Introduction

Thilo Klein

ZEW Mannheim

"*Only recently have we economists started to understand enough about how markets work so that we can help in that process.*"

Alvin E. Roth

2012 Nobel Prize laureate (with Lloyd Shapley)
"*for the theory of stable allocations and the practice of market design.*"

Maret Design

Market design is the area of economics where economists analyze and improve the way markets work.

Critical ingredients to a succesful design:

- Understanding existing institutions
- Good theory
- Good computational modeling
- Well-designed experiments

What is a market?

In economics, whenever there is:

- a demand for *something*
- a supply for *that* something

There is a market for *that* something.

The traditional approach consists of finding an equilibrium price, i.e., a price p such that:

$$\sharp \text{ units buyers are willing to buy at } p \text{ or more} \\ = \\ \sharp \text{ units sellers are willing to sell for } p \text{ or less}$$

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Questions

- How do we get the equilibrium price?
- Is the "price recipe" the same for all markets?
- What if the price is not the only parameter driving individuals' decisions?

  What if there's no price? (no monetary transactions between sellers and buyers)
- What if the price is "shared"? (e.g., roommates sharing a rent)

The exact details about how to organize a market do matter: they will affect agents' behavior and ultimately affect:

- Who gets what
- At what price (if there's a price...).

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The Easy case

A market for a very common good (e.g., milk):

- Milk is the same everywhere
- Large number of buyers and sellers
- Quantities for demand/supply can be adjusted
- sellers (i.e., stores) adjust their prices up/down, depending on the sales. Consumers react to prices. After some time, prices stabilize and we get an “equilibrium” price.
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More difficult

There's a Monet painting. Seller wants at least $\$1,000,000$.

- Price discovery: How do we get to know the price buyers are willing to accept?
- Each buyer has a maximum price at which he/she is willing to buy the painting:
  - Alice has the highest such maximum price: $\$5,000,000$.
  - Bob has the 2nd highest maximum price: $\$2,000,000$.
- There's only one such painting, so we need to find the price such that there's at most one buyer.

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- Any price between $\$\,2,000,000.01.$ and $\$\,5,000,000$ is thus an equilibrium price. What is the "correct" equilibrium price?
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- Few buyers, few sellers: we need to be precise on how prices are made.

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More challenging

- College admission: large demand (students) and large supply (colleges).
- price = tuition
- Looks like the market for milk. So, why don't we have a "*market for college admission*"?

  We're obviously not in equilibrium: top schools accept less than 5% of the applicants.

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- What matters here: Buyers/sellers do not only care about the good they are buying/selling (education), but also with whom they make transaction:

  Colleges and students have preferences over each other. Price (tuition) is not the only variable of decision.

- Conclusion: price may affect people's decisions, but may not be sufficient to determine the "equilibrium" (or the final allocation).

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Even worse

What if there's no monetary transaction at all?

- In almost all countries, selling/buying human organs for transplants is illegal
- Yet, there is a market: a demand (patients) and a supply (live/cadaveric donors).
- Is there a way to organize such markets?

Prices may have adverse effects, too.

- It is legal in some countries to compensate blood/sperm/eggs donors.
- Such compensation may prevent donation ("I don't do that for money").

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What a market needs to work

If a market "works" it means that some there are some trades. For this to occur several conditions must or should be met.

- We need "enough" actors from both sides. This is called market thickness.

  Sellers need to meet buyers, and buyers need to meet sellers. Roads, internet or trade treaties bring thickness.

  Also, if a seller can face many different buyers she can have a good knowledge of how the demand looks like.

- Avoid congestion: Too much thickness can create problems, like too much traffic can create traffic jams.
- Make the market safe: Actors must be able to make the "right" decision:
  - They need to understand the rules, how the market works
  - Avoid feeling ripped off (otherwise they don't want to participate).

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Commodities

We often think that market design is about the rules, how the market operates.

But defining what are the goods or services being traded can have some effect, too.

How goods and services are defined can in turn influence the design of the trading institution.

Take wheat, to make flour (to make bread).

- Two bags of wheat from two different farmers are no exactly identical
- In the past, a baker would then negotiate with each farmer/mill.
- This can make the market thin (I only deal with the farmers I know), or create congestion (I can't negotiate with too many farmers at the same time).

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- But wheat/flour can be categorized, as a function of the type of grain, the quality (the "grade"), etc.

  $\rightarrow$ Wheat/flour become a commodity: what matters is the type of wheat/flour, not its origin.

- 1848: The Chicago commodity market was created.

