Complicated Consumers: Heterogeneous Preferences in Competitive Selection Markets

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EEA Manchester - August 26, 2019

Overview

Selection markets

Cost of serving consumers is heterogeneous and unobservable.

- **Classical theory**: Firms "cream-skim" low-cost types with cheap and low-quality contracts
  $\Rightarrow$ Separating equilibrium + adverse selection (Rothschild and Stiglitz (1976); RS)
  $\Rightarrow$ Important rationale for policy intervention

- **Empirics**: mixed findings, often selection reverses ("advantageous selection"), important role of multi-dimensional heterogeneity in types
  (e.g., heterogeneous liquidity, background risks, cognitive abilities...)
  (Finkelstein and McGarry (2006), Fang et al. (2008), Einav et al. (2012))

Theoretical foundation for impact of multi-dimensional types in competitive equilibrium?
Policy implications?

Example: Insurance and patience

One-period model:
Consumers face risk of car accident that results in loss $D > 0$ at $t = 1$.
Firms offer to insure $x \times 100\%$ of D at price P to be paid at $t = 0$.

Multi-dimensionality: Consumer types differ in

- accident probability $\Rightarrow$ cost
- patience $\Rightarrow$ taste

Firms do not observe type, consumers do.

$\Rightarrow$ Firms offer a menu (x_i, P_i), consumers self-select into contracts.

Equilibrium allocation, prices? Efficiency?

What we know

One-dimensional types:

- adverse selection with separating equilibrium (Rothschild and Stiglitz (1976))
- scope for policy intervention (Einav and Finkelstein (2011), Azevedo and Gottlieb (2017))

Multi-dimensional types:

- adverse selection in *degenerate* contract space (Fang and Wu (2018))
- *single-contract* competitive equilibrium with advantageous selection is first-best efficient (Einav and Finkelstein (2011))

Contribution:
EQ characterization with multi-dimensional types, endogenous contracts, unrestricted contract space

Preview

If consumer preferences are sufficiently heterogeneous in taste (relative to cost):

- (semi-)separating EQ exists only if low-cost types sufficiently costly; otherwise, multiple EQ with pooling of different cost-types exist ($\leftrightarrow$ Rothschild and Stiglitz (1976)),
- advantageous selection exists ($\leftrightarrow$ Fang and Wu (2018)),
- efficient single-contract EQ exists,
- mandates can increase social welfare upon advantageous selection ($\leftrightarrow$ Einav and Finkelstein (2011)).

Adds to literature on

- multi-dimensional types in selection markets (Fang and Wu (2018), Einav et al. (2010), Einav and Finkelstein (2011), Spinnewijn (2013), Veiga and Weyl (2016))
- evolution of adverse vs advantageous selection and its measurement (Chiappori and Salanié (2000), Chiappori et al. (2006), de Meza and Webb (2001, 2017))

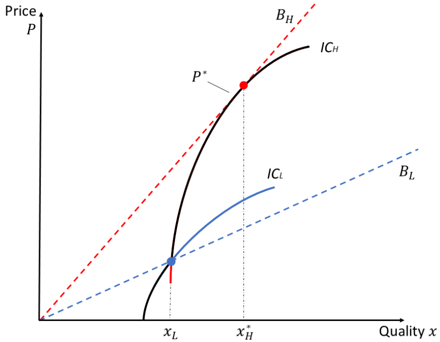
Overview

Recap: Seminal RS model

One-dimensional types:

2 types of consumers $\vartheta \in \{L, H\}$, differing only in cost, unobservable to firms.

Single-crossing: High cost-types are willing to pay more than low-cost types.



Azevedo and Gottlieb (2017) (AG) EQ.

Traded contracts break even and the price schedule P^* for all contracts is robust toward small "perturbations". Existence guaranteed.

Adding another dimension: Taste

Assumptions:

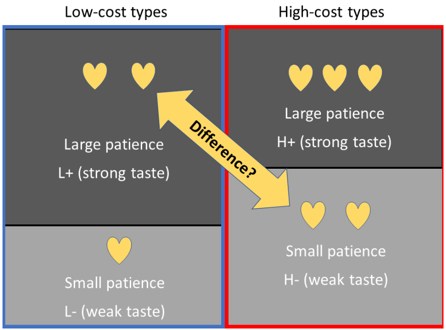
- Consumers differ in costliness μ and taste t
  $\Rightarrow$ Type space $\Theta = \{(\mu, t) : \mu \in \mathcal{M}, t \in \mathcal{T}(\mu)\}$
- Type ϑ has utility $V(x, P; \vartheta)$ from quality x at price P;
  $\partial_x V > 0$, $\partial_{xx} V < 0$, $\partial_P V < 0$
- WTP $\omega(x, P; \vartheta) = -V_x / V_P$ is increasing in costliness μ and taste t:

$$\partial_\mu \omega > 0 \quad \text{and} \quad \partial_t \omega > 0$$

  $\Rightarrow$ Higher-cost + stronger-taste types value quality more highly.
  $\Rightarrow$ Single-crossing.
- Cost $c(x; \mu)$ with $\partial_x c > 0$, $\partial_{x\mu} c > 0$, independent from t

Type space

Consider types $\Theta = \{L-, L+, H-, H+\}$



Example: Insurance and patience.

