General Equilibrium Theory

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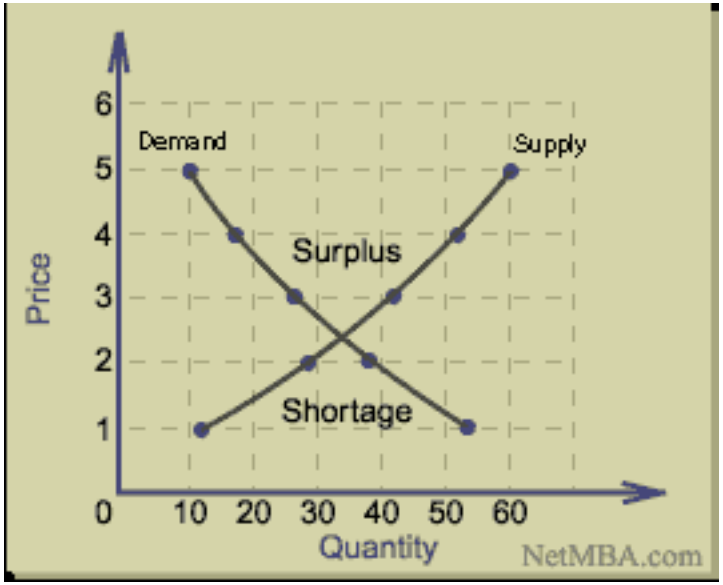
General Equilibrium

1. Production (supply) == Consumption (demand)
2. Consumers maximize utility
3. Producers maximize utility



Model

- Multiple Products
  - Each product has a price
- Multiple consumers
  - Several consumption bundles
  - Independent utility functions for bundles
  - Initial endowments
- Multiple producers
  - Several production vectors
    - some items in the vector may be negative
    - How can a product can be input into its own production?
  - Profits are distributed to consumers
    - as if they owned stock. why?

Properties

- Pareto Efficient
  - No agent can do better without another agent doing worse.
  - Can multiple points could satisfy this condition?
- Coalition Stability
  - With no producers, no group of agents is better off forming their own private market.
- With producers no general equilibrium may exist

More Properties

- Unique if society-wide demand for a good is non-decreasing in the prices of other goods
  - What does this mean?
- Consumption externality
  - One agents consumption affects another's utility.
  - Example?
- Production externality
  - One agents production is affected by another's actions.
  - Example?

Price-Based Mechanisms

- A way to determine prices such that there is a general equilibrium
- Let agents find an efficient joint solution.
- Centralized vs. Distributed
- Hillclimbing: price algorithm tâtonnement
  - What is error function?
- Newton method converges faster.
- WALRAS is similar to tâtonnement.
  - Agents may not update all demands at each cycle.

Quantity-Based Mechanism

- Mechanism announces production and consumption plans and the agents offer to pay.
- Increased centralization
  - mechanism needs to know production and consumption bundles

Speculation

- Previous techniques assume the market is too large for any one agent to affect it.
- If an agent's actions can affect the market, then it can act strategically by over or under representing its utility functions.
- Multiple speculating agents requires Nash equilibrium or dominant equilibrium.

Speculation

- An agent's bids reveal information about its utility function.
- A strategically acting agent could misrepresent his utility to get a lower price on products.
- This can be modeled as a game where each each agent is truthful or deceitful. There is a Nash equilibrium to this game.
  - Is this Nash equilibrium the same as the market general equilibrium?
  - Can agent detect if another agent is being deceitful?
  - Page 40 of Sandholm lists equations giving theoretical maximums for speculating consumer and producers.

WALRUS

- Price-based Distributed Mechanism
- Agents submit utility curves
  - How do the agents submit functions?
- Mechanism adjusts prices to clear
  - tâtonnement makes small incremental changes
- Each product has an independent auction.
  - How do auctions work?

Shipping Model

- Multiple agents, called Shippers, want to transport products over shared channel.
- Channels have an inverse economy of scale: more usage implies a higher cost.
- Everyone pays the same cost/usage.
- Leads to an overuse of the channels.

Tragedy of the Commons

- 100 people in a village with a community field.
- Each person has 1 cow that grazes on the field and earns $100/year for a GVP of $10000/year.
- If one person buys a second cow then each cow will only earn $99/year for a GVP of $9999/year, but that extra cow owner gets $198/year.
- Buying more cows is a dominant strategy and soon no one will make any money.
- Increased usage of the field by one villager is subsidized by the rest of the villagers.

Avoid the Tragedy

- Give the field to another agent with incentives to use it optimally.
- Agents managing common resources are called Carriers.

Questions

- Why a General Equilibrium unique under gross substitution? What is gross substitution?
- What are some differences between central and distributed mechanisms?
- WALRUS does not assume that consumers own producers. What, if any, effect does this have?
- Why is synchronicity important in WALRUS?