Market Structure and Adverse Selection

Dakang Huang\textsuperscript{1}
Christopher Sandmann\textsuperscript{2}
EEA-ESEM 2023, UPF, Barcelona

\textsuperscript{1}Toulouse School of Economics (TSE)
\textsuperscript{2}London School of Economics and Political Science (LSE)
Motivation

Classical Adverse Selection Models

Consider a competitive market plagued by adverse selection (e.g. Insurance)

→ High- and Low-risk buyers: high-risk more eager to trade and more costly to insure
Motivation

Classical Adverse Selection Models

Consider a competitive market plagued by adverse selection (e.g. Insurance)

→ High- and Low-risk buyers: high-risk more eager to trade and more costly to insure

① Exclusive competition (e.g. car insurance) ➞ Rothschild-Stiglitz 1976 (RS)

② Nonexclusive competition (e.g. annuities) ➞ Attar-Mariotti-Salanié 2014,2021,2022 (AMS).
Consider a competitive market plagued by adverse selection (e.g. Insurance)

→ High- and Low-risk buyers: high-risk more eager to trade and more costly to insure

① Exclusive competition (e.g. car insurance) → Rothschild-Stiglitz 1976 (RS)
   - One buyer can trade with at most one seller
     → Fully separating: different types purchase different contracts → Rationing on low types

② Nonexclusive competition (e.g. annuities) → Attar-Mariotti-Salanié 2014,2021,2022 (AMS).
Consider a competitive market plagued by **adverse selection** (e.g. Insurance)

→ **High- and Low-risk buyers**: high-risk more eager to trade and more costly to insure

1 **Exclusive competition** (e.g. car insurance) → Rothschild-Stiglitz 1976 (RS)
   - **One buyer** can trade with **at most one** seller
   → Fully separating: different types purchase different contracts → **Rationing on low types**

2 **Nonexclusive competition** (e.g. annuities) → Attar-Mariotti-Salanié 2014,2021,2022 (AMS).
   - **One buyer** can trade with **many** sellers
   → Partially pooling: pooling contracts + high type additional separation → **No separation for low types**
Consider a competitive market plagued by adverse selection (e.g. Insurance)

→ High- and Low-risk buyers: high-risk more eager to trade and more costly to insure

1 Exclusive competition (e.g. car insurance) → Rothschild-Stiglitz 1976 (RS)
   - One buyer can trade with at most one seller
   → Fully separating: different types purchase different contracts → Rationing on low types

2 Nonexclusive competition (e.g. annuities) → Attar-Mariotti-Salanié 2014,2021,2022 (AMS).
   - One buyer can trade with many sellers
   → Partially pooling: pooling contracts + high type additional separation → No separation for low types

Observation: different restrictions on trade suggest different outcomes.
Motivation

Normative point of view: Can we alleviate rationing and no separation?
Motivation

Normative point of view: Can we alleviate rationing and no separation?

- Literature: yes, through mandates, taxes, costly verification (Strong intervention)
**Motivation**

**Normative point of view: Can we alleviate rationing and no separation?**

- Literature: yes, through mandates, taxes, costly verification (Strong intervention)

- This paper: a rule stipulates sellers with whom a buyer can simultaneously trade (Weak intervention)
Motivation

Normative point of view: Can we alleviate rationing and no separation?

- Literature: yes, through mandates, taxes, costly verification (Strong intervention)
- This paper: a rule stipulates sellers with whom a buyer can simultaneously trade (Weak intervention)

Positive point of view: many markets are neither exclusive nor nonexclusive
Motivation

Normative point of view: Can we alleviate rationing and no separation?

- Literature: yes, through mandates, taxes, costly verification (Strong intervention)
- This paper: a rule stipulates sellers with whom a buyer can simultaneously trade (Weak intervention)

Positive point of view: many markets are neither exclusive nor nonexclusive

- Health Insurance in France: a basic coverage + an additional premium
- Senior Security: exclusively senior security (collateral) + other securities
- Bank lending in corporate finance: multiple but limited numbers of banks are the norm

Task for theorists: characterize equilibria that arise for different market structures
Unified Framework with Market Structure

**Definition (Market Structure)**

A market structure \( \mathcal{M} \) is a (non-empty) collection of subsets of sellers \( \{1, \ldots, K\} \) with whom a buyer can jointly trade: \( \mathcal{M} \subseteq \mathcal{P}(\{1, \ldots, K\}) \equiv \mathcal{P}(\{\text{all sellers}\}) \). \(^1\)

---

\(^1\)\(\mathcal{P}\) is the power set
### Definition (Market Structure)
A market structure $\mathcal{M}$ is a (non-empty) collection of subsets of sellers ($\{1, ..., K\}$) with whom a buyer can jointly trade: $\mathcal{M} \subseteq \mathcal{P}(\{1, ..., K\}) \equiv \mathcal{P}(\{\text{all sellers}\})$.  

