Examining the Fundamental Assumptions in Classical Economics

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Rationality

Everyone can make the optimal decisions (given time)

Which Option would you take?

♦ You have a product to sell.
♦ One customer offers £10
♦ Another offers £20
♦ Who should you sell to?

♦ Obvious choice for a rational seller

Which Option would you take?

♦ You are offered two choices:
  – to pay £100 now, or
  – to pay £10 per month for 12 months
♦ Given cost of capital, and basic mathematical training
♦ Not a difficult choice

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What Is Your Move?

- ♦ What is the optimal move?
- ♦ Rules are clearly defined
- ♦ No hidden information
- ♦ Shouldn't a **rational** player pick the optimal move?
- ♦ Problem: too much to compute!

The CIDER Theory

- ♦ Rationality involves Computation
- ♦ Computation has limits
- ♦ Herbert Simon: Bounded Rationality
- ♦ Rubinstein: model bounded rationality by explicitly specifying decision making procedures
- ♦ Decision procedures involves algorithms + heuristics
- ♦ Computational intelligence determines effective rationality
- ♦ Where do decision procedures come from?
  - – Designed? Evolved?

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1978 Nobel Economic Prize Winner

♦ Artificial intelligence

♦ "For his pioneering research into the decision-making process within economic organizations"

♦ *The social sciences, I thought, needed the same kind of rigor and the same mathematical underpinnings that had made the "hard" sciences so brilliantly successful.*"

♦ Bounded Rationality
  – *A Behavioral model of Rational Choice* 1957

Herbert
Simon
(CMU)

Artificial
intelligence

Sources: http://nobelprize.org/economics/laureates/1978/ http://nobelprize.org/economics/laureates/1978/simon-autobio.html

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"Bounded Rationality"

♦ Herbert Simon:
  – Most people are only partly rational, and are in fact emotional/irrational in part of their actions

♦ "Boundedly" rational agents behave in a manner that is nearly as optimal with respect to its goals as its resources will allow
  – Resources include processing power, algorithm and time available

♦ Quantifiable definition needed?

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Modelling Bounded Rationality (1998)

Ariel Rubinstein
New York University
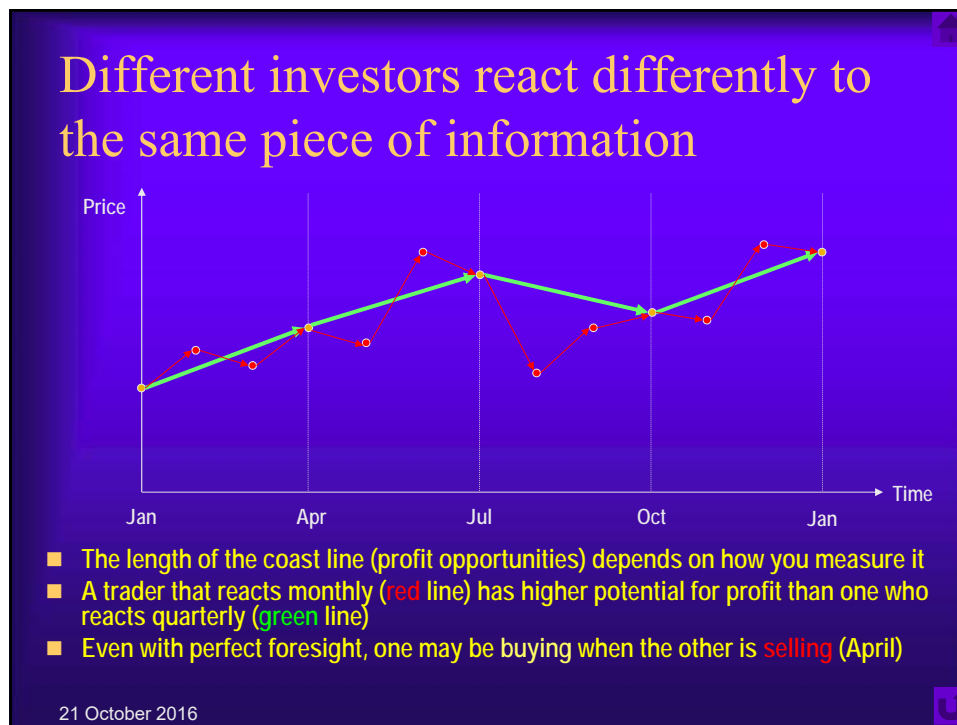
- ♦ Rational decisions are optimal decisions
  - – But decisions makers often try to satisfy constraints
  - – Rather than finding optimality
- ♦ Rationality comes from decision making procedures
  - – Procedures should be specified explicitly
  - – This put the study of procedures on the research agenda

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Homogeneity

Everyone will make the same decision,
at the same speed

Different investors react differently to the same piece of information

- The length of the coast line (profit opportunities) depends on how you measure it
- A trader that reacts monthly (red line) has higher potential for profit than one who reacts quarterly (green line)
- Even with perfect foresight, one may be buying when the other is selling (April)

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♦ If the homogeneity assumption holds…

– much of computer science is not worth studying

– much of computational intelligence is irrelevant

Classical economics and Computer Science:
*Neither can live
while the other survives*

Quote from J K Rowling, "Harry Potter: The Order of Phoenix", 2003

Conclusions

♦ Perfect Rationality
  – Everyone can make the optimal decision
♦ Homogeneity
  – Everyone will make the same decision, at the same speed
♦ These assumptions are far from the truth
♦ If they hold, then computer science shouldn't survive!

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