4.6 — Contestable Markets & Wrap Up

ECON 306 · Microeconomic Analysis · Fall 2020

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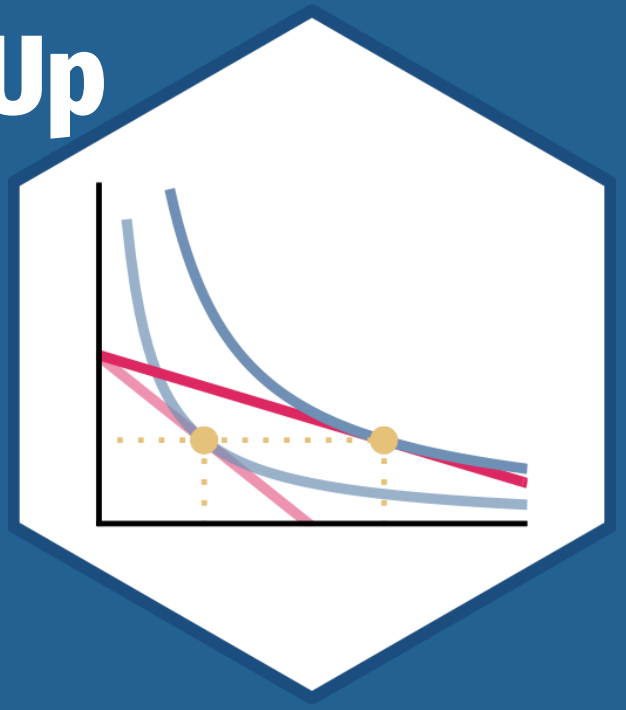
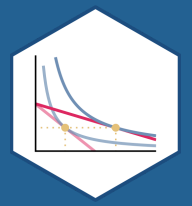




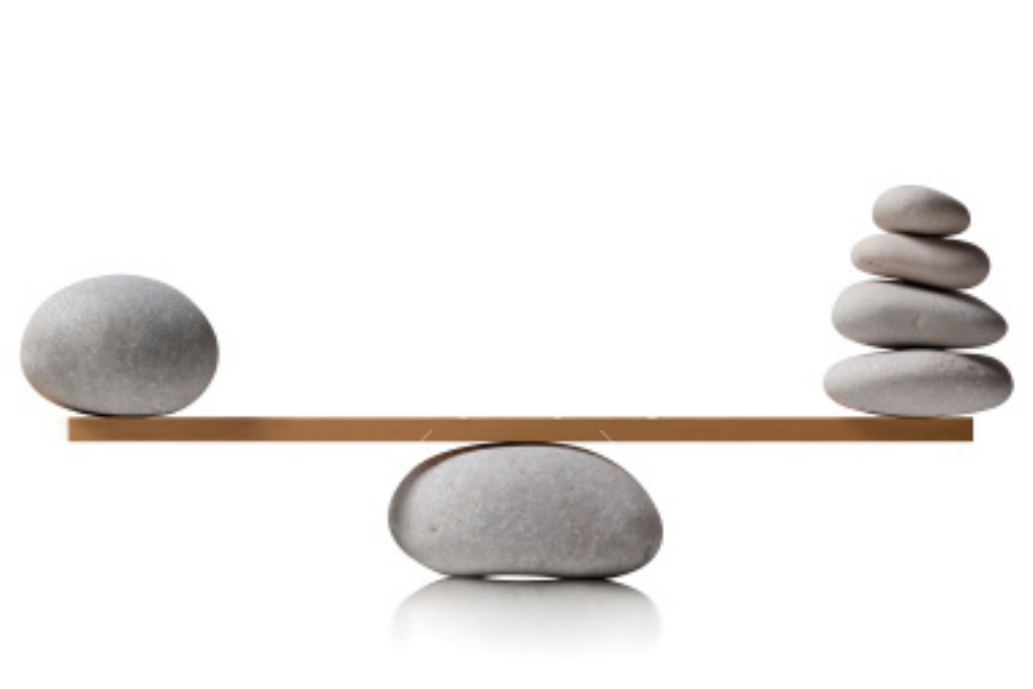
Game Theory: Some Generalizations

Game Theory: Some Generalizations

There's a *lot* more to game theory than a one-shot prisoners' dilemma:

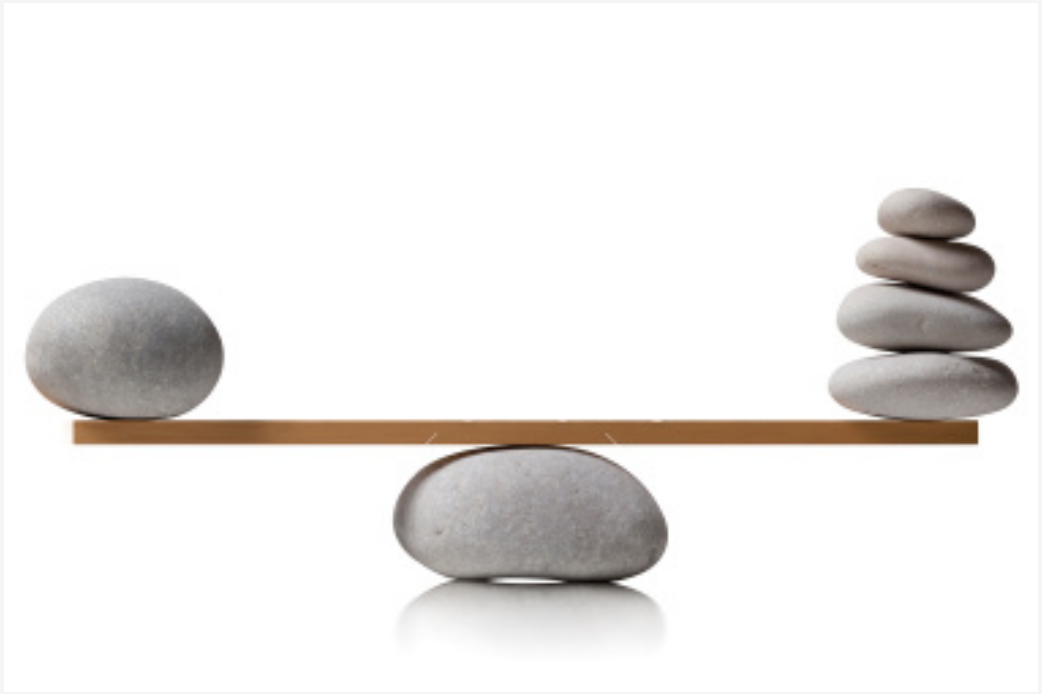
- one shot vs. repeated game
- discrete vs. continuous strategies
- perfect vs. incomplete vs. and asymmetric information
- simultaneous vs. sequential game
- See my game theory course for more (likely taught next in Fall 2021)

