Optimal variety and pricing of a trade platform

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BECCLE Conference, Bergen
April 27, 2017

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- Common features of trade platforms' pricing: Sellers pay lump-sum (listing) fees and transaction fees, but buyers do not pay fees.
- Consumers have to incur a search cost to evaluate products' characteristics and their match value to each product.

Research questions

1. Do platforms distort prices and variety offered to buyers?
2. If so, which direction would the distortion go?

Benchmark model of a trade platform

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- Assumption: $V(n, p)$ is increasing and concave in variety n, and decreasing in price p (holds for common demands).

Timing

1. The platform sets fees (w, ϕ) to sellers.
2. Sellers observe the platform's fees and decide whether to list their product on the platform. Buyers observe the platform's fees and decide whether to enter the platform.
3. Sellers set their prices. Buyers observe prices and their intrinsic match value to each product, and then decide which product to buy (if any).

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- The marginal consumer type $\tilde{\tau}$ is equal to the expected indirect utility from participating to the platform:

$$\tilde{\tau} = V(n^e, p^*(n^e, w)). \tag{2}$$

▸ Subgame Eqb

The platform vs multiproduct monopolist

- The platform's problem:

$$\max_{w,\phi}[nwD(n, p^*(n, w))F(\tilde{\tau}) + \phi n],$$

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- Proposition 1: Suppose $\pi^*(n,w)F(V(n,p^*(n,w)))$ is a real-valued continuous and invertible function of n to R^+ (at a given $w\in R$).The platform implements the multiproduct monopolist's variety and price.

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- Implication: The platform coordinates sellers' pricing (eliminate competition) by using its fees to sellers.

Socially optimal vs privately optimal variety

- The total welfare is the sum of the multiproduct monopolist's profit and the net consumer surplus:

$$W(p,n) = n(p-c)D(p,n)F(\tilde{\tau}) - nK + \tilde{\tau}F(\tilde{\tau}) - \int_0^{\tilde{\tau}} \tau f(\tau)d\tau.$$

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- We can replace $p = V^{-1}(n,\tilde{\tau})$ and rewrite the total welfare as

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- The first-best variety and marginal type are the solution to

$$\begin{aligned}\frac{\partial W}{\partial n} &= \frac{\partial \Pi}{\partial n} = 0,\\ \frac{\partial W}{\partial \tilde{\tau}} &= \frac{\partial \Pi}{\partial \tilde{\tau}} + F(\tilde{\tau}) = 0.\end{aligned}$$

The multiproduct monopolist provides too little variety

- Proposition 2: If a social planner can control variety (n), but cannot control the price set by the multiproduct monopolist, the planner wants to offer more variety than the monopolist.

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- Sketch of proof: The equilibrium variety is less than the socially optimal variety at the consumer participation set by the monopolist:

$$\begin{aligned} \frac{dW}{dn}\Big|_{\tilde{\tau}^*} &= \frac{\partial \Pi}{\partial n}\Big|_{\tilde{\tau}^*} + \frac{\partial W}{\partial \tilde{\tau}} \frac{d\tilde{\tau}^*}{dn}\Big|_{\tilde{\tau}^*} \\ &= F(\tilde{\tau}^*)\frac{d\tilde{\tau}^*}{dn} > 0 \end{aligned}$$

Example: Discrete choice model with iid tastes

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- A consumer buys a product if and only if $\mu \max\{\epsilon_i\} - p \geq v_0$, where v_0 is the outside option utility.
- So the indirect utility from going to the store is

$$V(p, n) = \int_{\hat{\epsilon}=\frac{p+v_0}{\mu}}^{\overline{\epsilon}} (\mu\epsilon - p)h(\epsilon)d\epsilon + v_0 H(\hat{\epsilon}) \tag{3}$$

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  - Due to the distortion on the consumer side, too few sellers enter the platform.

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- Corollary 1: If the trade platform cannot charge a subscription fee to consumers (due to transaction costs), it distorts both ex-post trade ($p^* > c$) and ex-ante participation of consumers.

Ex-ante commitment to variety, but not to prices

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- Thus, platforms might be able to commit to variety, but not to prices

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- Proposition 5: The monopolist offers fewer variants and lower prices than the case where both variety and prices observed ex-ante.

Ex-ante commitment to variety, but not to prices: Welfare vs Equilibrium

- Proposition 6: Compared to the second-best optimal variety, the monopolist offers too few variants if the indirect utility, $V(n, p^e(n))$, is increasing in n. Otherwise, it offers too many variants.

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- Intuition: With global competition between products, the direct variety effect dominates the price effect.

No ex-ante commitment to variety or price

- Proposition 7: If the indirect utility increases in variety (multinominal logit), the monopolist offers more variants in the partial commitment case than no commitment case. Otherwise, it offers fewer variants in the partial commitment case (Vickrey-Salop model).

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- Proposition 7: If the indirect utility increases in variety (multinominal logit), the monopolist offers more variants in the partial commitment case than no commitment case. Otherwise, it offers fewer variants in the partial commitment case (Vickrey-Salop model).
- Proposition 8: If $\partial_{np} V < 0$, the monopolist sets a higher n and $\tilde{\tau}$ in the full commitment case than no commitment case. Both the monopolist and consumers are better-off with full commitment. [Spence (1976)]

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  - This is to communicate consumers that there will be many consumers and products on the platform.

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- Puzzling fact: Consumers do not pay a subscription fee in practice.
- Our explanation: This might be due to full hold-up (consumers do not see prices or variety before visiting the platform) ($S < 0$).

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- Puzzling fact: Consumers do not pay a subscription fee in practice.
- Our explanation: This might be due to full hold-up (consumers do not see prices or variety before visiting the platform) ($S < 0$).
- Competition between platforms might eliminate the monopoly markup and so make below cost subscription fee more likely: $S = -\pi$.

