Redistribution through Markets

Scott Duke Kominers

Harvard Business School and Department of Economics, Harvard University

(joint work with Piotr Dworczak ® Mohammad Akbarpour[1])

Virtual Market Design Seminar

Bonn–Cologne–KIT–Paris II–ZEW–. . .

April 20, 2020

[1] Authors' names are in (ce®tified) random order.

Today

How should we design marketplaces in the presence of systematic wealth inequality?

Today

How should we design marketplaces in the presence of systematic wealth inequality?

- Framing assumption: designer regulates/controls *one market*.

Today

How should we design marketplaces in the presence of systematic wealth inequality?

- Framing assumption: designer regulates/controls *one market*.

- Price controls and subsidies are abundant!
  - rent control in housing markets / public housing
  - opposition to congestion pricing
  - (Iranian) Kidney market

Today

How should we design marketplaces in the presence of systematic wealth inequality?

- Framing assumption: designer regulates/controls *one market*.

- Price controls and subsidies are abundant!
  - rent control in housing markets / public housing
  - opposition to congestion pricing
  - (Iranian) Kidney market

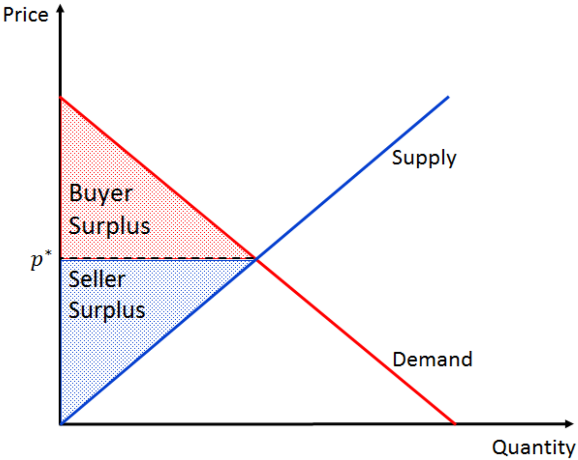
- Are these sorts of policies a good idea?

Today

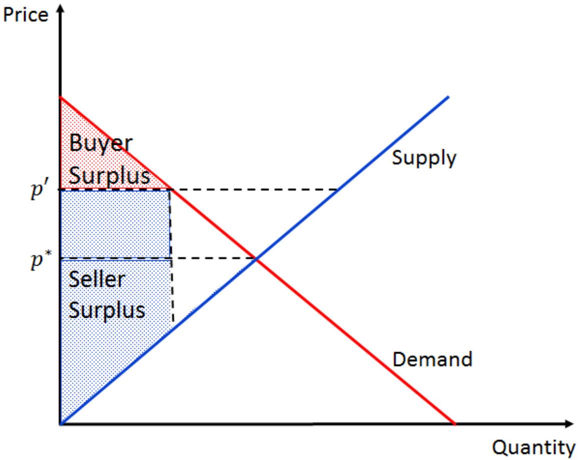
How should we design marketplaces in the presence of systematic wealth inequality?

- Framing assumption: designer regulates/controls *one market*.
- Price controls and subsidies are abundant!
  - rent control in housing markets / public housing
  - opposition to congestion pricing
  - (Iranian) Kidney market
- Are these sorts of policies a good idea?
- Knee-jerk economics answer: NO!

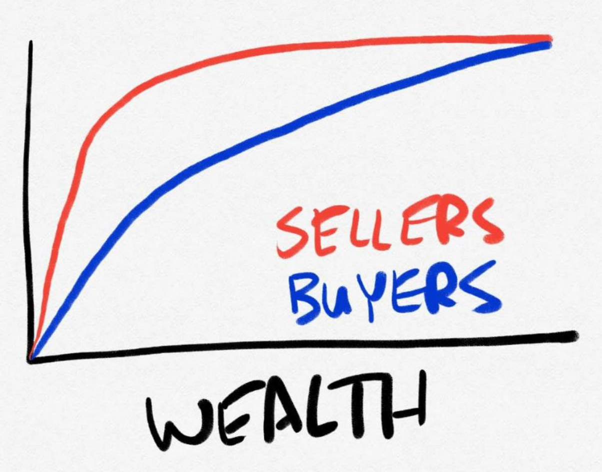
Standard Economic Intuition



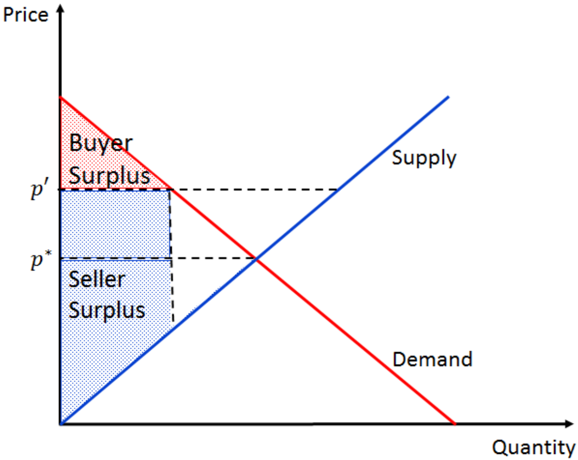
Standard Economic Intuition



Buyer/Seller Inequality



Standard Economic Intuition – revisited



Thought Experiment

- Consider a frictionless buyer/seller market.

Thought Experiment

- Consider a frictionless buyer/seller market.
- As sellers become (systematically) poorer than buyers, the competitive-equilibrium price decreases.

Thought Experiment

- Consider a frictionless buyer/seller market.
- As sellers become (systematically) poorer than buyers, the competitive-equilibrium price decreases.
- However, when sellers are poorer, the designer would like them to have *more* money on the margin, all else equal.

Thought Experiment

- Consider a frictionless buyer/seller market.
- As sellers become (systematically) poorer than buyers, the competitive-equilibrium price decreases.
- However, when sellers are poorer, the designer would like them to have *more* money on the margin, all else equal.

$\Rightarrow$ Past some point, competitive-equilibrium pricing will not be socially optimal(!).

Today – Preview

How should we design marketplaces in the presence of systematic wealth inequality?

[1] Following an approach from public finance.

[2] Implicit assumption: this is a good approximation.

Today – Preview

How should we design marketplaces in the presence of systematic wealth inequality?

- ⋆ Model inequality as dispersion in marginal values for money.[1,2]
  - ⇔ allowing for arbitrary Pareto weights in mechanism design.
  - ⇝ We seek to maximize weighted surplus subject to resource, budget balance, incentive, and individual rationality constraints.

[1] Following an approach from public finance.

[2] Implicit assumption: this is a good approximation.

Today – Preview

How should we design marketplaces in the presence of systematic wealth inequality?

- ⋆ Model inequality as dispersion in marginal values for money.[1,2]
  - ⇔ allowing for arbitrary Pareto weights in mechanism design.
  - ⇝ We seek to maximize weighted surplus subject to resource, budget balance, incentive, and individual rationality constraints.