Solution Concepts



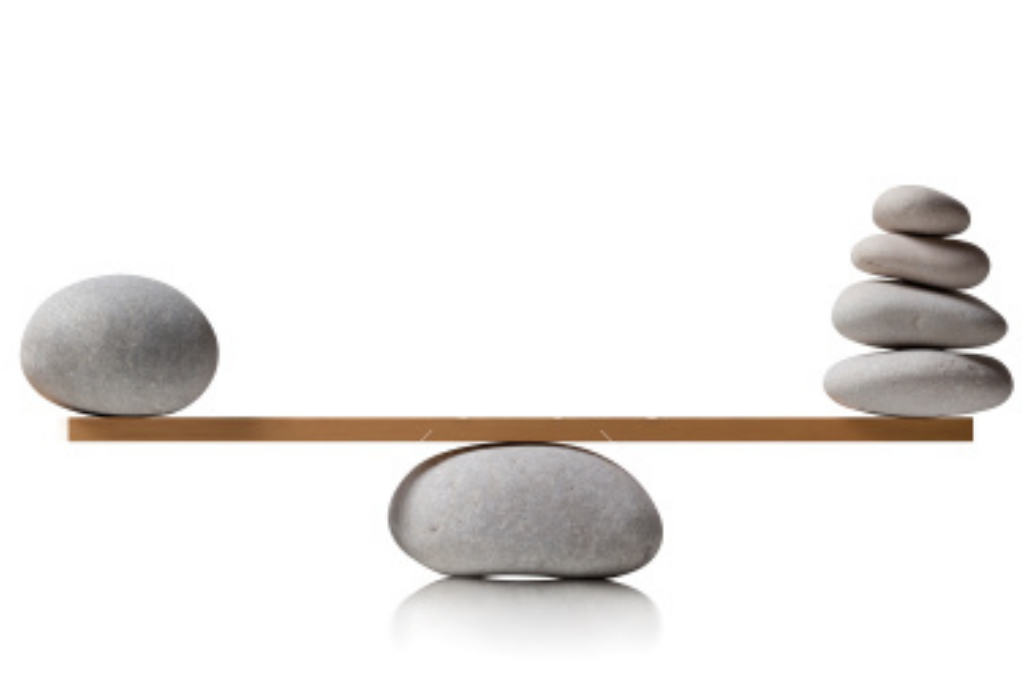
- We use **"solution concepts"** to allow us to predict an **equilibrium** of a game
- **Nash Equilibrium** is the primarly solution concept
    - Note it has *many* variants depending on if games are sequential vs. simultaneous, perfect vs. imperfect information, etc.

Solution Concepts: Nash Equilibrium



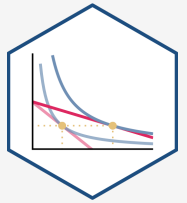
- Recall, **Nash Equilibrium**: no players want to change their strategy given what everyone else is playing
  - All players are playing a best response to each other

Solution Concepts: Nash Equilibrium



- Important about Nash equilibrium:
- N.E. *[Math Processing Error]* the "*best*" or *optimal* outcome
    - Recall the Prisoners' Dilemma!
- Game may have *multiple* N.E.
- Game may have *no* N.E. (in "pure" strategies)

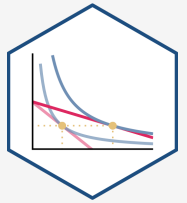
Example: Coordination Game



		Player 2	
		Standard A	Standard B
Player 1	Standard A	2 2	1 1
	Standard B	1 1	2 2

- A Coordination Game
  - No dominant strategies

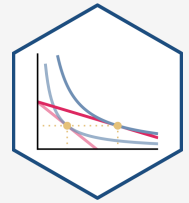
Example: Coordination Game



		Player 2: Standard A	Player 2: Standard B
Player 1	Standard A	2, 2	1, 1
	Standard B	1, 1	2, 2

- **Two Nash equilibria**: (A,A) and (B,B)
  - Either just as good
  - Coordination is most important

Example: Coordination Game



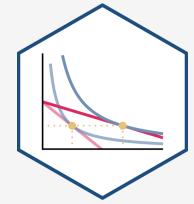
		Player 2: Standard A	Player 2: Standard B
Player 1	Standard A	2, 2	1, 1
	Standard B	1, 1	2, 2

- Two general methods to solve for Nash equilibria:

1) Cell-by-Cell Inspection: look in each cell, does either player want to deviate?

- **If no: a Nash equilibrium**
- If yes: *not a Nash equilibrium*

Example: Coordination Game



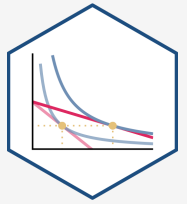
		Player 2: Standard A	Player 2: Standard B
Player 1	Standard A	2, 2	1, 1
	Standard B	1, 1	2, 2

- Two general methods to solve for Nash equilibria:

2) Best-Response Analysis: take the perspective of each player. If the other player plays a particular strategy, what is your strategy(s) that gets you the highest payoff?

