

How Markets Disrupt Mediated Trade

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Intermediated trade in a market with adverse selection.

*If the seller can also sell **without** the intermediary, are market breakdowns still preventable?*

No!

Main Result

Without exclusive intermediation:

- Total breakdown of trade.
- Only lowest quality asset traded in **any** equilibrium.

I offer a **necessary and sufficient condition** for market breakdowns.

What do we learn?

Non exclusive intermediation is “fragile” .

Helps explain *why* intermediaries might offer exclusive contracts e.g. real estate agents

If exclusive contracts **not** possible → other services might be necessary.

Other forms of Intermediation

Intermediaries play a variety of other roles in markets.

Examples: Financial institutions, Wholesalers, Auction houses, Insurance intermediaries.

- Help buyers and sellers find each other, reduce the search cost (Gherig 1993).
- Monitoring services to prevent moral hazard (Spulber 1996).
- Dispute resolution.
- Hold inventories to provide *immediacy* of trade etc.

This paper: A *specific* form of intermediation.

Related Literature

Mechanism Design approach to mitigating Adverse Selection:

- Samuelson 1984, Myerson 1985, Gerardi, Hörner & Maestri 2014.

Mechanism Design with a competitive fringe:

- Phillippon and Skreta 2012, Tirole 2012, Kang 2023.

Ratifiable Mechanisms:

- Cramtom and Palfrey 1995, Celik and Peters 2011.

Aftermarkets, Conflict Resolution, and Sequential Agency:

- Dworzak 2020, Balzer and Scneider 2019, Calzolari and Pavan (2006,2009).

1 Two type Example

2 General Analysis

3 What if BLC fails?

4 Conclusion

- A Seller and a Buyer.
- Seller has one unit of an indivisible good for sale.
- Good has quality $\theta \in \{\theta_L, \theta_H\}$, where $\theta_H > \theta_L > 0$; probability of θ_H is μ .
- Realisation of θ : Seller's **private information**, or **type**.
- If Seller's type is θ :

Seller's reservation utility : θ

Buyer's value for the good : $(1 + \alpha)\theta$, $\alpha \in (0, 1)$

So $\alpha\theta$ represents the **gains from trade**.

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Assumption

Lemons condition: The prior μ satisfies: $(1 + \alpha)\mathbb{E}[\theta] < \theta_H$.

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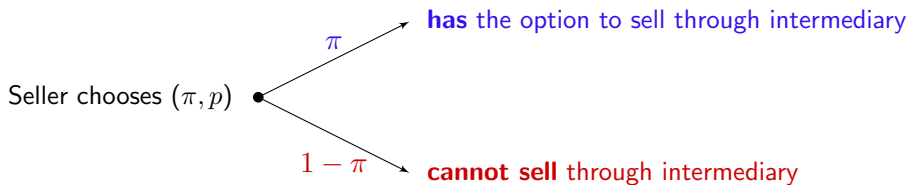
Intermediary offers a **menu** \mathcal{M} to the seller:

- Each option in \mathcal{M} is a tuple (π, p) .
- π is the **probability of trade**, and p is the **price** associated with (π, p) .

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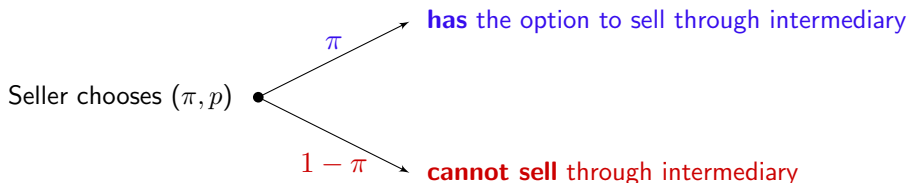
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If Seller chooses (π, p) , then *in the event* the seller sells through intermediary: **it is at p** .

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- **Single market clearing price** p_M , which is **determined in equilibrium**.
- If Seller sells on the market, trade happens at p_M with probability one.
- The market has at least two potential buyers; payoffs identical to the buyer associated with the intermediary.
- Buyers **cannot move** across channels.

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- Seller either **gets** the option to sell through intermediary (with prob π), or **not**.
- Seller decides **where** to sell, *given* the options she has.
- If Seller is selling through intermediary, Buyer decides whether or not to buy.

The menu \mathcal{M} induces a game: **Perfect Bayesian Equilibria** (PBE) of this game.

The market price p_M determined in equilibrium:

- Market clearing price given the distribution of types that trade on market in equilibrium.
- E.g., if *only* θ_L sells on the market in equilibrium, $p_M = (1 + \alpha)\theta_L$.