- ⋆ Optimal Mechanism uses two instruments:
  - cross-side inequality ⇒ price wedge*
  - same-side inequality ⇒ rationing

[1] Following an approach from public finance.

[2] Implicit assumption: this is a good approximation.

Today – Preview

Technical Contribution

- We characterize an optimal mechanism for an **arbitrary distribution of values for money**, and show that it has a simple form.

Today – Preview

Technical Contribution

- We characterize an optimal mechanism for an **arbitrary distribution of values for money**, and show that it has a simple form.

Market Design under Wealth Inequality

- We show how the form of the optimal mechanism depends on the type of inequality: **cross-side** vs. **same-side**.

Today – Preview

Technical Contribution

- We characterize an optimal mechanism for an **arbitrary distribution of values for money**, and show that it has a simple form.

Market Design under Wealth Inequality

- We show how the form of the optimal mechanism depends on the type of inequality: **cross-side** vs. **same-side**.

Conceptual Contribution

- Competitive equilibrium is not necessarily "optimal" in the presence of wealth inequality.

Related Literature (not exhaustive!)

Rationing vs. Market Mechanism: Weitzman (1977); Condorelli (2013); Huesmann (2017)

Auctions with Budget-Constrained Bidders: Che–Gale (1998); Fernandez–Gali (1999); Che–Gale–Kim (2012); Pai–Vohra (2014); Kotowski (2017)

Optimal Tax: Diamond–Mirrlees (1971); Atkinson–Stiglitz (1976); Piketty–Saez (2013); Scheuer (2014), Saez–Stantcheva (2016, 2017); Scheuer–Werning (2017)

Minimum Wage: Allen (1987); Guesnerie–Roberts (1987); Boadway–Cuff (2001); Lee–Saez (2012); Cahuc–Laroque (2014)

Fair Marketplace Design: Hylland–Zeckhauser (1979); Bogomolnaia–Moulin (2001); Budish (2011)

Standard Model

- good K (indivisible) and money M (divisible).

Standard Model

- good K (indivisible) and money M (divisible).
- Unit mass of sellers (own good K).
- Mass μ of buyers (don't yet own good K).

Standard Model

- good K (indivisible) and money M (divisible).
- Unit mass of sellers (own good K).
- Mass μ of buyers (don't yet own good K).
- Each agent has a valuation v^K for K.

Standard Model

- good K (indivisible) and money M (divisible).
- Unit mass of sellers (own good K).
- Mass μ of buyers (don't yet own good K).
- Each agent has a valuation v^K for K.
- If (x_K, x_M) denotes the holdings of K and M, then utility $\propto$

$$v^K \cdot x_K + x_M.$$

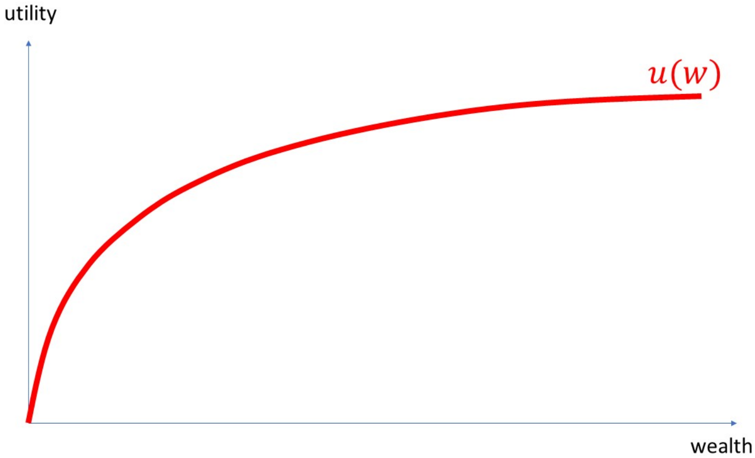
Standard Model

- good K (indivisible) and money M (divisible).
- Unit mass of sellers (own good K).
- Mass μ of buyers (don't yet own good K).
- Each agent has a valuation v^K for K.
- If (x_K, x_M) denotes the holdings of K and M, then utility $\propto$

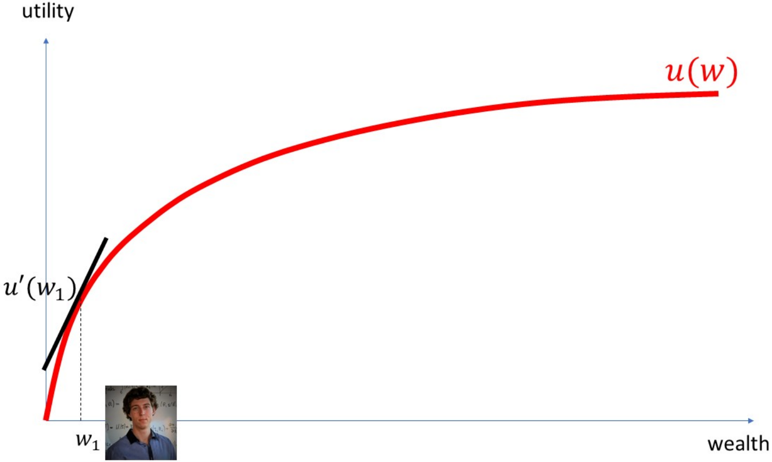
$$v^K \cdot x_K + x_M.$$

$\rightsquigarrow$ How to maximize welfare? Set price p^{CE}.

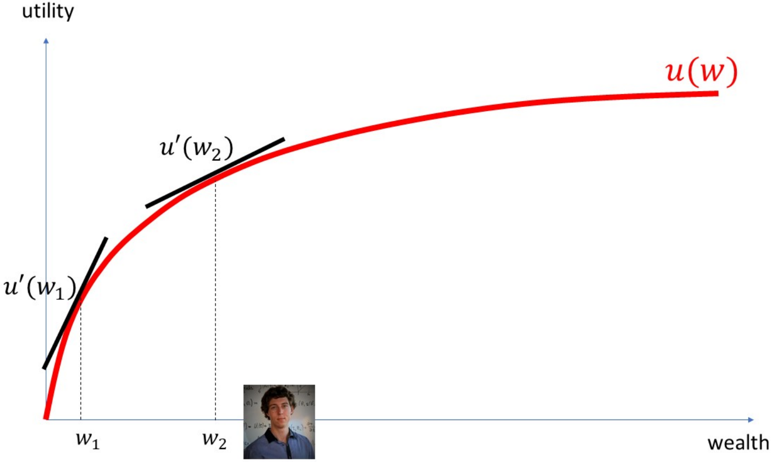
But wealth influences preferences!