  2008: Ethiopian commodity exchange (ECX) for sesame, coffee, etc.

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Market Design: a first example

- Food banks provide food to the poor.
- Distribution is typically done at the local level (food pantries, soup kitchens, churches, community centers, etc.) .
- Food in a food pantry can originate from nearby and far away (via regional food bank).

Feeding America

- 3rd largest not-for-profit in the US after the Red Cross and United Way Worldwide).
- Sources food donations from
  - Large food manufacturers
  - Large distributors
  - small/local entities

  and allocated it to $\approx$ 210 regional entities.
- 2 ways for distribution:
  - facilitate donations from donor to a particular food bank
  - donations directly to Feeding America, who allocates it to food banks.

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How to allocate food?

Feeding America receives donations (truckloads of some particular products). How to allocate it to regional food banks?

Objetives

- Fairness: allocate to the neediest foodbanks

  $\rightarrow$ Need to calculate the needs of each foodbank.

- Don't waste:
  - Avoid spoiling food.
  - If some food donation is not distributed the donnors may refrain to make future donation.

  $\rightarrow$ Need to incentivize food banks to accept food donations from Feeding America.

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Give to the neediest

- Feeding America calculates for each food bank
  - The pounds of food that is **should** receive (using comparisons across food banks and population size in service area)
  - The pounds of food that is received.
- Food offered to banks, starting with the bank with the highest ratio

$$\frac{\text{pounds should receive}}{\text{pounds received}}$$

This mechanism is known as the serial dictatorship.

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Incentives

A food bank would be proposed some food. Then choices between

- Yes.
  - Food bank is liable for transportation costs.
  - The "received pounds" add up to the tally, thus changing the ranking of the food bank in the queue.
- No
  - The "received pounds" add up to the tally, thus changing the ranking of the food bank in the queue (as if the food bank said "yes").

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- If the food cannot be stored for long, forcing the food bank to accept may be counterproductive.

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- transportation cost can be prohibitive for long distance,

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Problems

- Some food banks would receive food they didn't need.

  E.g., Idaho food bank receiving potatoes.

- Some food banks would never receive food they need.

  E.g., Alaska food bank never receives offer for produce.

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Problems from a market perspective

Lack of information:

- Food banks typically receive only 20% from Feeding America (and FA knows little about the other 80%).

  So FA is deciding what is best for food banks without really knowing their needs.

- For FA, 1 pound of potato chips = 1 pound milk = 1 pound frozen meat = 1 pount of whatever.

  $\rightarrow$ needs, regional differences, nutritional value, transportation costs not taken into account.

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Fixing the allocation system: Issues

- One key issue is to reveal information, i.e., food banks reveal how much they need each particular item.
- Need to introduce choice. So we need a budget.
- Without a budget, a consumer raises her hand for all items, and thus choice become uninformative:

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- 9 directors of regional food banks
- 3 senior staff at Feeding America
- 4 economists from the University of Chicago

For the economists, a solution quickly came out: use a market mechanism. But. . .

- Markets have a bad reputation, they don't always work well.
- Food banks precisely targets those who are left out by the system.
- One food bank director initially said:

> *"I am a socialist. That's why I run a food bank. I don't believe in markets. I'm not saying I won't listen, but I am against this."*

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Introducing prices?

- Prices are valuable: solve the local knowledge problem, showing how much people value different things.
- Real money not the right solution: neediest food banks may be the poorest.
- What about fake money? Just give fake money to the food banks.
- How do we ensure that the neediest get the most food?

  Just give them more of that fake money (so the poor can be wealthier than the rich!).

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The auction

- FA distributed "shares" to food banks, with neediest banks receiving more shares.
- Everyday, food banks log onto a website where food offering are posted.
  On average, 30-40 offerings/day
- Two auctions/day, first-price, sealed bid auction:
  - clearer for participants
  - avoid sniping (by large food banks)
- All shares spent on a given day redistributed at midnight, using the same formula as for the initial allocation.

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- **Delegated bidding**: food banks can delegate bidding to FA (explaining their needs).
- **Credit**: Food banks can access credit, paid off with their future allocations. One credit at a time.

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  - Some food banks may be in excess of some type of food.
  - Allow them to “sell” this food on the market.
  - 10% tax imposed on these sales (indicates “food richness”, FA want to level the playing field).
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Results

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    - highly demanded (meat, poultry, fish)
    - least demanded (produce, sugary drinks, potato chips).
- Price are stable (it facilitates bidding with a new currency). Some quantitative money theory introduced to manage monetary mass.
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