Useful to first describe a benchmark.

What happens if intermediary is operating in isolation?

Benchmark: Only Intermediary + No Market

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Fact

There exists a $\pi_H \in (0, 1)$, such that the intermediary can offer a menu, such that there exists an equilibrium with *this* menu where:

- i) low type trades with probability one
- ii) high type trades with probability π_H .

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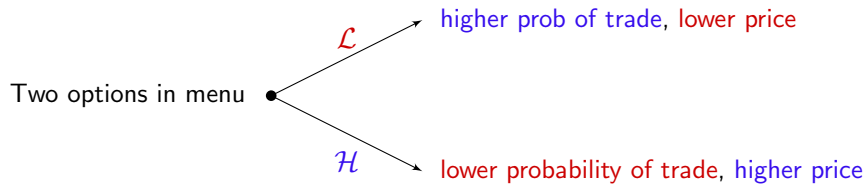
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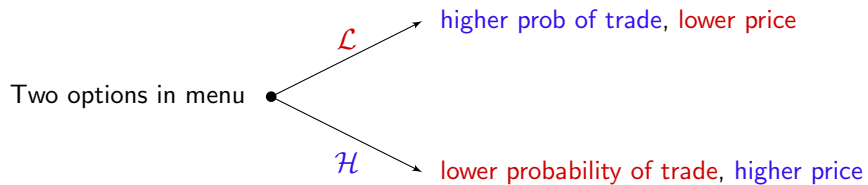
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Screens through *trade off between price and probability of trade*.

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In equilibrium: θ_L chooses \mathcal{L} , and θ_H chooses \mathcal{H} .

Intermediary operates alongside Market

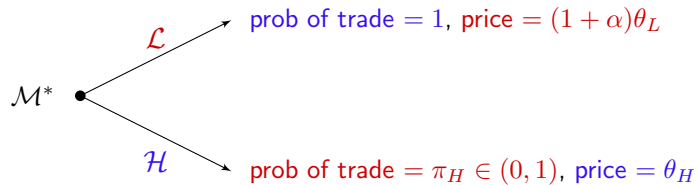
Main Result for Example

For every menu \mathcal{M} , the **unique** equilibrium outcome:

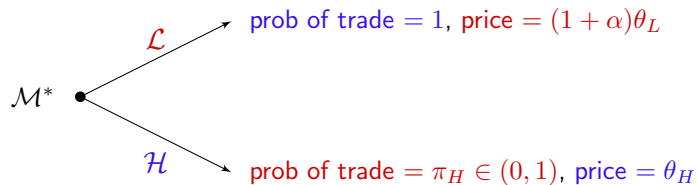
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- ii) high type trades with probability zero.

Market **disruptive**: *Separation of high and low types no longer possible.*

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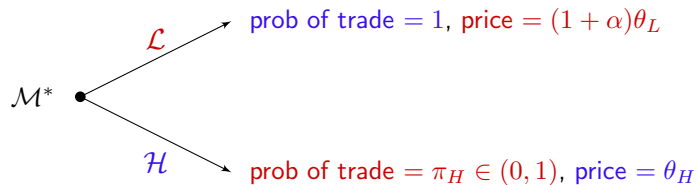


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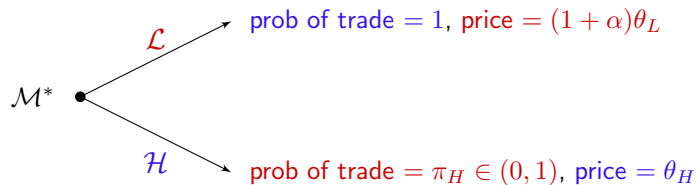
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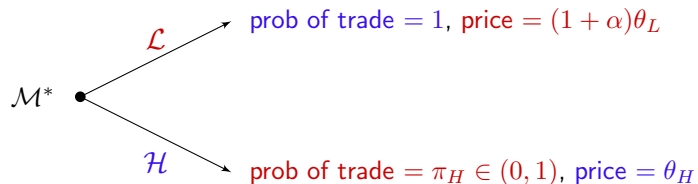
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Suppose high type trades with positive probability in this equilibrium.

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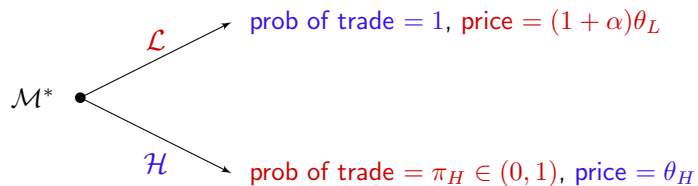


Fix an equilibrium induced by \mathcal{M}^* . Suppose $p_M = (1 + \alpha)\theta_L < \theta_H$.