2 important cases:

(A) Dominant cost heterogeneity: $\omega_{L+} < \omega_{H-}$
$\Rightarrow$ WTP monotonic in cost but not taste

(B) Dominant taste heterogeneity: $\omega_{L+} > \omega_{H-}$
$\Rightarrow$ WTP not monotonic in cost but taste

Overview

Dominant **cost** heterogeneity

WTP monotonic in cost but not taste, $\omega_{L-} < \boxed{\omega_{L+} < \omega_{H-}} < \omega_{H+}$.

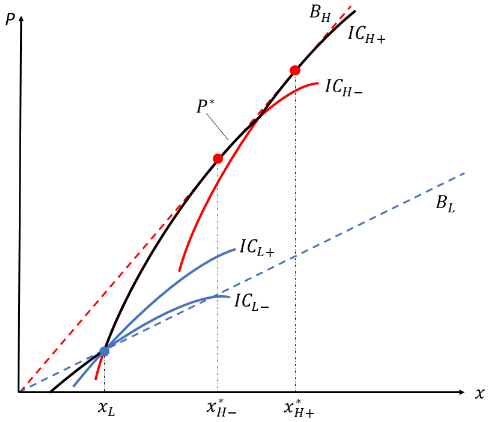


Figure: Equilibrium and price schedule P^*.

Familiar insights:

- EQ is unique and separating
- Adverse selection

$\approx$ one-dim RS model

Dominant **taste** heterogeneity (1)

WTP monotonic in taste but not cost, $\omega_{L-} < \boxed{\omega_{H-} < \omega_{L+}} < \omega_{H+}$.

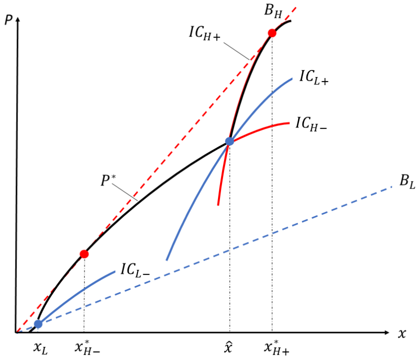


Figure: E1 allocation.

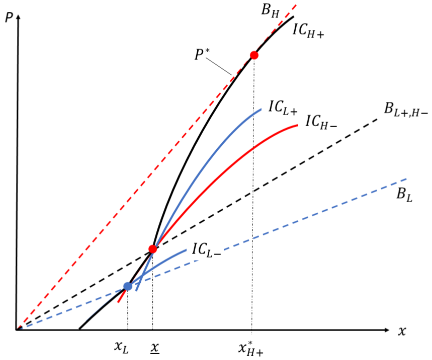


Figure: E2$^-$ allocation.

(E1) (Im-)perfect separation.
Advantageous selection at $\hat{x}$

(E2$^-$) pooling all L+ and H- types at $\underline{x}$.
Adverse selection

Dominant **taste** heterogeneity (2)

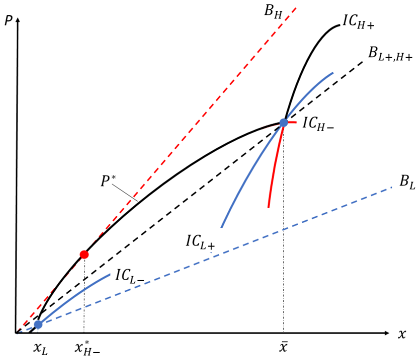


Figure: E2$^+$ allocation.

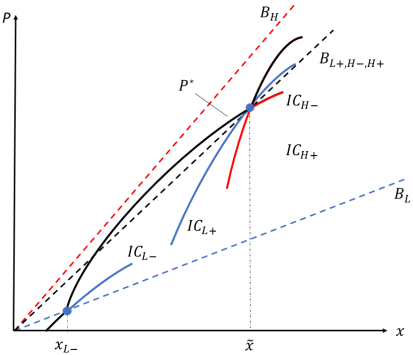


Figure: E3 allocation.

(E2$^+$) pooling all L+ and H+ types at $\bar{x}$.
Advantageous selection at $\bar{x}$

(E3) pooling all L+, H- and H+ types at $\tilde{x}$.
Adverse selection

$\Rightarrow$ L+ "captured" by subset of high-cost types. No Pareto-ranking.