- Two polar examples in the literature:
  - Exclusive competition (car insurance): $\mathcal{M} = \{\emptyset, \{1\}, \{2\}, \ldots, \{K\}\}$

---

1 $\mathcal{P}$ is the power set
Definition (Market Structure)

A market structure $\mathcal{M}$ is a (non-empty) collection of subsets of sellers ($\{1, \ldots, K\}$) with whom a buyer can jointly trade: $\mathcal{M} \subseteq \mathcal{P}(\{1, \ldots, K\}) \equiv \mathcal{P}(\{\text{all sellers}\})$.

- Two polar examples in the literature:
  1. Exclusive competition (car insurance): $\mathcal{M} = \{\emptyset, \{1\}, \{2\}, \ldots, \{K\}\}$
  2. Nonexclusive competition (annuity market): $\mathcal{M} = \mathcal{P}(\{1, \ldots, K\})$

---

$\mathcal{P}$ is the power set
Partition competitive market structures into \textit{partially exclusive} and \textit{never exclusive} structures.

- Partial exclusive: exists seller can exclusively trade with the buyer.
- Never exclusive: does Not exist seller can exclusively trade with the buyer.
Partition competitive market structures into partially exclusive and never exclusive structures.

- Partial exclusive: exists seller can exclusively trade with the buyer.
- Never exclusive: does Not exist seller can exclusively trade with the buyer.

**Unified results**

- Any equilibrium allocation in partially exclusive structures is the equilibrium allocation in **Exclusive structure**.
- Any equilibrium allocation in never exclusive structures is an equilibrium allocation in **“1+1” market structure**.
Key of This Paper

- The “1+1” Market Structure

Sellers
Key of This Paper

- The “1+1” Market Structure

- Divide sellers into two groups

Sellers

Subgroup 1

Subgroup 2
Key of This Paper

The “1+1” Market Structure

- Divide sellers into two groups
- Trade *inside* each group is *exclusive*
Key of This Paper

The “1+1” Market Structure

- Divide sellers into two groups
- Trade inside each group is exclusive
- Trade between groups is nonexclusive.
- “1+1”: $\mathcal{M} = \left\{ \emptyset, \{1\}, \{2\}, \ldots, \{K_1\} \right\} \times \left\{ \emptyset, \{K_1 + 1\}, \{K_1 + 2\}, \ldots, \{K\} \right\}$
Preview of Results

1. Equilibria Allocations in Never Exclusive Market Structures

- Equilibrium candidate (Theorem 1)
  
  → Any equilibrium under a never exclusive competitive market structure is pooling + separating (or just pooling)
Preview of Results

2, Equilibria Allocations in Never Exclusive Market Structures

- **Equilibrium candidate (Theorem 1)**
  - Any equilibrium under a never exclusive competitive market structure is pooling + separating (or just pooling)

- **Equilibrium existence (Theorem 2)**
  - If an equilibrium exists under a never exclusive competitive market structure, it is also an equilibrium under the 1+1 market structure (requires latent contracts)

- **Contribution:** first time **pooling + low type separation** occurs in equilibrium
• Equilibrium candidate (Theorem 1)
  → Any equilibrium under a never exclusive competitive market structure is pooling + separating (or just pooling)

• Equilibrium existence (Theorem 2)
  → If an equilibrium exists under a never exclusive competitive market structure, it is also an equilibrium under the 1+1 market structure (requires latent contracts)

• Contribution: first time pooling + low type separation occurs in equilibrium

• Welfare comparison
  • If RS separation entails a lot of rationing, pooling + separation Pareto dominates
  • "1+1" sometimes implements the second-best allocation
The Model

Insurance Economy: Buyers and Sellers

- A contract specifies coverage \( q \) in exchange for a premium \( t \)
The Model

Insurance Economy: Buyers and Sellers

- A **contract** specifies **coverage** $q$ in exchange for a **premium** $t$

- 2 type of **buyers**
  - high-risk $\rightarrow H$ (frequency $m_H$)
  - low-risk $\rightarrow L$ (frequency $m_L$)
The Model

Insurance Economy: Buyers and Sellers

- A contract specifies coverage $q$ in exchange for a premium $t$

- 2 type of buyers
  - high-risk $\rightarrow H$ (frequency $m_H$)
  - low-risk $\rightarrow L$ (frequency $m_L$)

- $K$ seller, $k \in \{1, \ldots, K\}$
  - Seller $k$ offers a single contract $(q^k, t^k)$
  - Profit when trading with type $\theta \in \{H, L\}$: $t^k - c_\theta q^k$
The Model