Suppose high type trades with positive probability in this equilibrium.

Then, both types choose \mathcal{H} . This leads to a **contradiction**.

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Low type trades through intermediary with positive probability, at price θ_H .

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Why?

Suppose $p_M > (1 + \alpha)\theta_L$. This implies that $p_M \geq \theta_H$.



Low type trades through intermediary with positive probability, at price θ_H .



Buyers' expected value, conditional on **both** p_M , and price θ_H is at least θ_H .



Contradiction!

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No equilibrium of the game induced by \mathcal{M}^* where high type trades.

Breakdown result not dependent on choice of menu.

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No equilibrium of the game induced by \mathcal{M}^* where high type trades.

Breakdown result not dependent on choice of menu.

For any menu, in *every* equilibrium, $p_M = (1 + \alpha)\theta_L$.

If high type trades, has to be through intermediary.

No way to separate low type from high type.

Proof Sketch

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2 General Analysis

3 What if BLC fails?

4 Conclusion

Identical to example, except quality can now take *arbitrarily finitely many values*.

Quality $\theta \in \{\theta_1, \theta_2, \dots, \theta_n\}$, where $\theta_1 > \theta_2 > \dots > \theta_n > 0$; probability of θ is $\mu(\theta)$.

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With *arbitrarily finitely many types*, when is there a complete breakdown of trade?

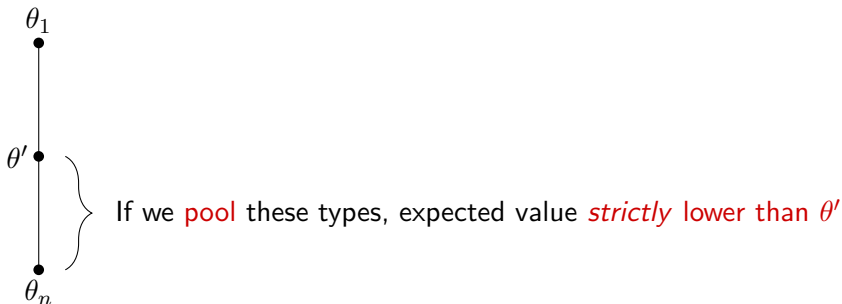
I provide a **necessary and sufficient condition**.

Bottom Lemons Condition

Definition

Bottom Lemons Condition: The prior $\mu(\cdot)$ satisfies the *Bottom Lemons Condition* (BLC) if for any $\theta' > \theta_n$, we have that $(1 + \alpha)\mathbb{E}[\theta|\theta \leq \theta'] < \theta'$.

Lemons problem for *every* subset of types at the bottom.



Main Result

If and only if BLC is satisfied, there is a **unique** equilibrium outcome where *the lowest type trades with probability one*, and *all higher types trade with probability zero*.

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BLC: **severe adverse selection**.

Only Market: BLC **characterises** conditions under which only lowest type trades.

Main Result

If and only if BLC is satisfied, there is a **unique** equilibrium outcome where the lowest type trades with probability one, and all higher types trade with probability zero.

BLC: severe adverse selection.

Only Market: BLC **characterises** conditions under which only lowest type trades.

Only Intermediary: Higher types *can* trade in equilibrium.

Intermediary + Market: **Only** lowest type trades in equilibrium.

BLC implies types cannot be *pooled at the bottom*.

- *Pooling*: There exists a $\bar{\theta} > \theta_n$, such that all $\theta \leq \bar{\theta}$ trade at the same price p' in equilibrium.
- If this is true, conditional on p' ,
 - Buyers' expected value for the good is $(1 + \alpha)\mathbb{E}[\theta | \theta \leq \bar{\theta}]$.
 - $(1 + \alpha)\mathbb{E}[\theta | \theta \leq \bar{\theta}] < \bar{\theta}$ by BLC.
 - **Contradiction!**

Any equilibrium where types $\theta > \theta_n$ trade, *must* have such pooling.

So, $\theta > \theta_n$ **cannot** trade in equilibrium. [Proof Sketch](#)

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BLC \implies severe adverse selection.

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What if adverse selection is less severe, i.e. BLC fails?

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Breakdown avoided: There exist equilibria where types **higher** than lowest type trade.

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Breakdown avoided: There exist equilibria where types **higher** than lowest type trade.