- Ties are allowed
- **Any cell where both players are playing a best response is a Nash Equilibrium**

Example: Coordination Game



		Player 2: Standard A	Player 2: Standard B
Player 1	Standard A	2, 2	1, 1
	Standard B	1, 1	2, 2

Player 1's best responses

- Two general methods to solve for Nash equilibria:

2) Best-Response Analysis: take the perspective of each player. If the other player plays a particular strategy, what is your strategy(s) that gets you the highest payoff?

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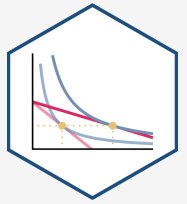
Example: Coordination Game



		Player 2: Standard A	Player 2: Standard B
Player 1	Standard A	2, 2	1, 1
	Standard B	1, 1	2, 2

Player 2's best responses

- Two general methods to solve for Nash equilibria:

2) Best-Response Analysis: take the perspective of each player. If the other player plays a particular strategy, what is your strategy(s) that gets you the highest payoff?

- Ties are allowed
- **Any cell where both players are playing a best response is a Nash Equilibrium**

Example: Coordination Game

		Player 2: Standard A	Player 2: Standard B
Player 1	Standard A	2, 2	1, 1
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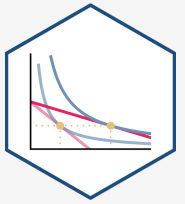
N.E.: each player is playing a best response

- Two general methods to solve for Nash equilibria:

2) Best-Response Analysis: take the perspective of each player. If the other player plays a particular strategy, what is your strategy(s) that gets you the highest payoff?

- Ties are allowed
- **Any cell where both players are playing a best response is a Nash Equilibrium**

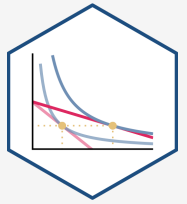
A Change in the Game



		Player 2: Standard A	Player 2: Standard B
Player 1	Standard A	3, 3	1, 1
	Standard B	1, 1	2, 2

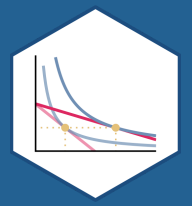
- Two Nash equilibria again: (A,A) and (B,B)
- But here (A,A) *[Math Processing Error]* (B,B)!

A Change in the Game



		Player 2: Standard A	Player 2: Standard B
Player 1	Standard A	3, 3	1, 1
	Standard B	1, 1	2, 2

- **Path Dependence**: early choices may affect later ability to choose or switch
- **Lock-in**: the switching cost of moving from one equilibrium to another becomes prohibitive
- Suppose we are currently in equilibrium (B,B)
- **Inefficient lock-in**:
  - Standard A is superior to B
  - But too costly to switch from B to A



Contestable Markets

Is Monopoly a Nash Equilibrium?

- Now that we understand Nash equilibrium...
- Are outcomes of other market structures Nash equilibria?

Is Monopoly a Nash Equilibrium?

- Now that we understand Nash equilibrium...
- Are outcomes of other market structures Nash equilibria?
- **Perfect competition**: no firm wants to raise or lower price given the market price *[Math Processing Error]*

Is Monopoly a Nash Equilibrium?

- **Monopolist** maximizes *[Math Processing Error]* by setting *[Math Processing Error]*: *[Math Processing Error]* and *[Math Processing Error]*
- This is *an* equilibrium, but is it the *only* equilibrium?
- We've assumed just a *single* player in the model
- **What about *potential* competition?**

Contestable Markets I

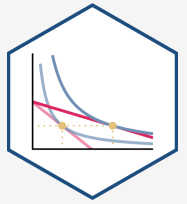
- Model the market as an **entry game**, with two players:

1. **Incumbent** which sets its price *[Math Processing Error]*

2. **Entrant** decides to **stay out** or **enter** the market, setting its price *[Math Processing Error]*

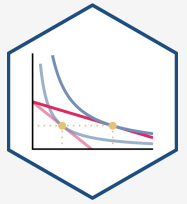
- Price competition between 2 firms with similar products *[Math Processing Error]* **consumers buy only from firm with lower price**

Contestable Markets II



- Suppose firms have costs of *[Math Processing Error]*
- If **Incumbent** sets *[Math Processing Error]*, then **Entrant** would enter and set *[Math Processing Error]* (for arbitrary *[Math Processing Error]*