Overview

Selection

Adverse (advantageous) selection if $\bar{\mathcal{S}}$=corr(quality, marg. cost) > 0 (< 0)
Idea: Asymmetric information restricts low-cost types' quality $\Rightarrow \bar{\mathcal{S}} > 0$
Application: empirical tests for asymmetric information (Chiappori and Salanié (2000))

New insights:

- Multidimensionality can cause advantageous selection ($\bar{\mathcal{S}} < 0$)
  $\Rightarrow$ may explain empirical findings
- If taste heterogeneity dominant, $F(\{H+\}) \leq F(\{H-\})$, and $F(\{L+, H-\})$ large, there exists a Pareto-dominant EQ with $\bar{\mathcal{S}} < 0$.

$\Rightarrow \bar{\mathcal{S}}$ driven by type distribution.

$\Rightarrow \bar{\mathcal{S}}$ uninformative about information frictions.

Efficiency

Einav and Finkelstein (2011): *There is no welfare distortion in advantageously selected single-product markets and these are efficient.*

New insights with endogenous contracts:

- E3 pooling EQ is unconstrained and constrained Pareto-efficient for types L+, H-, and H+
- Larger consumer surplus with dominant taste than dominant cost heterogeneity
- Advantageous selection equilibria not necessarily (constrained-)efficient
  + scope for policy-intervention

⇒ Distortions from information frictions weaker not because of advantageous selection but because of dominant taste heterogeneity.

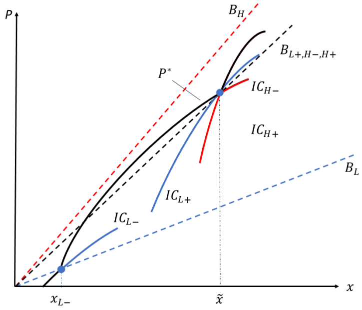


Figure: E3 equilibrium.

Conclusion

Focus: Selection markets with multidimensional unobservable types.

New insights:

- Dominant taste heterogeneity enables pooling across cost-types
- Taste heterogeneity weakens information distortions
  $\Rightarrow$ Unconstrained efficient pooling equilibria exist, total surplus is larger
- Advantageous selection exists in equilibrium if taste heterogeneity dominates and cost and taste negatively correlate in population

  $\Rightarrow$ Explanation for empirical results

Take-away: when consumers differ mostly in taste, equilibrium isn't what it used to be.

Thank you.

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Backup

First-best equilibrium (AG=RS)

If **types are observable**, equilibrium quality is $x^*_\vartheta = \arg\max_x [V(x, c(x, \mu); \vartheta)]$.

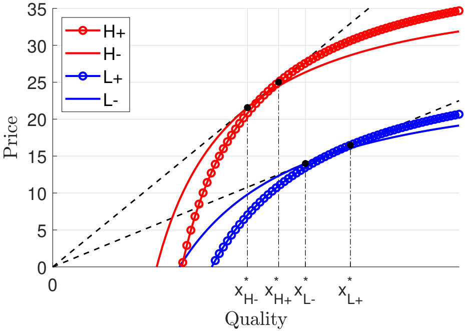


Figure: Exemplary first-best EQ. WTP is monotonic in cost, $\omega_{L-} < \omega_{L+} < \omega_{H-} < \omega_{H+}$.

- Stronger taste → larger optimal quality, $\partial_t x^*_\vartheta > 0$.
- Higher costliness → larger optimal quality iff

$$\partial_\mu \omega > \partial_{\mu x} c,$$

i.e., iff WTP more elastic in costliness μ than marginal cost.

$\Rightarrow$ Monotonicity of WTP uninformative about $\operatorname{sgn}(\partial_\mu x^*_\vartheta)$.

Dominant **taste** heterogeneity: Equilibrium multiplicity

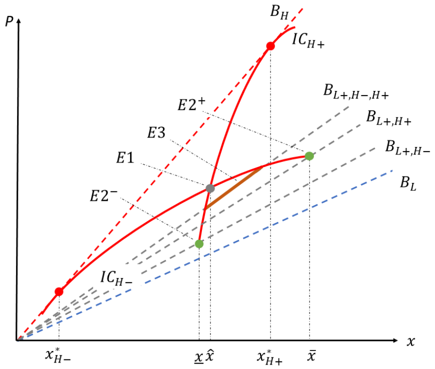


Figure: Overview of AG equilibria.

If μ_L small and $F(\{L+\})$ large ($\approx$ *cheap pooling*):
$\Rightarrow$ Pooling sustainable (E2$^-$, E2$^+$, E3).
$\Rightarrow$ E2$^-$, E2$^+$ and E3 simultaneously not Pareto-dominated by another EQ.

