MARKET STRUCTURE

CENTRALIZED VS. OVER-THE-COUNTER ("DARK") MARKETS?

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Fundamental result in economics:

- Competitive markets have an *equilibrium*: they settle
- At this equilibrium, they provide *optimal allocations*

“Pareto optimality:” no re-arrangement is better because it hurts someone [“efficiency;” after Vilfredo Pareto, from Lausanne, Switzerland (1800s)]

What are these competitive markets really?

*There are some conditions*
Nobody on the demand and supply side can affect prices

Announced prices are such that:

\[ \text{DEMAND} = \text{SUPPLY} \]

This is the competitive equilibrium

A.k.a. *the Walrasian equilibrium*, after Léon Walras, from Lausanne (1800s)

Sharp predictions about (net) quantity that will be traded, who trades, and at what prices
The Usual Plot:

- **Supply**
- **Demand**

Price vs. Quantity

- $P_e$
- $Q_e$
The theory is SILENT about
- How to implement competitive markets
- Specifically, how to get to equilibrium
When economists claim that “markets always work best”, they are really talking about the beautiful abstract constructions of the theory. Whether a given market institution can be associated with the markets in the theory is not a foregone conclusion. Unfortunately, many economists believe that any “free” (unregulated) market will do...
- *Ebay*: probably not, because it is *one-sided*
- *Treasury auctions*: same problem
- *OTC derivatives markets*: not everyone trades at the same price
- *Real estate market*: like the OTC markets?
- The *NYSE*: looks more like a competitive market
For Competitive Markets, We Need, At A Minimum:

Price taking on both demand and supply side
In fact, in a competitive situation, “strategy” (e.g., attempts to manipulate opponent) is not supposed to work!!

Books like “Competitive Strategy,” like from one of my former colleagues at Yale, are a contradiction in terms!
Here Is An Institution That Does Not Work

- Bilateral private markets
- E.g., 30 subjects meet in the “marketplace” to exchange securities for cash
- 15 have an incentive to sell (they pay us for every unit they sell and they keep the difference with the selling price)
- 15 have an incentive to buy (we pay them for every unit they buy and they keep the difference with the buying price)
The competitive equilibrium price is \( \sim 10 \)

The (net) amount of optimal trade is 18

This provides the *best* possible re-allocation of securities
- 3 trades (despite 178 orders!)
- Between the WRONG people
- And one at prices way off equilibrium level (to the delight of the counterparty, who should never have traded!)
We Know An Institution That Does Work

- Lots of trade
- *Net trade* ~18
- Prices slightly above predicted
We Used The Double Auction

- Centralized market
- Anonymous
- Double-sided: both buyers and sellers
- Our version: open limit order book
  - Orders for execution at indicated price or better
  - If no match, stay around until canceled or matched
  - Strict time/price priority imposed

(This is Flex-E-Markets of course)
A financial markets lab class (to be introduced at Melbourne soon)

- Where we teach the theory of asset pricing using 7 canonical settings

The outcomes on the previous slides are from a class at EPFL, Switzerland (Master of Financial Engineering)

If you don’t believe that this replicates, here is what happened at the Eccles School of Business, University of Utah, Fall 2013…

(Experimentation is also about REPLICATION; standard empirical work in finance cannot be replicated because it concerns HISTORY)
Induced demand/supply, equilibrium price = 10
Left: centralized; Right: decentralized
(Are MBA students more active?)
Compare to single-sided auctions:

- Single seller makes it hard to analyze (Multiple units: Uniform price? Discriminatory price? Simultaneous or staggered auctions?...)
- Analyzed using game theory: not competitive, but strategic!
- Strategic equilibrium is not necessarily efficient (Pareto optimal)
- Often complex assignment rules (see next)
We have therefore chosen a method that attempts to balance minimizing the slack variables and reducing the fluctuations in pseudo-dual prices from round to round. This method requires solving two optimization problems, the first of which is alternative 3 above, which we present as (P4):

\[
\Omega^* = \min \sum_{j \in B' \setminus (W' \cup F)} \delta_j \\
\text{s.t.} \sum_{i \in L} a_j \pi_i + \delta_j \geq b_j, \text{ for all } j \in B' \setminus (W' \cup F) \\
(P4): \sum_{i \in L} a_j \pi_i = b_j, \quad \text{for all } j \in W' \\
\pi_i \geq b_j, \quad \text{for all } j \in F \setminus (W' \cap F) \\
\delta_j \geq 0, \quad \text{for all } j \in B' \setminus (W' \cup F)
\]

and \(i\) is the license index associated with bid \(j\)

Since multiple optimal solutions can exist to (P4) we solve a second optimization problem that chooses a solution in a way that reduces the magnitude of price fluctuations between rounds.
They sometimes work with simple robots (Gode-Sunder)

They work from ~10 participants on (5 on each side) (Vernon Smith, Charles Plott,…)

Do not work because of Walras’ conjecture that prices increase if there is excess demand and \( v.v. \) (Asparouhova-Bossaerts-Plott)

Conjectured to work because participants make marginally optimal adjustments (Bossaerts-Ledyard)
From A Market Design Point Of View:

- Try to design claims so that problems can be solved with a double-sided market
- Implement the double-sided market as a centralized, anonymous open book system
Every day permits to enter city center are available

How to generate optimal allocation?

One option: city office sets the price (Singapore)

This is a single-sided auction
Annual permits are distributed which can be sub-leased on a daily basis

Allocate permits to city center residents?

Double-sided market in daily entry permits:
- Sellers: holders of annual permits
- Buyers: don’t hold annual permits but need a one-day permit
The “markets” of economic theory are abstract concepts.

The theory gives little guidance as to how to implement them and ensure equilibration.

Some institutions work.

What distinguishes these institutions is that they are centralized, and competitive on both sides: Two-sided.
… Should be about *institutions* that are allowed

So, about rules of exchange

[Perhaps no dark pools, no private CDS markets?]

- Dodd-Frank in US
- MiFID 2 in EU
- REALLY? Let’s re-visit this in 2 weeks…