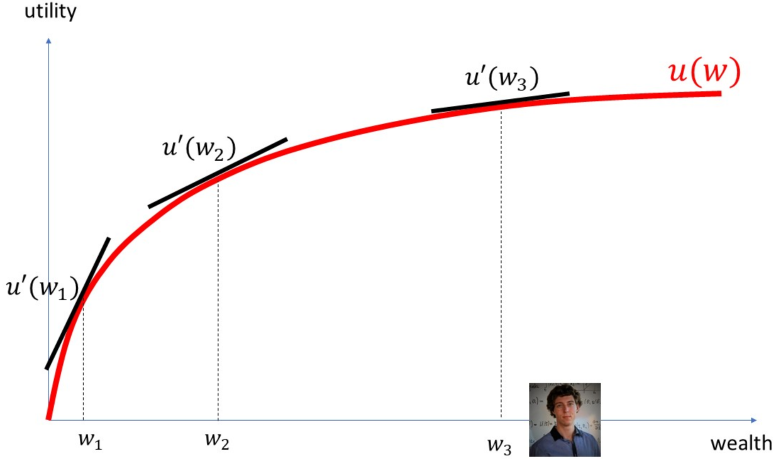
But wealth influences preferences!



But wealth influences preferences!



But wealth influences preferences!



Our Model

- good K (indivisible) and money M (divisible).
- Unit mass of sellers (own good K).
- Mass μ of buyers (don't yet own good K).
- Each agent has a valuation v^K for K.
- If (x_K, x_M) denotes the holdings of K and M, then utility $\propto$

$$v^K \cdot x_K + x_M.$$

Our Model

- good K (indivisible) and money M (divisible).
- Unit mass of sellers (own good K).
- Mass μ of buyers (don't yet own good K).
- Each agent has a valuation v^K for K.
- Each agent has a valuation v^M for M.
- If (x_K, x_M) denotes the holdings of K and M, then utility $\propto$

$$v^K \cdot x_K + v^M \cdot x_M.$$

Our Model

- good K (indivisible) and money M (divisible).

- Unit mass of sellers (own good K).
- Mass μ of buyers (don't yet own good K).

- Each agent has a valuation v^K for K.
- Each agent has a valuation v^M for M.

- If (x_K, x_M) denotes the holdings of K and M, then utility $\propto$

$$v^K \cdot x_K + v^M \cdot x_M.$$

Our Model

- good K (indivisible) and money M (divisible).
- Unit mass of sellers (own good K).
- Mass μ of buyers (don't yet own good K).
- Each agent has a valuation v^K for K.
- Each agent has a valuation v^M for M.
- If (x_K, x_M) denotes the holdings of K and M, then utility $\propto$

$$v^K \cdot x_K + v^M \cdot x_M.$$

$\rightsquigarrow$ Rates of substitution $\frac{v^K}{v^M} =: r \sim G_j(r)$ ($\sim \mathrm{Unif}[0,1]$ for now).

Simple Mechanisms under Uniform Distribution

- First, we solve one-sided problems given Q and R.
- Then, we link our characterizations of seller- and buyer-side solutions through the optimal choice of Q and R.
- Our general results have the same structure/intuition(!).

Simple Mechanisms under Uniform Distribution

- First, we solve one-sided problems given Q and R.
- Then, we link our characterizations of seller- and buyer-side solutions through the optimal choice of Q and R.
- Our general results have the same structure/intuition(!).

Key Observation

Agents' behavior depends only on $r = \frac{v^K}{v^M}$*, but* r *is informative about welfare weight* $\lambda(r) := \mathbb{E}[v^M \mid \frac{v^K}{v^M} = r]$.

Simple Mechanisms under Uniform Distribution

- First, we solve one-sided problems given Q and R.
- Then, we link our characterizations of seller- and buyer-side solutions through the optimal choice of Q and R.
- Our general results have the same structure/intuition(!).

Key Observation

Agents' behavior depends only on $r = \frac{v^K}{v^M}$*, but* r *is informative about welfare weight* $\lambda(r) := \mathbb{E}[v^M \mid \frac{v^K}{v^M} = r]$*.*

$\Rightarrow$ *Identifying "poorer" agents through market behavior.*

Measures of Inequality

- $\Lambda_j := \mathbb{E}^j[v^M]$

Measures of Inequality

- $\Lambda_j := \mathbb{E}^j[v^M]$
- **cross-side inequality** if $\Lambda_S \neq \Lambda_B$

Measures of Inequality

- $\Lambda_j := \mathbb{E}^j[v^M]$
- **cross-side inequality** if $\Lambda_S \neq \Lambda_B$
- **same-side inequality on side** $j \in \{B, S\}$ if $\lambda_j \not\equiv \Lambda_j$
  - **low** if $\lambda_j(\underline{r}_j) \leq 2\Lambda_j$; **high** otherwise

The Optimal Seller Price p_S

GOAL: Acquire Q objects while spending at most R.

$$\max_{p_S \geq G_S^{-1}(Q)} \left\{ \frac{Q}{G_S(p_S)} \int_{\underline{r}_S}^{p_S} \lambda_S(r)(p_S - r) dG_S(r) + \Lambda_S(R - p_S Q) \right\}.$$

The Optimal Seller Price p_S

GOAL: Acquire Q objects while spending at most R.

$$\max_{p_S \geq G_S^{-1}(Q)} \left\{ \frac{Q}{G_S(p_S)} \int_{\underline{r}_S}^{p_S} \lambda_S(r)(p_S - r) dG_S(r) + \Lambda_S(R - p_S Q) \right\}.$$

Three effects of pushing p_S above p_S^C:

1. allocative efficiency $\downarrow$;
2. lump sum transfer $R - p_S Q \downarrow$;
3. money to sellers who trade $\uparrow$.

The Optimal Seller Price p_S

GOAL: Acquire Q objects while spending at most R.

$$\max_{p_S \geq G_S^{-1}(Q)} \left\{ \frac{Q}{G_S(p_S)} \int_{\underline{r}_S}^{p_S} \lambda_S(r)(p_S - r)dG_S(r) + \Lambda_S(R - p_S Q) \right\}.$$

Proposition

When seller same-side inequality is low, $p_S = p_S^C$ is optimal. When seller same-side inequality is high and Q is low enough, rationing at a price $p_S > p_S^C$ is optimal.

The Optimal Seller Price p_S

GOAL: Acquire Q objects while spending at most R.

$$\max_{p_S \geq G_S^{-1}(Q)} \left\{ \frac{Q}{G_S(p_S)} \int_{\underline{r}_S}^{p_S} \lambda_S(r)(p_S - r) dG_S(r) + \Lambda_S(R - p_S Q) \right\}.$$

Proposition

When seller same-side inequality is low, $p_S = p_S^C$ is optimal. When seller same-side inequality is high and Q is low enough, rationing at a price $p_S > p_S^C$ is optimal.

- Decision to trade always identifies sellers with low rates of substitution ($\Rightarrow$ equity $\uparrow$)!

The Optimal Buyer Price p_B

GOAL: Allocate Q objects with revenue at least R.

$$\max_{p_B \leq G_B^{-1}(1-Q)} \left\{ \frac{Q}{1 - G_B(p_B)} \int_{p_B}^{\bar{r}_B} \lambda_B(r)(r - p_B) dG_B(r) + \Lambda_B(p_B Q - R) \right\}.$$

The Optimal Buyer Price p_B

GOAL: Allocate Q objects with revenue at least R.

$$\max_{p_B \leq G_B^{-1}(1-Q)} \left\{ \frac{Q}{1-G_B(p_B)} \int_{p_B}^{\bar{r}_B} \lambda_B(r)(r-p_B)dG_B(r) + \Lambda_B(p_B Q - R) \right\}.$$

Three effects of pushing p_B below p_B^C:

1. allocative efficiency $\downarrow$;
2. lump sum transfer $p_B Q - R \downarrow$;
3. "money to" buyers who buy $\uparrow$.

