*

*“The days may be over when a single smartphone could inspire universal lust. That’s not a bad thing for consumers, who will get the option of paying less, and it doesn’t have to be a bad thing for Apple and Samsung. **If they embrace a more diverse industry, they have a good chance of succeeding in it;** a larger pie can feed everyone. Trying to eat the whole thing would be a terrible mistake.”*

In price-sensitive markets... not much of a choice...

In transforming **Volvo** into a more luxurious brand, Stefan Jacoby (CEO) said he does not aim to imitate others in defining the brand:

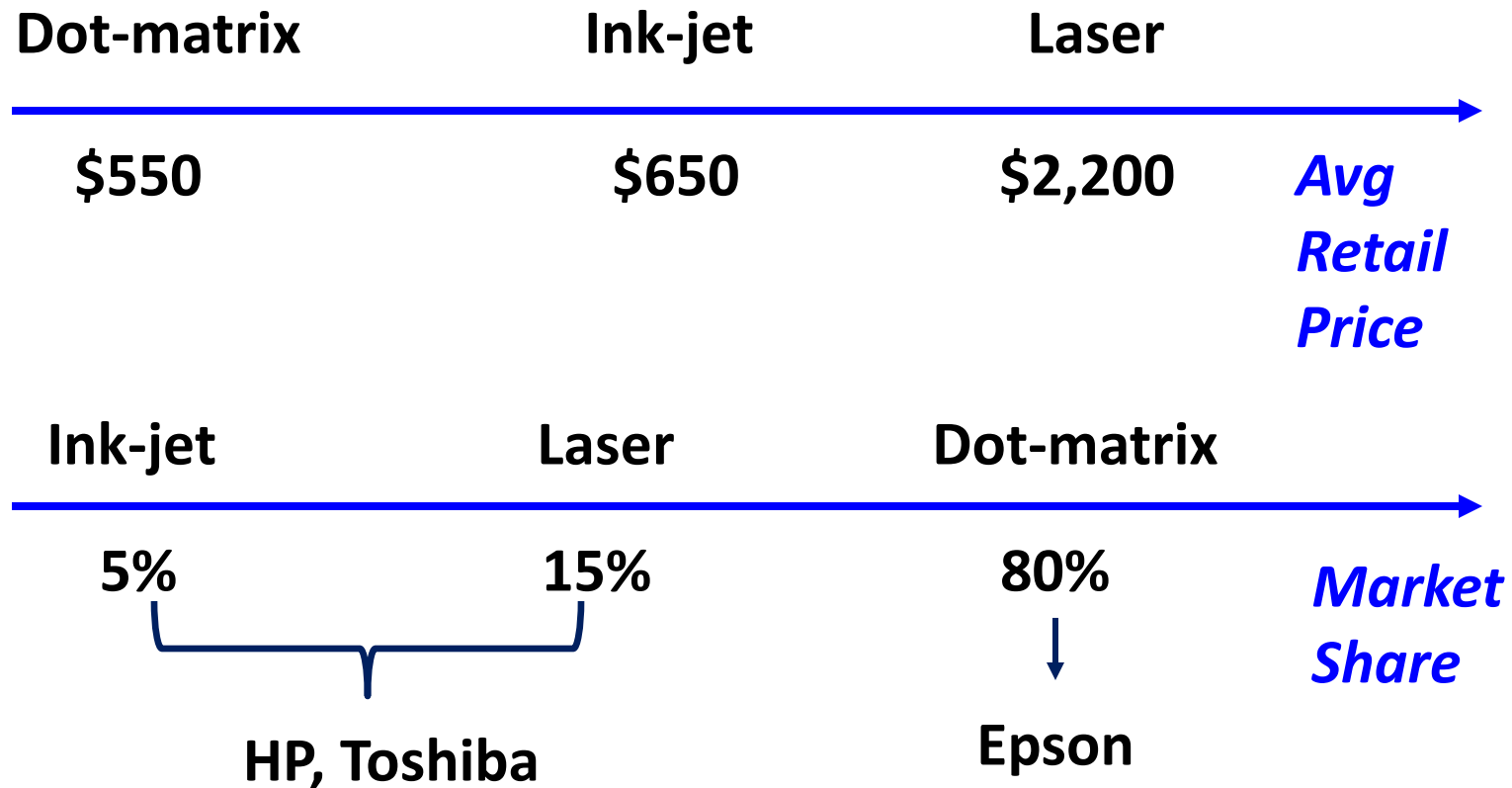
*“One thing that's crystal clear is that we will not copy...
...BMW or any other premium competitors.”*

“We will define our own positioning for a premium brand.”

What Have We Learned So Far?

- You must account for your own and your opponents' rationality / sophistication
- In some games, it is appropriate (useful!) to exploit the logic of rationalizability

1989 Desktop Printers Market



Epson '89: what would you do?

- Epson launches low-priced **Laser EPL 6000**
- HP responds with a new *LaserJet* (lower price)
- Epson cuts price → gains 5% of laser market
- Toshiba lowers laser prices
- Cheap lasers → Ink-jets don't sell
- HP promotes cheap ink-jets
- Epson's dot-matrix printers are priced out

There is
always a
larger
game

Key Elements of a Game

- **Players:** Who is interacting?
- **Strategies:** What are their possible choices?
- **Payoffs:** What do they care about?



- **Systematic** representation of **strategic** interaction

Which Game?

- Epon thought the game was

$i = \text{Epson, HP}$

$A_{\text{EPSON}} = \{\text{Price and Quality for Dot-Matrix and Laser}\}$

$A_{\text{HP}} = \{\text{Price and Quality for Laser}\}$

- And payoffs....

- The real game was

$i = \text{Epson, HP, Toshiba}$

$A_{\text{EPSON}} = \{\text{Price and Quality for Laser}\}$

$A_{\text{HP}} = \{\text{Price and Quality for Laser and Ink-Jet}\}$

$A_{\text{TOSHIBA}} = \{\text{Price and Quality for Laser}\}$

- And payoffs....

What Have We Learned So Far?

- You must account for your own and your opponents' rationality / sophistication
- In some games, it is appropriate (useful!) to exploit the logic of rationalizability
- You must also have the right game in mind

Takeaways

Game theory as a **tactical** framework:

1. Identify your opponent(s).
2. Put yourself in their shoes.
3. Keep the larger game in mind.

Formal language (**dominance**, **rationalizability**)
helps understand which **assumptions** are
necessary for which **recommendations**

Next week:

How to anticipate the behavior of others

- **Rationality:** they'll never play a (dominated) strategy that is always worse than another one
- **Rationalizability:** they'll play to optimize against some beliefs about what others play
- **Equilibrium:** they'll play to optimize against *correct* beliefs about others
- **Evolution:** they'll play in a non-strategic and adaptive way (*e.g.*, observe past play and adjust)

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15.025 Game Theory for Strategic Advantage
Spring 2015

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