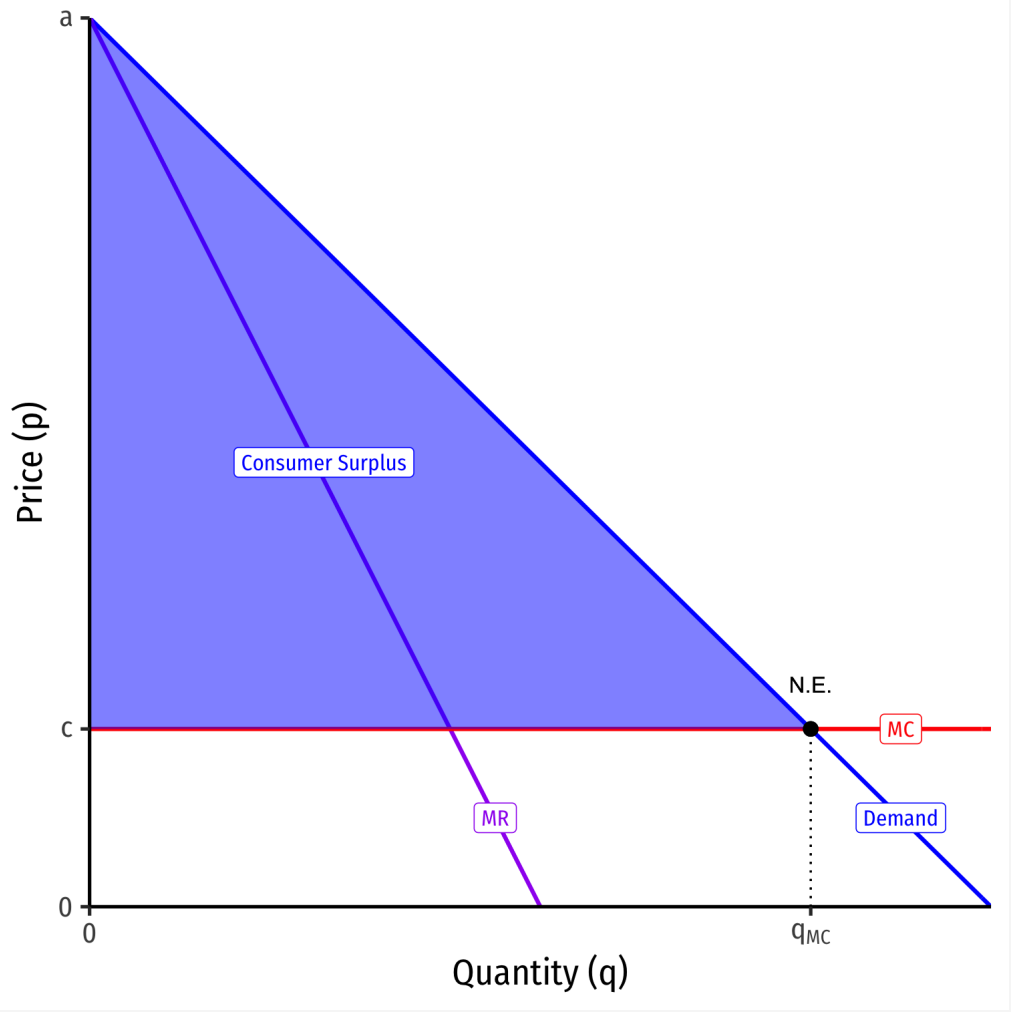
Contestable Markets II



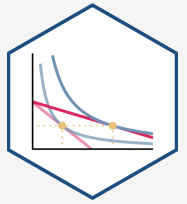
- Suppose firms have costs of *[Math Processing Error]*
- If **Incumbent** sets *[Math Processing Error]*, then **Entrant** would enter and set *[Math Processing Error]* (for arbitrary *[Math Processing Error]*
  - **Incumbent** would forsee this, and try to price lower than *[Math Processing Error]*
  - undercutting continues until...

Contestable Markets II

- **Nash Equilibrium**: incumbent sets *[Math Processing Error]*, **no entry**
- **A market with a single firm, but the competitive outcome!**
  - *[Math Processing Error]*, *[Math Processing Error]*
  - competitive *[Math Processing Error]*
  - max **Consumer Surplus**, no DWL



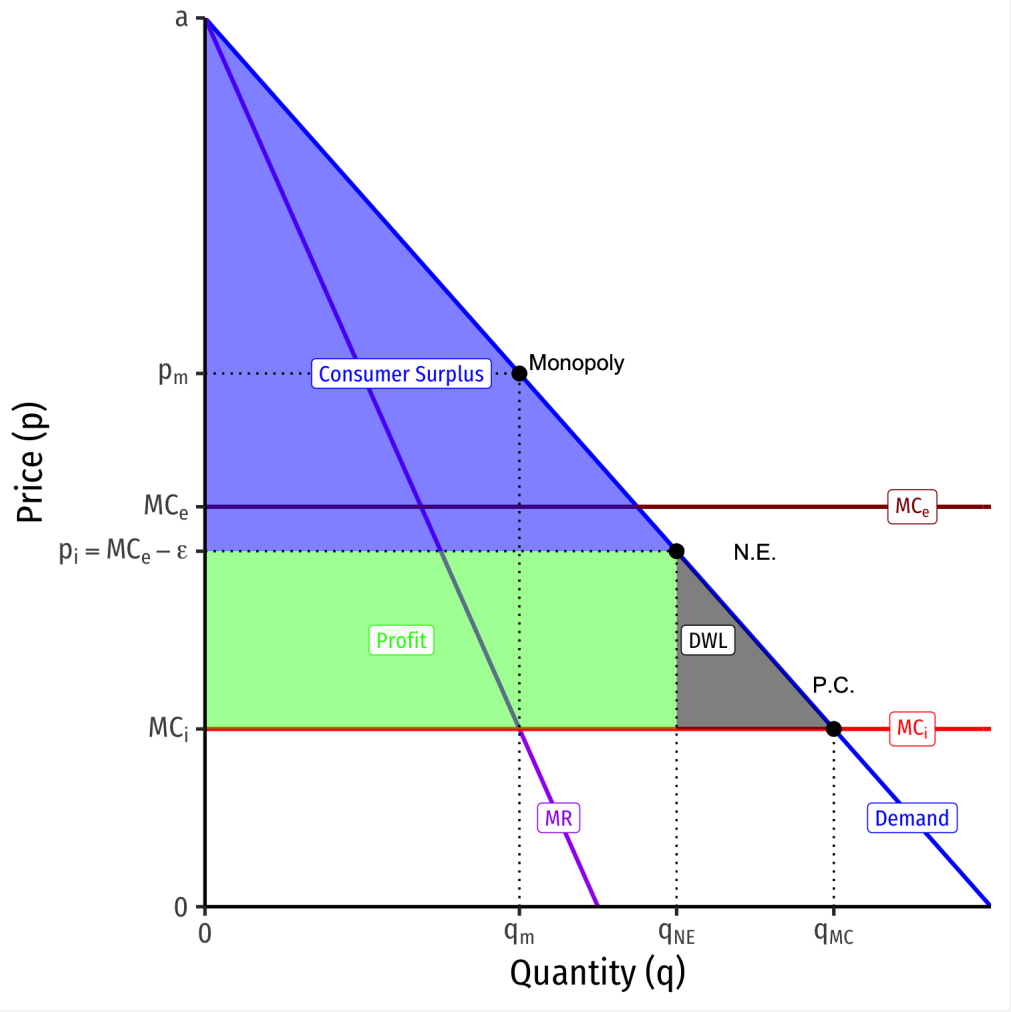
Contestable Markets II



- What if the **entrant** has *higher costs* than the **incumbent**: *[Math Processing Error]*?