The Optimal Buyer Price p_B

GOAL: Allocate Q objects with revenue at least R.

$$\max_{p_B \leq G_B^{-1}(1-Q)} \left\{ \frac{Q}{1 - G_B(p_B)} \int_{p_B}^{\bar{r}_B} \lambda_B(r)(r - p_B) dG_B(r) + \Lambda_B(p_B Q - R) \right\}.$$

Proposition

Setting $p_B = p_B^C$ is optimal ("fullstop").

The Optimal Buyer Price p_B

GOAL: Allocate Q objects with revenue at least R.

$$\max_{p_B \leq G_B^{-1}(1-Q)} \left\{ \frac{Q}{1 - G_B(p_B)} \int_{p_B}^{\bar{r}_B} \lambda_B(r)(r - p_B) dG_B(r) + \Lambda_B(p_B Q - R) \right\}.$$

Proposition

Setting $p_B = p_B^C$ is optimal ("fullstop").

- Decision to trade always identifies buyers with higher rates of substitution ($\Rightarrow$ equity $\downarrow$)!

Multiple Prices?

- Single price p_S is optimal for seller-side.

Multiple Prices?

- Single price p_S is optimal for seller-side.
- Not so for buyers!

Multiple Prices?

- Single price p_S is optimal for seller-side.
- Not so for buyers!
  - Using two prices can improve screening: buy at p_B^H with probability 1 or at p_B^L with probability $\delta < 1$

$\rightsquigarrow$ "wealthier" buyers choose p_B^H.

Multiple Prices?

- Single price p_S is optimal for seller-side.
- Not so for buyers!
  - Using two prices can improve screening: buy at p_B^H with probability 1 or at p_B^L with probability $\delta < 1$

  $\rightsquigarrow$ "wealthier" buyers choose p_B^H.

Proposition

When buyer same-side inequality is low, $p_B^H = p_B^C$ is optimal. When buyer same-side inequality is high and Q is large enough, rationing at p_B^L is optimal.

Multiple Prices?

- Single price p_S is (globally) optimal for seller-side.
- Not so for buyers!
  - Using two prices can improve screening: buy at p_B^H with probability 1 or at p_B^L with probability $\delta < 1$

$\rightsquigarrow$ "wealthier" buyers choose p_B^H.

Proposition

When buyer same-side inequality is low, $p_B^H = p_B^C$ is (globally) optimal. When buyer same-side inequality is high and Q is large enough, rationing at p_B^L is (globally) optimal.

Linking the Two Sides (I)

Proposition

When seller same-side inequality is low, $p_S = p_S^C$ is optimal. When seller same-side inequality is high and Q is low enough, rationing at a price $p_S > p_S^C$ is optimal.

Proposition

When buyer same-side inequality is low, $p_B^H = p_B^C$ is optimal. When buyer same-side inequality is high and Q is large enough, rationing at p_B^L is optimal.

Linking the Two Sides (II) – price wedges

Proposition

When same-side inequality is low on both sides, it is optimal to set prices such that the market clears, $G_S(p_S) = \mu(1 - G_B(p_B))$*; we redistribute any revenue as a lump-sum payment to the side with higher average value for money* Λ_j*.*

Linking the Two Sides (III) – rationing

Proposition

If seller same-side inequality is high and $\Lambda_S \geq \Lambda_B$, then (if μ is low enough) it is optimal to ration the sellers by setting a single price above the market-clearing level.

Linking the Two Sides (III) – rationing

Proposition

If seller same-side inequality is high and $\Lambda_S \geq \Lambda_B$, then (if μ is low enough) it is optimal to ration the sellers by setting a single price above the market-clearing level.

Proposition

If buyer same-side inequality is high and buyers' willingness to pay is sufficiently high [relative to the seller's rates of substitution], then it is optimal to ration the buyers for $\mu \in (1, 1 + \epsilon)$.

Today – (P)review

How should we design marketplaces in the presence of systematic wealth inequality?

- ⋆ Model inequality as dispersion in marginal values for money.[1,2]
  - ⇔ allowing for arbitrary Pareto weights in mechanism design.
  - ⇝ We seek to maximize weighted surplus subject to resource, budget balance, incentive, and individual rationality constraints.

- ⋆ Optimal Mechanism uses two instruments:
  - cross-side inequality ⇒ price wedge*
  - same-side inequality ⇒ rationing

[1] Following an approach from public finance.

[2] Implicit assumption: this is a good approximation.

Main Result

For the full model ($(v^K, v^M) \sim f_{\{B,S\}}$), we seek to maximize welfare subject to incentive compatibility, individual rationality, market-clearing, and budget balance constraints.

Main Result

For the full model $((v^K, v^M) \sim f_{\{B,S\}})$, we seek to maximize welfare subject to incentive compatibility, individual rationality, market-clearing, and budget balance constraints.

Theorem

There exists an optimal mechanism that uses some combination of a price wedge (with lump-sum transfer) and rationing.

Main Result

For the full model $((v^K, v^M) \sim f_{\{B,S\}})$, we seek to maximize welfare subject to incentive compatibility, individual rationality, market-clearing, and budget balance constraints.

Theorem

There exists an optimal mechanism that uses some combination of a price wedge (with lump-sum transfer) and rationing.

- *Total number of prices involved is small (4 at most; 3 if nonzero lump-sum transfer).*

Sketch of Proof

1. We transform the problem into maximization over allocation rules alone.

Sketch of Proof

1. We transform the problem into maximization over allocation rules alone.
2. We represent a feasible allocation rule as a lottery over quantities $\Rightarrow$ deterministic outcome in aggregate.

Sketch of Proof

1. We transform the problem into maximization over allocation rules alone.
2. We represent a feasible allocation rule as a lottery over quantities $\Rightarrow$ deterministic outcome in aggregate.
3. Market-clearing $\Leftrightarrow$ expected quantity sold to buyers equals the expected quantity bought from sellers – essentially, a Bayes-plausibility constraint.

Sketch of Proof

1. We transform the problem into maximization over allocation rules alone.
2. We represent a feasible allocation rule as a lottery over quantities $\Rightarrow$ deterministic outcome in aggregate.
3. Market-clearing $\Leftrightarrow$ expected quantity sold to buyers equals the expected quantity bought from sellers – essentially, a Bayes-plausibility constraint.
4. The solution is characterized as a concave closure of the objective function, subject to a linear constraint.

Sketch of Proof

1. We transform the problem into maximization over allocation rules alone.
2. We represent a feasible allocation rule as a lottery over quantities $\Rightarrow$ deterministic outcome in aggregate.
3. Market-clearing $\Leftrightarrow$ expected quantity sold to buyers equals the expected quantity bought from sellers – essentially, a Bayes-plausibility constraint.
4. The solution is characterized as a concave closure of the objective function, subject to a linear constraint.
5. By Carathéodory's Theorem, the solution is supported on at most three points $\rightsquigarrow$ three-price characterization for each side. (And two constraints are common across the market!)