Insurance Economy: Buyers and Sellers

- A contract specifies coverage $q$ in exchange for a premium $t$

- 2 type of buyers
  - high-risk $\rightarrow$ $H$ (frequency $m_H$)
  - low-risk $\rightarrow$ $L$ (frequency $m_L$)

- $K$ sellers, $k \in \{1, ..., K\}$
  - Seller $k$ offers a single contract $(q^k, t^k)$
  - Profit when trading with type $\theta \in \{H, L\}$: $t^k - c_\theta q^k$

- Buyers trade with group of sellers $M \subseteq \{1, ..., K\}$ $\rightarrow$ Utility: $U_\theta(\sum_{k \in M} q^k, \sum_{k \in M} t^k)$
  - Utility function is twice differentiable and strict quasi-concave
The Model
◮ Additional Assumptions

● **Single-Crossing:**

→ High types have a greater propensity to consume:

● For all \((q, t)\) and \((q′, t′)\) so that \(q′ > q\) it holds that
\[
U_L(q′, t′) \geq U_L(q, t) \implies U_H(q′, t′) > U_H(q, t)
\]
The Model
◮ Additional Assumptions

- **Single-Crossing:**
  - High types have a greater propensity to consume:
  - For all \((q, t)\) and \((q', t')\) so that \(q' > q\) it holds that
    \[ U_L(q', t') \geq U_L(q, t) \Rightarrow U_H(q', t') > U_H(q, t) \]

- **Adverse Selection:**
  - High types are more costly to serve: \(c_H > c_L\)
The Model
◮ Additional Assumptions

- **Single-Crossing:**
  - High types have a greater propensity to consume:
    - For all \((q, t)\) and \((q', t')\) so that \(q' > q\) it holds that
      \[ U_L(q', t') \geq U_L(q, t) \Rightarrow U_H(q', t') > U_H(q, t) \]

- **Adverse Selection:**
  - High types are more costly to serve: \(c_H > c_L\)

- **Flatter Curvature:**
  - Type H’s indifference curve is ‘flatter’ than type L’s indifference curve, e.g. CARA, Quadratic utility
The Model

- **Timing**: Fix a market structure $\mathcal{M} \subseteq \mathcal{P}\{1, \ldots, K\}$
The Model

◮ Timing and Equilibrium

- **Timing:** Fix a market structure $\mathcal{M} \subseteq \mathcal{P}(\{1, \ldots, K\})$

---

Stage 1

Stage 2
The Model

▶ Timing and Equilibrium

- **Timing**: Fix a market structure \( M \subseteq \mathcal{P} \{1, \ldots, K\} \)

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Stage 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Each seller \( k \) proposes a contract \( (q^k, t^k) \in \mathbb{R}^2_+ \)
The Model
◮ Timing and Equilibrium

- **Timing**: Fix a market structure $\mathcal{M} \subseteq \mathcal{P}(\{1, \ldots, K\})$

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Stage 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each seller $k$ proposes a contract $(q^k, t^k) \in \mathbb{R}_+^2$</td>
<td>Each type $\theta$ buyer chooses some $M \in \mathcal{M}$</td>
</tr>
<tr>
<td>trades with sellers $k \in M$</td>
<td>trades with sellers $k \in M$</td>
</tr>
<tr>
<td>derives utility $U_\theta(\sum_{k \in M} q^k, \sum_{k \in M} t^k)$</td>
<td>derives utility $U_\theta(\sum_{k \in M} q^k, \sum_{k \in M} t^k)$</td>
</tr>
</tbody>
</table>
The Model

◮ Timing and Equilibrium

- **Timing**: Fix a market structure \( \mathcal{M} \subseteq \mathcal{P}(\{1, ..., K\}) \)

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Stage 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Each seller ( k ) proposes a contract ((q_k^k, t_k^k) \in \mathbb{R}_+^2)</td>
<td>- Each type ( \theta ) buyer chooses some ( M \in \mathcal{M} )</td>
</tr>
<tr>
<td></td>
<td>- trades with sellers ( k \in M )</td>
</tr>
<tr>
<td></td>
<td>- derives utility ( U_\theta(\sum_{k \in M} q_k^k, \sum_{k \in M} t_k^k) )</td>
</tr>
</tbody>
</table>

- **Equilibrium**: Sellers maximize expected profit, buyers maximize utility (PBE in pure strategies)
Market Outcomes for Two-Polar Structure

**Exclusive Competition: RS Allocation**

- Zero-profit line when trading with Low ($L$) and High ($H$) risk type

**In equilibrium**

- The high-risk type purchases the efficient amount of quantity given that the unit price is $c_H$ → full insurance
- The low-risk type purchases less than the efficient amount of quantity given that the unit price is $c_L$: he is being rationed