Contestable Markets II

- What if the **entrant** has *higher costs* than the **incumbent**: *[Math Processing Error]*?
- **Nash equilibrium**: **incumbent** sets *[Math Processing Error]*
  - arbitrary *[Math Processing Error]*
- **Entrant** stays out
- One firm, but not a *worst case* monopoly



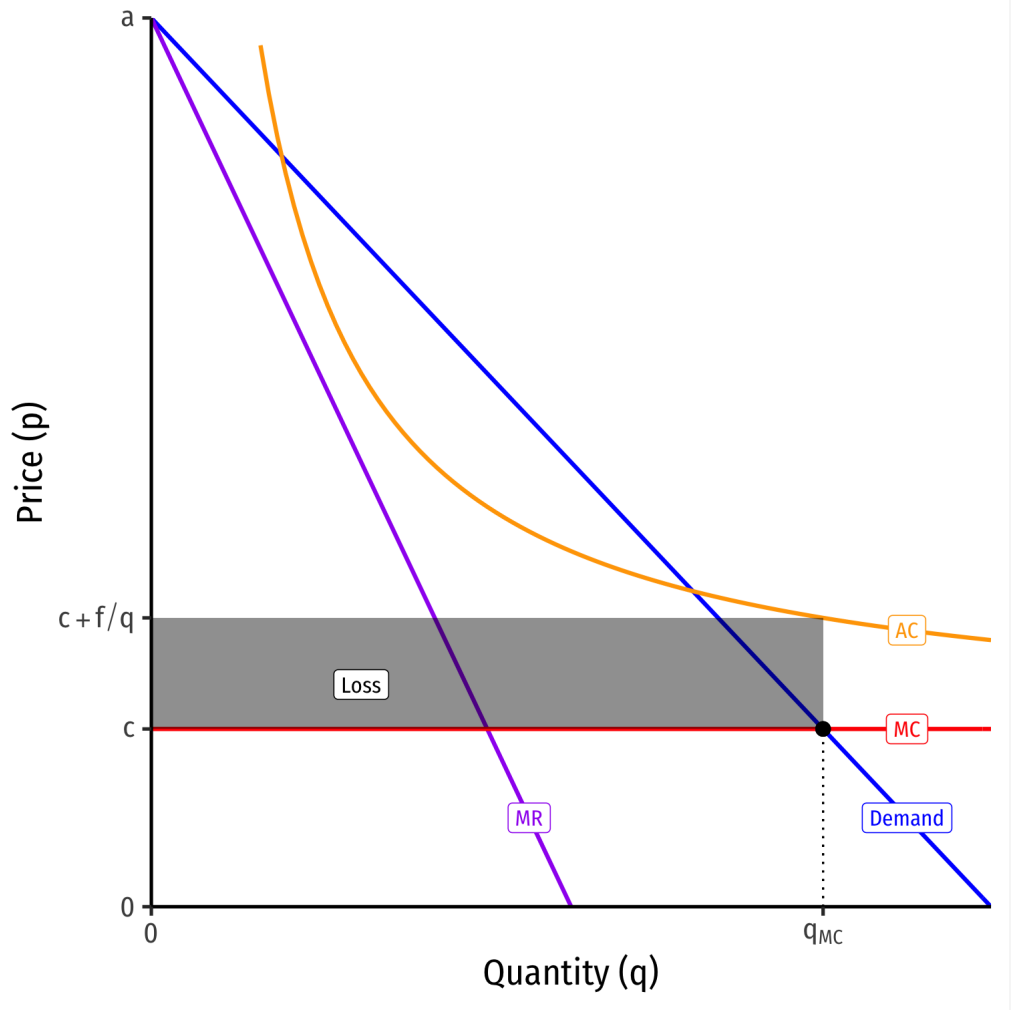
Contestable Markets III

- What if there are **fixed costs**, *[Math Processing Error]*?

[Math Processing Error]