When to use each instrument? (modulo reg. conditions)

- Cross-side inequality ($\Lambda_B \neq \Lambda_S$) $\rightsquigarrow$ price wedge.
  - $\rightsquigarrow$ moves money to the poorer side of the market.
  - N.B. Drawback: Each seller receives the same lump-sum transfer regardless of how much she contributes to social welfare.

When to use each instrument? (modulo reg. conditions)

- Cross-side inequality ($\Lambda_B \neq \Lambda_S$) $\rightsquigarrow$ price wedge.
  - $\rightsquigarrow$ moves money to the poorer side of the market.
  - N.B. Drawback: Each seller receives the same lump-sum transfer regardless of how much she contributes to social welfare.
- High seller-side inequality $\rightsquigarrow$ rationing.
  - $\rightsquigarrow$ shifts more money to the sellers who are most eager to trade – identifies the "poorest."

When to use each instrument? (modulo reg. conditions)

- Cross-side inequality ($\Lambda_B \neq \Lambda_S$) $\rightsquigarrow$ price wedge.
  - $\rightsquigarrow$ moves money to the poorer side of the market.
  - N.B. Drawback: Each seller receives the same lump-sum transfer regardless of how much she contributes to social welfare.
- High seller-side inequality $\rightsquigarrow$ rationing.
  - $\rightsquigarrow$ shifts more money to the sellers who are most eager to trade – identifies the "poorest."
- High buyer-side inequality + large amount of trade $\rightsquigarrow$ rationing with multiple prices.
  - N.B. The "poorest" buyers are those that are *least able* to trade!
  - $\rightsquigarrow$ Rationing at a single price helps richer buyers more than poorer.

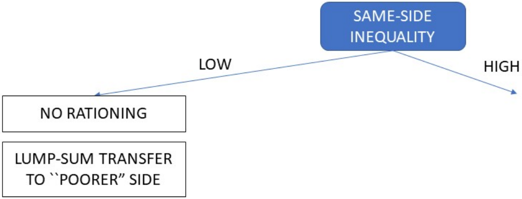
Optimal Market Design under Wealth Inequality

SAME-SIDE INEQUALITY

Optimal Market Design under Wealth Inequality

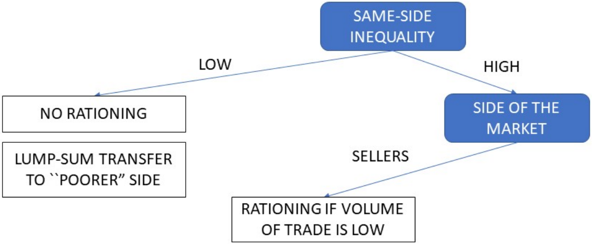
Optimal Market Design under Wealth Inequality

Optimal Market Design under Wealth Inequality

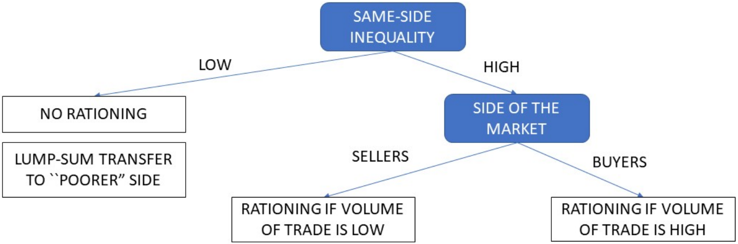


Optimal Market Design under Wealth Inequality

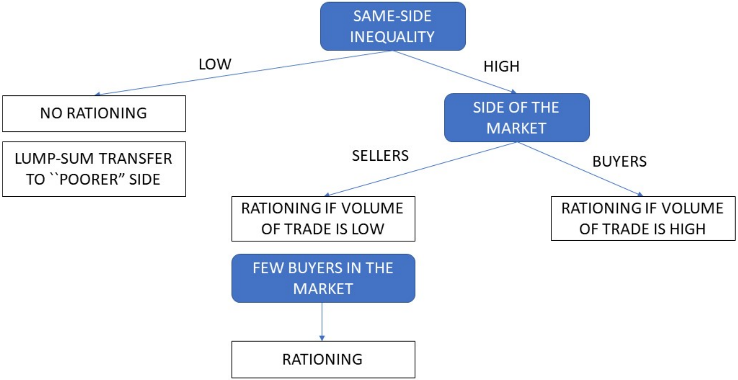
Optimal Market Design under Wealth Inequality



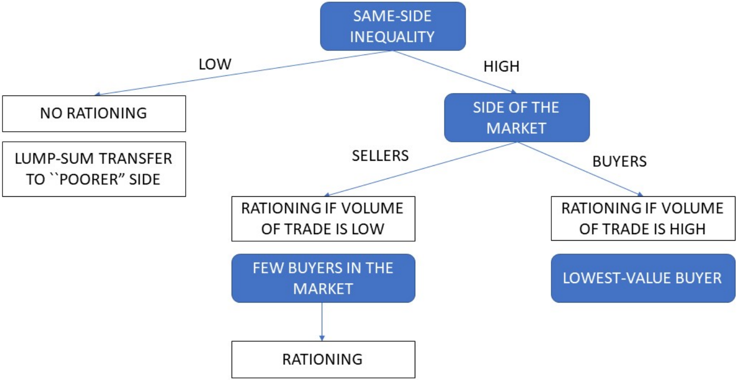
Optimal Market Design under Wealth Inequality



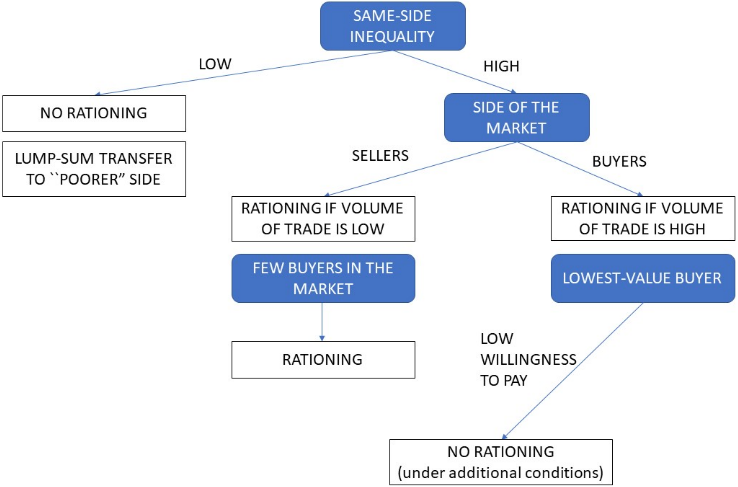
Optimal Market Design under Wealth Inequality