**Relax Exclusivity**

→ RS allocation is not an equilibrium, a seller can propose a deviating contract to attract type $H$
Market Outcomes for Two-Polar Structure

- Nonexclusive Competition: Jaynes-Hellwig-Glosten (JHG) Allocation

- Zero profit lines for
  - serving both types (pooling $c = m_H c_H + m_L c_L$)
  - serving for high types

- In equilibrium
  - the pooling quantity is the efficient quantity for the low type if the unit price is the zero-profit pooling price $c$
  - the top-up quantity is the efficient quantity for the high type if the unit price is $c_H$. → cross-subsidy from low to high types
  - It is impossible for low types to purchase a separating contract
The Outline for Equilibria

- **Focus on “1+1” market structure** ➔ Divide sellers into two disjoint subgroups 1 and 2
  ➔ buyers can trade with at most one seller from each group
The Outline for Equilibria

- **Focus on “1+1” market structure** ➔ Divide sellers into two disjoint subgroups 1 and 2
  ➔ buyers can trade with at most one seller from each group

- **Characterization:** Identify 4 necessary conditions that pin down candidates for equilibrium
  1. Global Incentive Compatibility
  2. Competitive Pricing
  3. Conditional Efficiency (MRS=marginal cost)
  4. Large Pooling
The Outline for Equilibria

- **Focus on “1+1” market structure** ➔ Divide sellers into two disjoint subgroups 1 and 2
  ➔ buyers can trade with at most one seller from each group

- **Characterization**: Identify 4 necessary conditions that pin down candidates for equilibrium
  1. Global Incentive Compatibility
  2. Competitive Pricing
  3. Conditional Efficiency \((MRS=\text{marginal cost})\)
  4. Large Pooling

- Sufficient condition:
  - Latent contract blocks the cream-skimming deviations
Equilibrium

Necessary Conditions and Forms of Equilibrium

- Competitive Pricing
  - Pooling trade with break-even unit price \( c \)
  - High type separating with unit price \( c_H \)
  - Low type separating with unit price \([c_L, c]\)
Equilibrium

Necessary Conditions and Forms of Equilibrium

- Competitive Pricing
  - Pooling trade with break-even unit price $c$
  - High type separating with unit price $c_H$
  - Low type separating with unit price $[c_L, c]$

- Conditional efficiency: $MRS_H = c_H$, $MRS_L = c$
**Equilibrium**

* Necesssary Conditions and Forms of Equilibrium

Pooling + Separating

- Competitive Pricing
  - **Pooling** trade with break-even unit price $c$
  - **High type separating** with unit price $c_H$
  - **Low type separating** with unit price $[c_L, c]$

- Conditional efficiency: $MRS_H = c_H$, $MRS_L = c$

- Large Pooling: the pooling should be large to deter pivoting deviation (at most two trade)
Equilibrium

Theorem:

Given an allocation \((Q_L, T_L)\) and \((Q_H, T_H)\) that satisfies the four necessary conditions, moreover, aggregate active trades are

1. incentive compatible,
2. competitively priced,
3. conditionally efficient,
4. large pooling.

there exist finitely latent contracts that sustain this allocation as an equilibrium under the ”1+1” market structure.

Note: this theorem requires the flatter curvature assumption to block cream-skimming deviations (i.e. type L no longer buys the pooling contract).

One Example of Flatter Curvature: \(U_\theta = A_\theta Q - BQ^2 + C_\theta - T\)
Welfare Comparison

“1+1” VS “Exclusive Competition”

- The “Pooling+Separating” allocation in “1+1” Market structure
Welfare Comparison

- “1+1” VS “Exclusive Competition”

- The “Pooling+Separating” allocation in “1+1” Market structure

- RS allocation in exclusive market structure

  - High types are always better off with “1+1”
Welfare Comparison

- “1+1” VS “Exclusive Competition”

- The “Pooling+Separating” allocation in “1+1” Market structure

- RS allocation in exclusive market structure
  - High types are always better off with “1+1”
  - Low types are better off with “1+1” in some cases
Conclusions

“1+1” market structure ➞ Divide sellers into two disjoint groups, buyers can trade with at most one seller from each group but can nonexclusively trade between groups

Unified result:
Any equilibrium allocation in a never exclusive structure (No seller can exclusively trade with buyers) is an equilibrium allocation in “1+1” market structure

Novel result:
New equilibria with “Pooling + Separating” form
Sustain some competitive positive profit equilibria

Desirable result:
Pareto Dominates Rothschild-Stiglitz allocation when rationing is severe
Sometimes sustain Second-best allocation
Weak Mandates: buyers should purchase enough quantity in group 1

- All the equilibria can still be equilibrium in the new setting
- New Pareto-efficient allocations exist: can Pareto Dominates JHG allocation