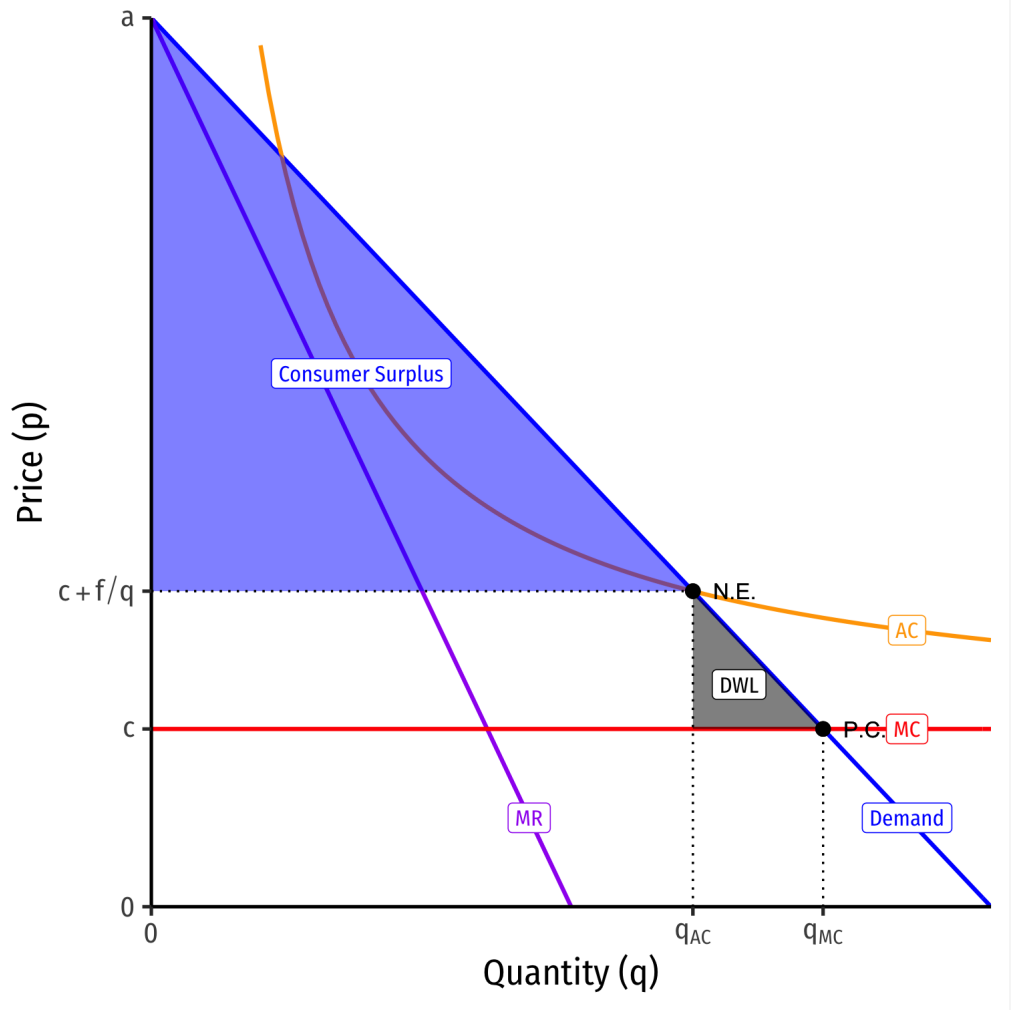
- With high enough *[Math Processing Error]*, **Economies of scale** may prevent marginal cost pricing from a being profitable Nash Equilibrium

[Math Processing Error]



Contestable Markets IV

- **Nash equilibrium**: **Incumbent** prices at *[Math Processing Error]* earns *[Math Processing Error]*
- **Entrant** stays out
- Again, single firm, but not a monopoly
  - no profits
  - not allocatively efficient, *[Math Processing Error]*, some DWL



Contestable Markets: Recap

- **Markets are contestable if**:

    1. There are no barriers to entry or exit
    2. Firms have similar technologies (i.e. similar cost structure)
    3. There are no sunk costs

- Economies of scale need not be inconsistent with competitive markets (as is assumed) if they are contestable

- Generalizes "prefect competition" model in more realistic way, also game-theoretic

Contestable Markets: Summary

William Baumol

(1922--2017)

> "This means that...an incumbent, even if he can threaten retaliation after entry, dare not offer profit-making opportunities to potential entrants because an entering firm can hit and run, gathering in the available profits and departing when the going gets rough."

Baumol, William, J, 1982, "Contestable Markets: An Uprising in the Theory of Industry Structure," *American Economic Review,* 72(1): 1-15

Implications for Competition

- Regulation & antitrust (once) focus(ed) on *number* of firms
    - "Count the number of firms, if it's 1, it's a monopoly!"
- **Perfect competition as "gold standard", only market arrangement that is socially efficient**:
    - **Allocatively efficient**: *[Math Processing Error]*, *[Math Processing Error]*

Implications for Competition

- But number of firms is **endogenous** and **can evolve over time**!
  - Function of how firms mutually interact strategically
- A more **dynamic** situation: firms respond over time

Implications for Competition

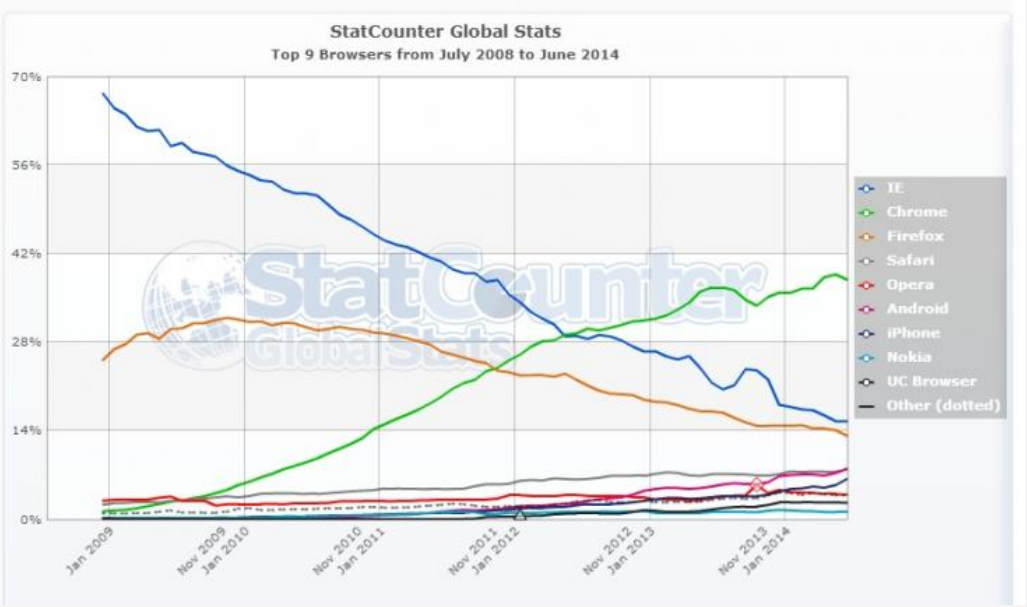
- Perfect competition not the only socially efficient market-structure
    - Small number of firms (including 1) may be efficient **if they are contestable**
- **Regulation and antitrust should consider whether a market is *contestable*, not just the *number* of firms**
    - Free entry
    - No sunk costs