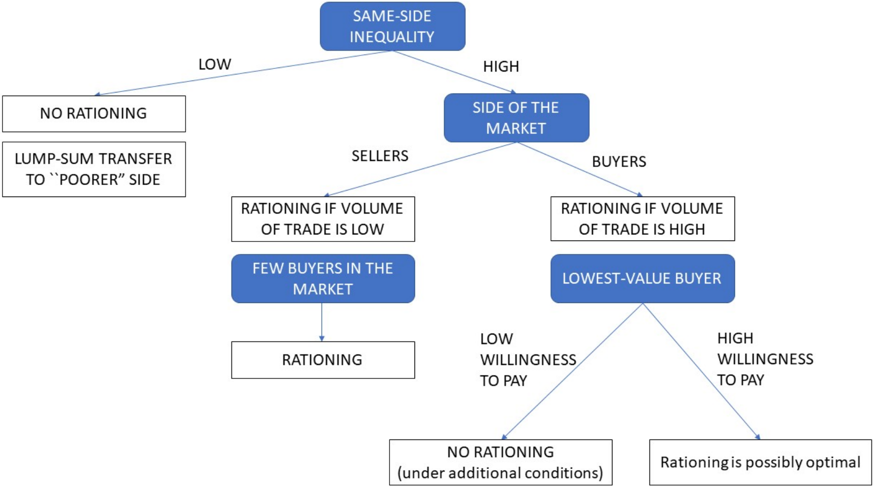
Optimal Market Design under Wealth Inequality



Optimal Market Design under Wealth Inequality



Optimal Market Design under Wealth Inequality



Coming Soon: New Paper!

Redistributive Allocation Mechanisms

Mohammad Akbarpour ® Piotr Dworczak ® Scott Duke Kominers*

April 14, 2020 – PRELIMINARY (AND SOMEWHAT INCOMPLETE)

COMING SOON!

Abstract

Many scarce public resources are allocated below market-clearing prices (and sometimes for free). Such "non-market" mechanisms necessarily sacrifice some surplus, yet they can potentially improve equity by increasing the rents enjoyed by agents with low willingness to pay. In this paper, we develop a model of mechanism design with redistributive concerns. Agents are characterized by a privately observed willingness to pay for quality, and a publicly observed label. A market designer controls allocation and pricing of a set of objects of heterogeneous quality, and maximizes a linear combination of revenue and total surplus—with Pareto weights that depend both on observed and unobserved agent characteristics. We develop methods to solve for an optimal mechanism in this framework, and derive conditions for optimality of certain simple mechanisms such as allocating the objects assortatively at "market" prices, fully random allocation at a price of 0, and hybrid mechanisms that offer the lowest-quality objects for free using a lottery and allocate higher-quality objects at strictly positive prices.

Keywords: optimal mechanism design, redistribution, inequality, welfare

JEL codes: C78, D47, D61, D63, D82

Coming Soon: New Paper!

- We introduce quality q; rate of substitution r now characterizes trade-off between q and money.
  - Agents also have a label representing observable characteristics (linked to r and/or Pareto weights).

Coming Soon: New Paper!

- We introduce quality q; rate of substitution r now characterizes trade-off between q and money.
  - Agents also have a label representing observable characteristics (linked to r and/or Pareto weights).
- We can again identify an optimal mechanism (even with a partial revenue objective).

Coming Soon: New Paper!

- We introduce quality q; rate of substitution r now characterizes trade-off between q and money.
  - Agents also have a label representing observable characteristics (linked to r and/or Pareto weights).
- We can again identify an optimal mechanism (even with a partial revenue objective).
  - Assortative matching on $r \times q$ under revenue maximization, or when lump-sum transfer especially valuable.
  - Random matching when poorer agents also value quality.

Coming Soon: New Paper!

- We introduce quality q; rate of substitution r now characterizes trade-off between q and money.
    - Agents also have a label representing observable characteristics (linked to r and/or Pareto weights).
- We can again identify an optimal mechanism (even with a partial revenue objective).
    - Assortative matching on $r \times q$ under revenue maximization, or when lump-sum transfer especially valuable.
    - Random matching when poorer agents also value quality.
    - More generally, regions of assortative and random matching.

Coming Soon: New Paper!

- We introduce quality q; rate of substitution r now characterizes trade-off between q and money.
  - Agents also have a label representing observable characteristics (linked to r and/or Pareto weights).
- We can again identify an optimal mechanism (even with a partial revenue objective).
  - Assortative matching on $r \times q$ under revenue maximization, or when lump-sum transfer especially valuable.
  - Random matching when poorer agents also value quality.
  - More generally, regions of assortative and random matching.
- Surprising(?) insight: Degree of assortativeness may be non-monotone in welfare weight on "poorer" agents.

Coming Soon: New Paper!

- We introduce quality q; rate of substitution r now characterizes trade-off between q and money.
  - Agents also have a label representing observable characteristics (linked to r and/or Pareto weights).
- We can again identify an optimal mechanism (even with a partial revenue objective).
  - Assortative matching on $r \times q$ under revenue maximization, or when lump-sum transfer especially valuable.
  - Random matching when poorer agents also value quality.
  - More generally, regions of assortative and random matching.
- Surprising(?) insight: Degree of assortativeness may be non-monotone in welfare weight on "poorer" agents.
  - Why? Past some point, revenue is a better way to redistribute!

Policy

Bloomberg Opinion

Economics

Keep Sanitizer Out of the Market's Invisible Hand

Price gouging represents a shift in essential goods from the poor to the wealthy at the worst time.

By Scott Duke Kominers
March 16, 2020, 2:56 PM EDT

Policy

Bloomberg Opinion

Politics & Policy

Food-Stamp Work Requirements Just Look Cruel

The rule doesn't help beneficiaries find the steady employment that doesn't exist.

By Scott Duke Kominers
January 27, 2020, 7:30 AM EST

Wrap

Micro "market design" approach to redistribution.

Wrap

Micro "market design" approach to redistribution.

- If you regulate/control an individual market, it may be worth distorting allocative efficiency to improve equity.

Wrap

Micro "market design" approach to redistribution.

- If you regulate/control an individual market, it may be worth distorting allocative efficiency to improve equity.
  - Rent control, price controls in kidney markets, and similar might be optimal responses to underlying inequality.
    - (Complements macro approaches from PF!)

Wrap

Micro “market design” approach to redistribution.

- If you regulate/control an individual market, it may be worth distorting allocative efficiency to improve equity.
    - Rent control, price controls in kidney markets, and similar might be optimal responses to underlying inequality.
        - (Complements macro approaches from PF!)

    - **cross-side ineq.** $\Rightarrow$ price wedge $+$ lump-sum redistribution
    - **same-side ineq.** $\Rightarrow$ rationing

Wrap

Micro "market design" approach to redistribution.

- If you regulate/control an individual market, it may be worth distorting allocative efficiency to improve equity.
    - Rent control, price controls in kidney markets, and similar might be optimal responses to underlying inequality.
        - (Complements macro approaches from PF!)