Two possibilities. Intermediary + Market:

- 1 **Lower** surplus compared to *only* Intermediary, higher surplus compared to *only* Market.
- 2 **Higher** surplus compared to both *only* Intermediary, and *only* Market.

First possibility: Market (weakly) reduces surplus compared to *only* Intermediary.

The lower types are **guaranteed** $p_M \geq (1 + \alpha)\theta_n$ on market.

So higher types either

- cannot trade, or
- trade with **lower probability**

Sufficient Condition: “sufficient” mass on $\theta < (1 + \alpha)\theta_n$.

Second possibility: When BLC is violated, market can improve surplus.

Main idea: Intermediary has *limited commitment*; cannot offer **lotteries over prices**.

Market can help with *randomisation*.

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Ability to *walk away* from mediated trade can have stark consequences.

Helps explain why we might see exclusive contracts, or **binding** intermediation.

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Future work:

When exclusive contracts not possible, services like **hard info** might be necessary.

Lotteries over prices.

Only θ_L can trade on market in equilibrium



θ_H can only trade through intermediary



If θ_H trades in equilibrium, both θ_L and θ_L choose the same (π, p) in menu, where $p \geq \theta_H$.



Buyer's beliefs given p equal the prior, so will not buy at $p \geq \theta_H$.

Proof Sketch

Claim 1

In **every** equilibrium, $p_M = (1 + \alpha)\theta_L$.

Implication: *Only* θ_L can trade on market in equilibrium.

Why? $\rightarrow (1 + \alpha)\theta_L < \theta_H$

Proof Sketch

Suppose θ_H trades in equilibrium. Fix such an equilibrium.

Claim 2

Suppose θ_L chooses (π, p) in equilibrium. Then $p > (1 + \alpha)\theta_L$, and Buyer buys at p .

Proof:

Step 1: There exists $(\pi', p') \in \mathcal{M}$ such that i) $p' \geq \theta_H$, and ii) Buyer's strategy: *buy at p'* .

- θ_H trades in equilibrium \rightarrow can only trade at $p \geq \theta_H$.
- By Claim 1, θ_H can only trade through intermediary.

Proof Sketch

By Step 1, Any (π, p) chosen by θ_L must have $p > (1 + \alpha)\theta_L$.

Why? There exists (π', p') such that payoff from choosing it:

$$\begin{aligned} & \underbrace{\pi'(p' - \theta_L)}_{\text{Intermediary}} + \underbrace{(1 - \pi')(p_M - \theta_L)}_{\text{Market}} \\ & \geq \pi'(\theta_H - \theta_L) + (1 - \pi')((1 + \alpha)\theta_L - \theta_L) \\ & > \underbrace{(1 + \alpha)\theta_L - \theta_L}_{\text{Payoff from choosing } (\pi, p) \text{ with } p \leq (1 + \alpha)\theta_L} \end{aligned}$$

Proof Sketch

Claim 3

θ_H and θ_L choose the same (π, p) in equilibrium.

Let (π'', p'') be the option chosen by θ_L . By Claim 2, $p'' > (1 + \alpha)\theta_L$.

Only θ_L chooses (π'', p'')



Buyer will *not* buy at $p'' > (1 + \alpha)\theta_L$.



θ_H *also* chooses (π'', p'')

Proof Sketch

Claim 3 leads to a contradiction.

$$\theta_H \text{ chooses } (\pi'', p'') \implies p'' \geq \theta_H$$

\Downarrow

Buyer's beliefs at p'' equal prior.

\Downarrow

Buyer will **not** buy at $p'' \geq \theta_H$. **Contradiction!**

So, there is no menu that intermediary can offer such that θ_H trades in equilibrium.

Proof Sketch

Lemma

Suppose there is a $(\pi, p) \in \mathcal{M}$ such that in equilibrium, it is chosen by both:

i) θ' such that $\theta' > p_M$, ii) Some $\theta'' \leq p_M$.

Then, in equilibrium, (π, p) is chosen by **all** $\theta \in (p_M, \theta')$ (if any).

Proof of Lemma

Proof Sketch

Claim 1

In **every** equilibrium, $p_M = (1 + \alpha)\theta_n$.

Implication: *Only* θ_n can trade on market in equilibrium.

Why? → BLC implies that $\theta > (1 + \alpha)\theta_n$ for all $\theta > \theta_n$.

Proof Sketch

Suppose some $\theta > \theta_n$ trades in equilibrium. Fix such an equilibrium.