Implications for Competition

- Firms engaging in egregious monopolistic behavior *[Math Processing Error]*, *[Math Processing Error]*, *[Math Processing Error]*, *[Math Processing Error]*) largely persist because of **barriers to entry**
    - Attempts to make market **uncontestable**
- Business activities or political dealings with the goal to raise *[Math Processing Error]*

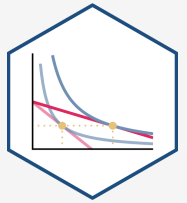
Monopoly Or Contestable Market?

Contestable Markets



"Of far greater concern to Microsoft is the competition from new and emerging technologies, some of which are currently visible and others of which certainly are not. This array of known, emerging, and wholly unknown competitors places enormous pressure on Microsoft to price competitively and innovate aggressively." (Schmalensee 1999)

Contestable Markets

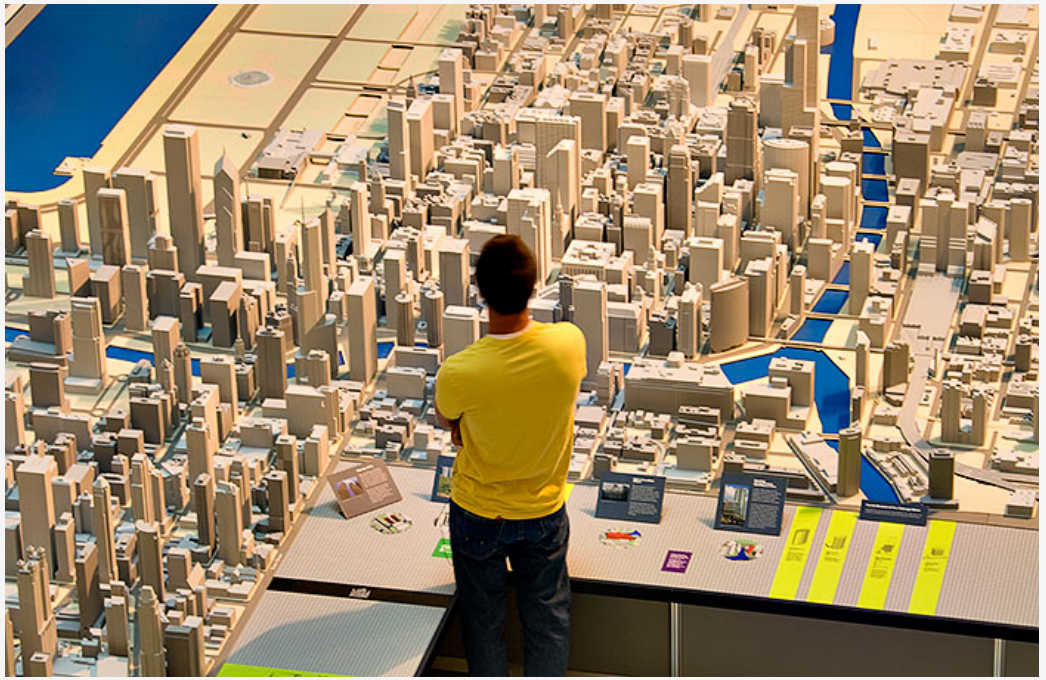


So What's the Point of the Models?

- In perfect competition (model):
  - price-taking firms set price equal to marginal cost
  - long run economic profits are zero
  - allocative efficiency: consumer and producer surplus maximized
- This is a *tendency* **only because of free entry and exit**

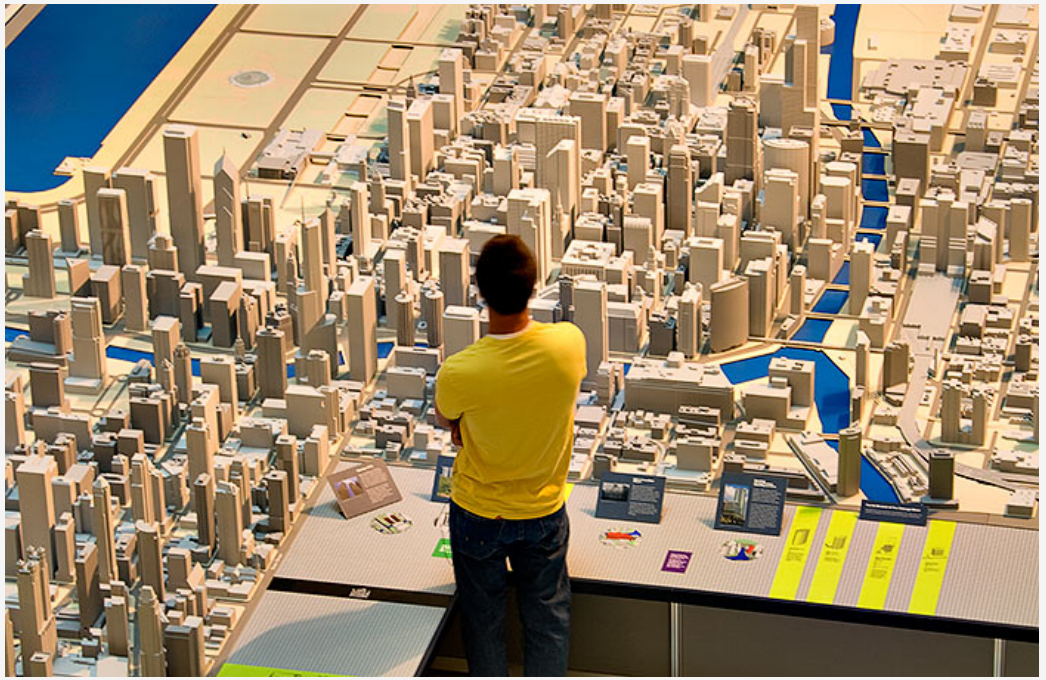
So What's the Point of the Models?