    - **cross-side ineq.** $\Rightarrow$ price wedge $+$ lump-sum redistribution
    - **same-side ineq.** $\Rightarrow$ rationing

$\rightsquigarrow$ Real opportunity for this type of design with the rise of new marketplace businesses.

Wrap

Micro "market design" approach to redistribution.

- If you regulate/control an individual market, it may be worth distorting allocative efficiency to improve equity.
  - Rent control, price controls in kidney markets, and similar might be optimal responses to underlying inequality.
    - (Complements macro approaches from PF!)
  - **cross-side ineq.** $\Rightarrow$ price wedge + lump-sum redistribution
  - **same-side ineq.** $\Rightarrow$ rationing

$\rightsquigarrow$ Real opportunity for this type of design with the rise of new marketplace businesses.

- Framework for "Inequality-Aware" Marketplace Design
  - $(v^K, v^M) \rightsquigarrow$ "Macro-Founded" Micro

Wrap

Micro "market design" approach to redistribution.

- If you regulate/control an individual market, it may be worth distorting allocative efficiency to improve equity.
  - Rent control, price controls in kidney markets, and similar might be optimal responses to underlying inequality.
    - (Complements macro approaches from PF!)
  - **cross-side ineq.** $\Rightarrow$ price wedge $+$ lump-sum redistribution
  - **same-side ineq.** $\Rightarrow$ rationing

$\rightsquigarrow$ Real opportunity for this type of design with the rise of new marketplace businesses.

- Framework for "Inequality-Aware" Marketplace Design
  - $(v^K, v^M) \rightsquigarrow$ "Macro-Founded" Micro

\end{talk}

Main Argument (I)

$\rightsquigarrow$ Maximize over H_S, $H_B \in \Delta([0,1])$, $\underline{U}_B$, $\underline{U}_S \geq 0$

$$\mu \int_0^1 \phi_B^\alpha(q) dH_B(q) + \int_0^1 \phi_S^\alpha(q) dH_S(q)$$

subject to

$$\mu \int_0^1 q dH_B(q) = \int_0^1 q dH_S(q).$$

Main Argument (II)

$\rightsquigarrow$ Maximize over H_S, $H_B \in \Delta([0,1])$, $\underline{U}_B$, $\underline{U}_S \geq 0$

$$\mu \int_0^1 \phi_B^\alpha(q) dH_B(q)$$
$$+ \int_0^1 \left[\int_0^{G_S^{-1}(q)} (\Pi_S^\Lambda(r) - \alpha J_S(r)) g_S(r) dr + (\Lambda_S - \alpha)\underline{U}_S \right] dH_S(q)$$

Main Argument (II)

$\rightsquigarrow$ Maximize over $H_S,\ H_B \in \Delta([0,1]),\ \underline{U}_B,\ \underline{U}_S \geq 0$

$$\mu \int_0^1 \phi_B^{\alpha}(q) dH_B(q)$$
$$+ \int_0^1 \left[\int_0^{G_S^{-1}(q)} (\Pi_S^{\Lambda}(r) - \alpha J_S(r)) g_S(r) dr + (\Lambda_S - \alpha)\underline{U}_S \right] dH_S(q),$$

where $\Lambda_j = \int \lambda_j(r) dG_j(r)$ is the average weight of j and

$$\Pi_B^{\Lambda}(r) := \frac{\int_r^1 \lambda_B(r) dG_B(r)}{g_B(r)}, \quad \Pi_S^{\Lambda}(r) := \frac{\int_0^r \lambda_S(r) dG_S(r)}{g_S(r)}.$$

Main Argument (II)

$\rightsquigarrow$ Maximize over H_S, $H_B \in \Delta([0,1])$, $\underline{U}_B$, $\underline{U}_S \geq 0$

$$\mu \int_0^1 \phi_B^{\alpha}(q) dH_B(q)$$
$$+ \int_0^1 \left[\int_0^{G_S^{-1}(q)} (\Pi_S^{\Lambda}(r) - \alpha J_S(r)) g_S(r) dr + (\Lambda_S - \alpha) \underline{U}_S \right] dH_S(q),$$

where $\Lambda_j = \int \lambda_j(r) dG_j(r)$ is the average weight of j and

$$\Pi_B^{\Lambda}(r) := \frac{\int_r^1 1 dG_B(r)}{g_B(r)}, \quad \Pi_S^{\Lambda}(r) := \frac{\int_0^r 1 dG_S(r)}{g_S(r)}.$$

Main Argument (II)

$\rightsquigarrow$ Maximize over H_S, $H_B \in \Delta([0,1])$, $\underline{U}_B$, $\underline{U}_S \geq 0$

$$\mu \int_0^1 \phi_B^\alpha(q) dH_B(q)$$
$$+ \int_0^1 \left[\int_0^{G_S^{-1}(q)} (\Pi_S^\Lambda(r) - \alpha J_S(r)) g_S(r) dr + (\Lambda_S - \alpha)\underline{U}_S \right] dH_S(q),$$

where $\Lambda_j = \int \lambda_j(r) dG_j(r)$ is the average weight of j and

$$\Pi_B^\Lambda(r) := \frac{1 - G_B(r)}{g_B(r)}, \quad \Pi_S^\Lambda(r) := \frac{G_S(r)}{g_S(r)}.$$

Main Argument (III)

$\rightsquigarrow$ Maximize over H_S, $H_B \in \Delta([0,1])$, $\underline{U}_B$, $\underline{U}_S \geq 0$

$$\mu \int_0^1 \phi_B^\alpha(q) dH_B(q) + \int_0^1 \phi_S^\alpha(q) dH_S(q)$$

subject to

$$\mu \int_0^1 q dH_B(q) = \int_0^1 q dH_S(q).$$

Main Argument (III)

$\rightsquigarrow$ Maximize over H_S, $H_B \in \Delta([0,1])$, $\underline{U}_B$, $\underline{U}_S \geq 0$

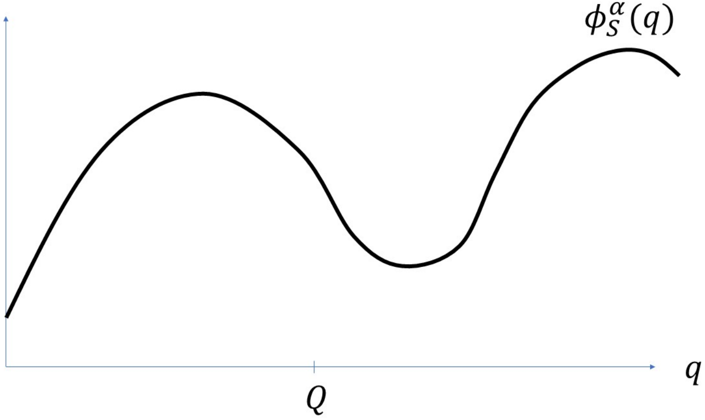
$$\mu \int_0^1 \phi_B^\alpha(q) dH_B(q) + \int_0^1 \phi_S^\alpha(q) dH_S(q)$$

subject to

$$Q = \int_0^1 q dH_S(q).$$

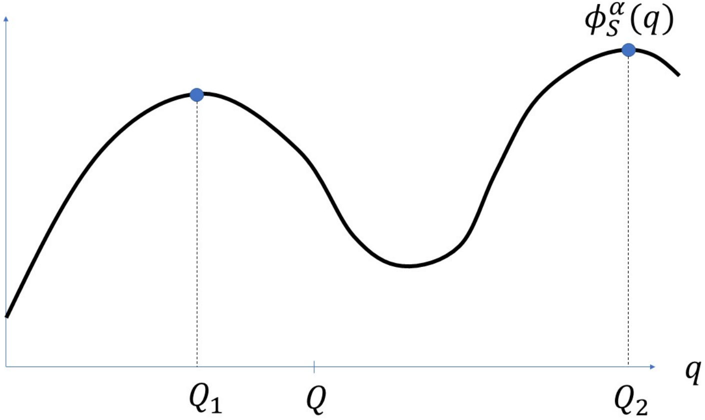
Main Argument (IV)