Claim 2

Suppose θ_n chooses (π, p) in equilibrium. Then $p > (1 + \alpha)\theta_n$, and Buyer buys at p .

Proof:

Step 1: There exists $(\pi', p') \in \mathcal{M}$ such that i) $p' \geq \theta_{n-1}$, and ii) Buyer's strategy: *buy at p'* .

- $\theta > \theta_n$ trades in equilibrium \rightarrow can only trade at $p \geq \theta_{n-1}$.
- By Claim 1, $\theta > \theta_n$ can only trade through intermediary.

Since θ_{n-1} , by *Step 1*, Any (π, p) chosen by θ_n must have $p > (1 + \alpha)\theta_n$.

Proof Sketch

Claim 3

θ_n mimics choice of *some* $\theta > \theta_n$ in the intermediary's menu.

Let (π'', p'') be the option chosen by θ_n . By Claim 2, $p'' > (1 + \alpha)\theta_n$.

Only θ_n chooses (π'', p'')



Buyer will *not* buy at $p'' > (1 + \alpha)\theta_n$.



Some $\theta > \theta_n$ *also* chooses (π'', p'')

This **mimicking** leads to *pooling at the bottom*.

Proof Sketch

Suppose θ_n chooses (π'', p'') in equilibrium.

Claim 4

There exists $\bar{\theta} > \theta_n$ such that the set of types that chooses (π'', p'') in equilibrium is $\{\theta | \theta \leq \bar{\theta}\}$.

Proof:

- By Claim 3, *some* $\theta > \theta_n$ also chooses (π'', p'') . Let $\bar{\theta}$ be the highest such θ .
- By the Lemma, all $\theta \in (\theta_n, \bar{\theta})$ (if any), *also* chooses (π'', p'') .

Proof Sketch

Claim 4 leads to a **contradiction**.

- $\bar{\theta}$ chooses $(\pi'', p'') \implies p'' \geq \bar{\theta}$.
- The set of types that chooses (π'', p'') in equilibrium is $\{\theta | \theta \leq \bar{\theta}\}$.
- Buyer's expected value at p'' is $(1 + \alpha)\mathbb{E}[\theta | \theta \leq \bar{\theta}]$.
- By BLC, $(1 + \alpha)\mathbb{E}[\theta | \theta \leq \bar{\theta}] < \bar{\theta} \rightarrow$ **contradicts that Buyer buys at p''** .

Proof of Lemma

Lemma

Suppose there is a $(\pi, p) \in \mathcal{M}$ such that in equilibrium, it is chosen by both:

i) θ' such that $\theta' > p_M$, ii) Some $\theta'' \leq p_M$.

Then, in equilibrium, (π, p) is chosen by **all** $\theta \in (p_M, \theta')$ (if any).

Fix any $\theta \in (p_M, \theta')$. For any $(\pi', p') \neq (\pi, p)$, two possibilities:

Case 1 : $p' < p$, and $\pi' > \pi$

Case 1 : $p' > p$, and $\pi' < \pi$

In both cases, will show: θ strictly prefers (π, p) to (π', p') .

Proof of Lemma

Case 1: $p' > p$ and $\pi' < \pi$.

$\theta > p_M$ so **cannot** sell through market, if trade through intermediary does **not** happen.

$$\underbrace{\pi(p - \theta'') + (1 - \pi)(p_M - \theta'') \geq \pi'(p' - \theta'') + (1 - \pi')(p_M - \theta'')}_{\theta'' \text{ prefers } (\pi, p) \text{ to } (\pi', p')}$$

$$\iff \pi'p' - \pi p \leq (\pi' - \pi)p_M$$

$$\implies \pi'p' - \pi p < (\pi' - \pi)\theta$$

$$\underbrace{\pi(p - \theta) > \pi'(p' - \theta)}_{\theta \text{ strictly prefers } (\pi, p) \text{ to } (\pi', p')}$$

Proof of Lemma

Case 2: $p' < p$ and $\pi' > \pi$.

Both $\theta', \theta > p_M$ so **cannot** sell through market, if trade through intermediary does **not** happen.

$$\underbrace{\pi(p - \theta') \geq \pi'(p' - \theta')}_{\theta' \text{ prefers } (\pi, p) \text{ to } (\pi', p')} \iff \pi p - \pi' p' \geq (\pi - \pi')\theta'$$

$$\implies \pi p - \pi' p' > (\pi - \pi')\theta$$

$$\iff \underbrace{\pi(p - \theta) > \pi'(p' - \theta)}_{\theta \text{ strictly prefers } (\pi, p) \text{ to } (\pi', p')}$$