Related Literature

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- Monopolist pricing and quality provision: Spence (1976)
- Variety in two-sided markets (platforms): Nocke, Peitz and Stahl (2007), Hagiu (2009).

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  - In the benchmark, all results apply for an ad-valorem fee and a fixed fee to sellers.
  - If sellers were heterogenous in quality, the platform might prefer an ad-valorem fee to capture more rent from high quality sellers.
  - This would distort allocations further by increasing the margins of high quality sellers (since they pay more fees over transactions).

Conclusions

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    - when the platform cannot commit to variety or prices.
  - It over-provides variety when the platform can only commit to variety, but not to prices, and the indirect utility decreases in variety (Vickrey-Salop).

Equilibrium

- Lemma 1: If $F(\tau)$ is weakly concave and $\pi^*(n, w)$ is decreasing and $1/\pi^*(n, w)$ is convex in n, then there exists maximum three equilibria to the sellers' and buyers' participation decisions at given (w, ϕ).

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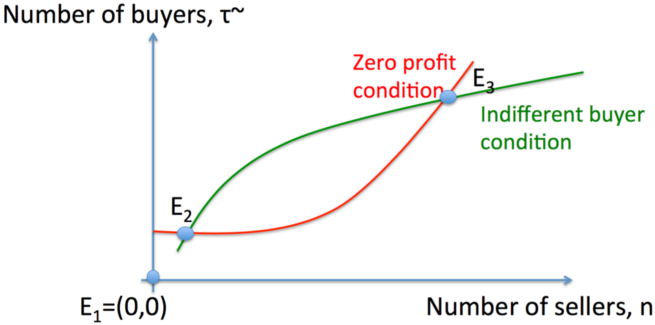

Figure: Subgame equilibrium number of sellers and buyers

The effect of platform's pricing on equilibrium allocations

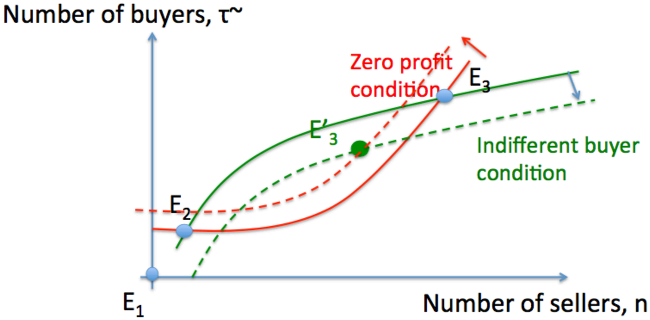

Figure: Effect of increasing w on equilibrium.

- Sellers' prices increase and margins decrease (in case of imperfect passthrough). The zero profit curve shifts left.

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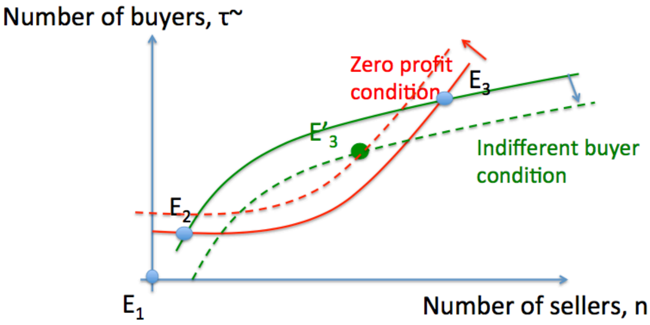

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- Sellers' prices increase and margins decrease (in case of imperfect passthrough). The zero profit curve shifts left.
- Higher prices lead to lower utility from participating (consumer indifference curve shifts down). Back

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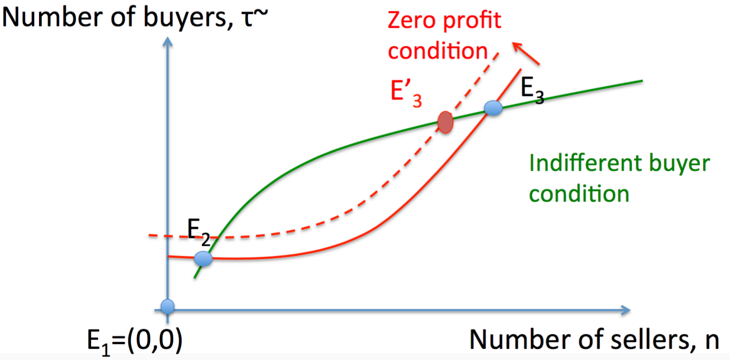

Figure: Effect of increasing ϕ on equilibrium

- Fewer sellers enter (zero-profit curve shifts left).

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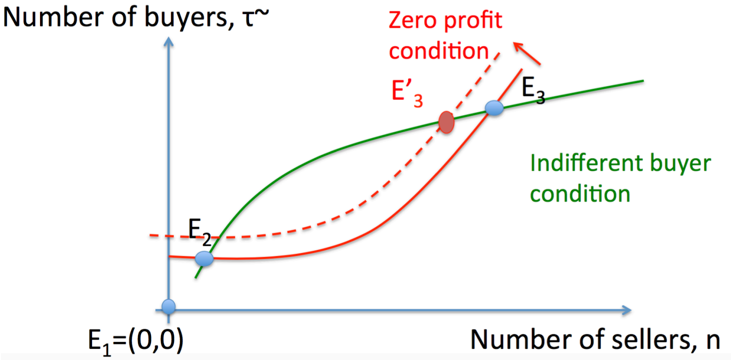

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- The new equilibrium will be E_3'. Back

Example: Covered market at the intensive margin

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- The sellers' zero-profit condition,

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