Find a probability distribution over $q \in [0,1]$ with mean Q that maximizes the expectation of $\phi_S^\alpha(q)$



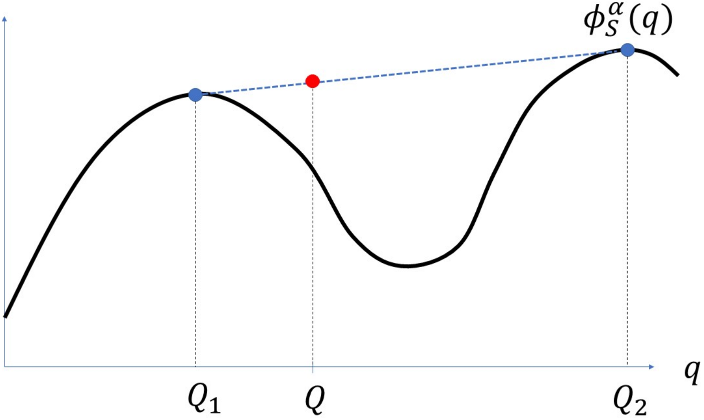
Main Argument (IV)

Find a probability distribution over $q \in [0,1]$ with mean Q that maximizes the expectation of $\phi_S^\alpha(q)$



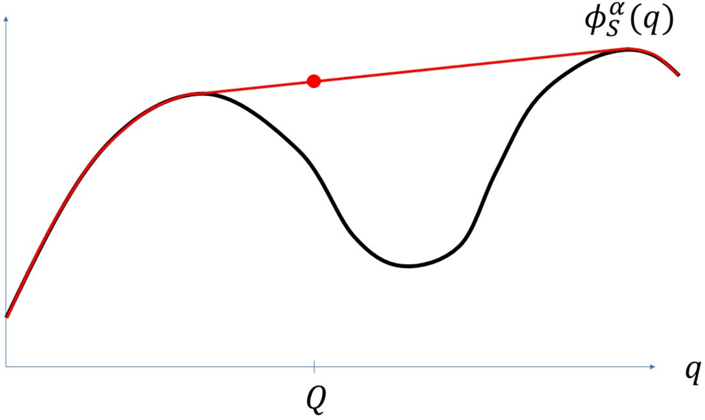
Main Argument (IV)

Find a probability distribution over $q \in [0, 1]$ with mean Q that maximizes the expectation of $\phi_S^{\alpha}(q)$



Main Argument (IV)

Find a probability distribution over $q \in [0,1]$ with mean Q that maximizes the expectation of $\phi_S^\alpha(q)$



Main Argument (V)

$\rightsquigarrow$ Maximize over $Q^{\star}$, $\underline{U}_B$, $\underline{U}_S \geq 0$

$$\mu \, \text{co}(\phi_B^{\alpha})(Q^{\star}/\mu) + \text{co}(\phi_S^{\alpha})(Q^{\star}).$$

Main Argument (V)

$\rightsquigarrow$ Maximize over $Q^{\star}$, $\underline{U}_B$, $\underline{U}_S \geq 0$

$$\mu\,\text{co}(\phi_B^{\alpha})(Q^{\star}/\mu) + \text{co}(\phi_S^{\alpha})(Q^{\star}).$$

Last Step: Carathéodory's Theorem

Main Argument (V)

$\rightsquigarrow$ Maximize over $Q^\star$, $\underline{U}_B$, $\underline{U}_S \geq 0$

$$\mu\, \mathrm{co}(\phi_B^\alpha)(Q^\star/\mu) + \mathrm{co}(\phi_S^\alpha)(Q^\star).$$

Last Step: Carathéodory's Theorem

Bonus Step: Linear Algebra eliminates some constraints

$\rightsquigarrow$ four-price characterization

What if direct redistribution is not feasible?

Lump-sum transfers give agents a constant amount of money even if they do not trade.

- If we consider a model with entry to the market, this might undermine budget balance.
- It might also be problematic if the designer cannot distinguish buyers from sellers.

What if direct redistribution is not feasible?

Lump-sum transfers give agents a constant amount of money even if they do not trade.

- If we consider a model with entry to the market, this might undermine budget balance.
- It might also be problematic if the designer cannot distinguish buyers from sellers.

Assumption ("No Free Lunch")

The participation constraints of the lowest-utility type of buyers $\underline{r}_B = 0$, and of the lowest-utility type sellers $\bar{r}_S = 1$ both bind.

$\rightsquigarrow$ rules out price wedges

What if direct redistribution is not feasible?

Lump-sum transfers give agents a constant amount of money even if they do not trade.

- If we consider a model with entry to the market, this might undermine budget balance.
- It might also be problematic if the designer cannot distinguish buyers from sellers.

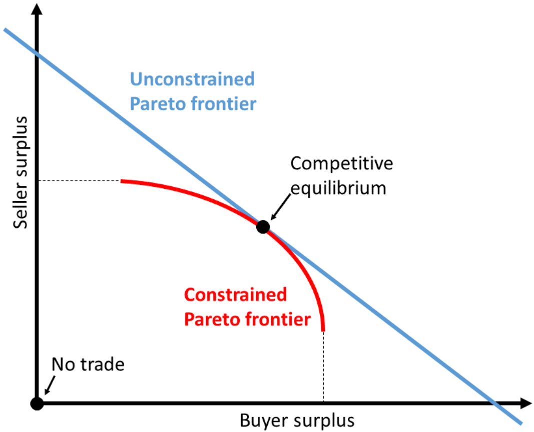
Assumption ("No Free Lunch")

The participation constraints of the lowest-utility type of buyers $\underline{r}_B = 0$, and of the lowest-utility type sellers $\bar{r}_S = 1$ both bind.

$\rightsquigarrow$ rules out price wedges

$\rightsquigarrow$ Rationing can emerge even if there is no same-side inequality (provided that cross-side inequality is sufficiently large).

Model – Welfare



Index

- Preview
- Intuition?
- Model (Pareto)
- Simple Mechanisms
- Optimal Mechanism
  - Proof Sketch
- Designing Under Inequality
- New Paper
- NFL
- Policy
- Wrap (wrapped)