- **Don't judge real markets by their similarity to the perfect competition model**
- Judge them more on their level of contestability, ease of potential entry



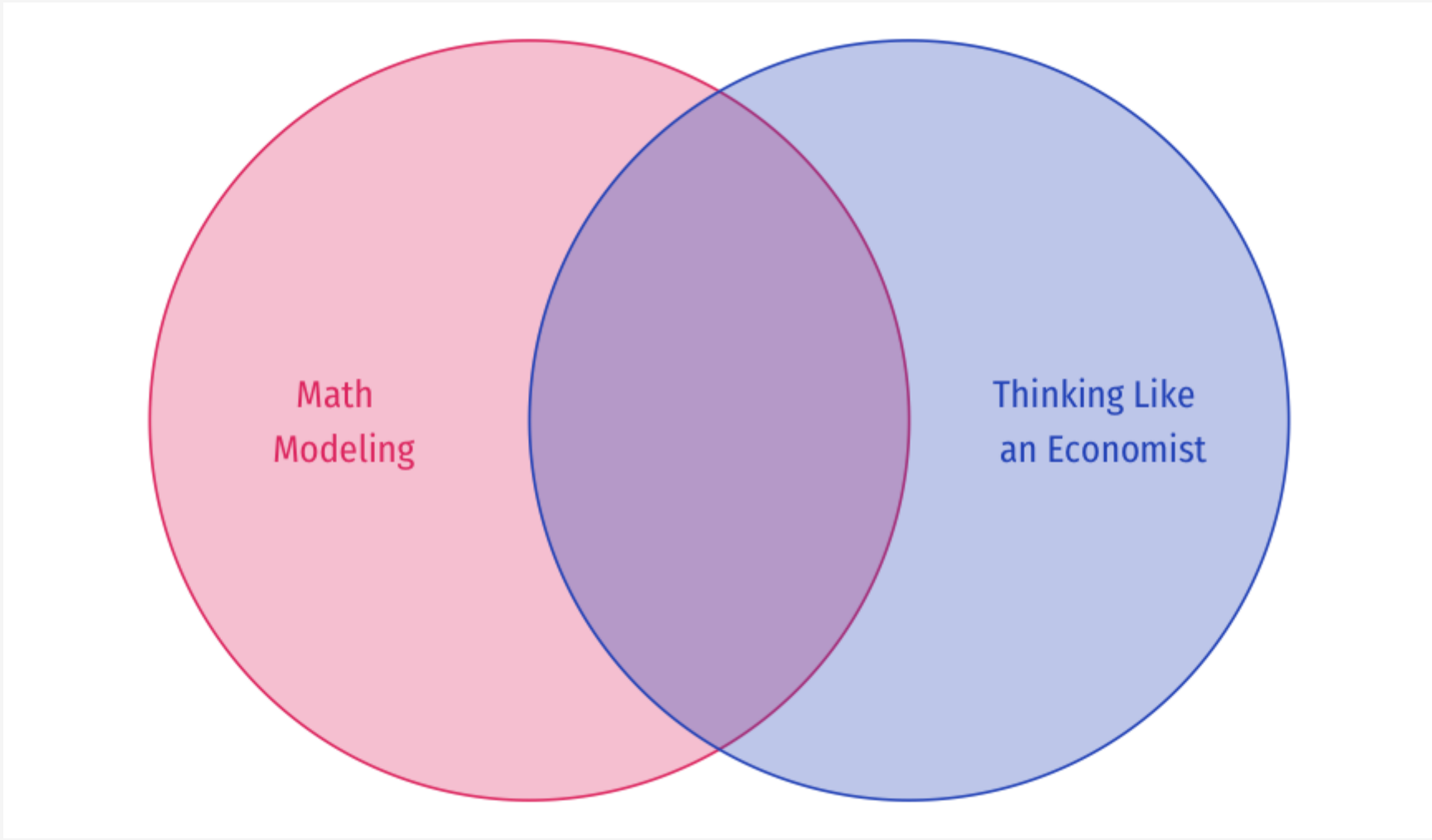
So What's the Point of the Models?

> "...In that Empire, the Art of Cartography attained such Perfection that the map of a single Province occupied the entirety of a City, and the map of the Empire, the entirety of a Province. In time, those Unconscionable Maps no longer satisfied, and the Cartographers Guilds struck a Map of the Empire whose size was that of the Empire, and which coincided point for point with it. The following Generations, who were not so fond of the Study of Cartography as their Forebears had been, saw that that vast Map was Useless..."

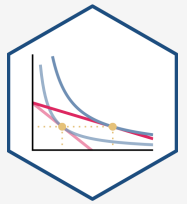


Jorge Luis Borges, 1658, *On Exactitude in Science*

Economics Uses, but Is Not Limited to, Math



The Two Major Models of Economics as a "Science"



Optimization

- Agents have **objectives** they value
- Agents face **constraints**
- Make **tradeoffs** to maximize objectives within constraints

Equilibrium

- Agents **compete** with others over **scarce** resources
- Agents **adjust** behaviors based on prices
- **Stable outcomes** when adjustments stop

Economics Is Broader Than You Think