Otherwise, E1 is the unique EQ.

Lemma

Reason for multiplicity: Fluctuations in demand and supply are absorbed by high-cost types.

Dominant **taste** heterogeneity: Equilibrium multiplicity

Assume that there exists $(\hat{x}, \hat{P})$ with $\hat{P} > c(\hat{x}, \mu_L)$ that makes both H- and H+ indifferent to their first-best contracts, respectively.

Lemma

$\exists \lambda_1, \lambda_2^+, \lambda_2^-, \lambda_3 > 0$ *such that*

- *If* $\min \left\{ \frac{F(\{L+\})}{F(\{H-\})}, \frac{F(\{L+\})}{F(\{H+\})} \right\} < \lambda_1$, *E1 is the unique AG EQ.*

  Otherwise, multiple AG equilibria exist and E1 is Pareto-dominated by another AG EQ.
- *If* $\frac{F(\{L+\})}{F(\{H-\})} \geq \lambda_2^-$, *E2*$^-$ *exists and is Pareto-dominant among AG EQ.*

  If $\frac{F(\{L+\})}{F(\{H+\})} \geq \lambda_2^+$, *E2*$^+$ *exists and is Pareto-dominant among AG EQ.*
- *If* $\frac{F(\{L+\})}{F(\{H-,H+\})} \geq \lambda_3$, *there exists* $x_a \leq x_b$ *such that each E3 allocation with pooled quality* $\tilde{x} \in [x_a, x_b]$ *exists and is Pareto-dominant among AG EQ.*

back

Local and global selection

Local selection: $\mathcal{S}(x_{n+1}) = \mathbb{E}^{\alpha}_{x_{n+1}}[\mu] - \mathbb{E}^{\alpha}_{x_n}[\mu]$ with $x_n < x_{n+1}$

How costly are x_{n+1}-consumers compared to x_n-consumers?

Azevedo and Gottlieb (2017): $\mathcal{S}(x_{n+1}) \approx$ cost of selection

New insights:

- $\bar{\mathcal{S}} = \sum_{j=2}^{N} w_j \mathcal{S}(x_j)$ with $w_j > 0$
  $\Rightarrow$ Local selection $\neq$ global selection
- If $F(\{H+\}) \leq F(\{H-\})$, there exists a Pareto-dominant EQ such that one traded contract x has $\mathcal{S}(x) < 0$ (E1 and E2$^+$)
- If $F(\{H+\}) \leq F(\{H-\})$ and $F(\{L+, H-\})$ "sufficiently large", there exists a Pareto-dominant EQ with $\bar{\mathcal{S}} < 0$.

$\Rightarrow$ Advantageous selection driven by dominant taste heterogeneity and small tails in type distribution.

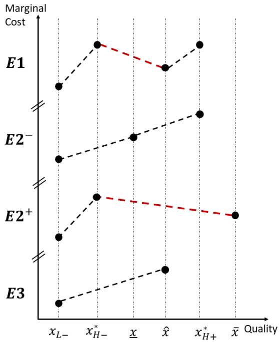
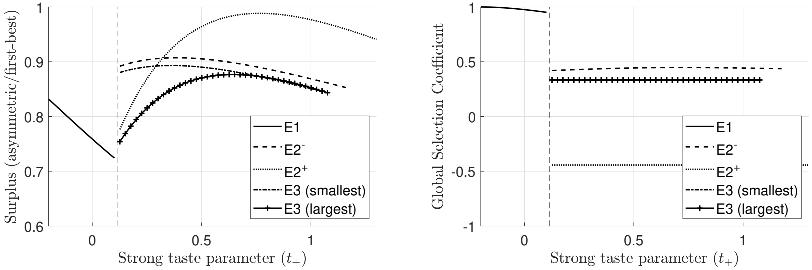


Figure: Marginal cost vs. quality.

Welfare distortion of asymmetric information

Assume that low-taste and high-taste types have the same optimal contract, respectively.
⇒ Dominant taste heterogeneity: L+ closer to optimal quality than under cost heterogeneity.
⇒ Smaller welfare distortion with dominant taste heterogeneity.
But: advantageously selected equilibria do not necessarily entail higher welfare.



(a) Welfare: asymmetric info vs. first-best.

(b) Global selection ($\bar{S}$).

Figure: Example. Vertical line divides into dominant cost (left) and taste heterogeneity (right).
Insurance for loss $L \sim \mathcal{N}(\mu, \sigma^2)$; CARA consumers differ in μ and vulnerability β (experience loss by βL).
WTP for coverage x is $\nu(x; \mu, \beta) = x\mu - \gamma x(x - 2(1 + \beta))\sigma^2/2$, cost $c(x; \mu) = x\mu$.