

Session 3: TSP pricing principles (II) and videogames vs. PC platforms pricing structures

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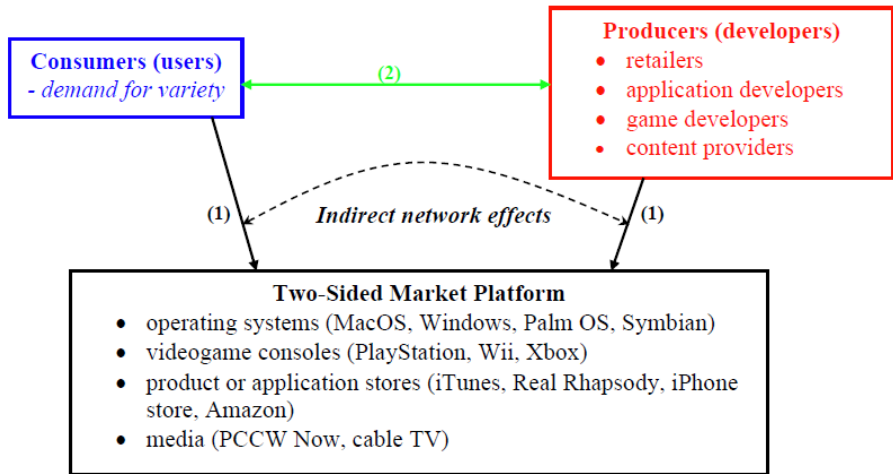
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 - More pricing principles (and questions on last time's models!)
 - Videogames and PC platforms - *INTERACTIVE* discussion (based on HBS case study)

Two-sided pricing for buyers-sellers platforms

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Two-sided pricing for buyers-sellers platforms

- Problem with previous models: the two sides are essentially symmetric
 - hard to apply to platforms connecting producers and consumers



- How to make sense of contrasting platform pricing structures observed?
 - software platforms vs. videogames pricing puzzle

Multi-sided platform	Loss-leader side(s)	Profit-making side
Dating Clubs	Women	Men
eBay, Yahoo! Auctions, Amazon	Buyers	Sellers
Payment systems (Visa, Octopus)	Consumers	Merchants
iPhone store	Consumers	Application developers
Videogame consoles	Consumers	Game developers
PC, PDA and smart phone operating systems	Application developers, Hardware makers	Consumers

- **Timing:**
 - 1) Platform(s) set(s) *access* prices for users (P^U) and developers (P^D)
 - 2) Users and developers decide whether or not to adopt the platform
 - 3) Platform users and developers interact
- Users and developers are differentiated only "horizontally" by their preferences for the platform

- User θ 's *net surplus* from adopting platform supported by n applications:

$$u(n) - P^U - \theta$$

$u(n)$ user surplus from n applications, net of prices paid to developers
; $u' > 0$

$F(\theta)$ number of users with "adoption cost" $\theta' \leq \theta$; $F' = f > 0$

- Developer ϕ 's net profits when platform adopted by $F(\theta^m)$ users:

$$\pi(n) F(\theta^m) - P^D - \phi$$

$\pi(n)$ developer profits per platform user ; $\pi' < 0$

$H(\phi)$ number of developers with fixed cost $\phi' \leq \phi$; $H' = h > 0$

- The key primitive is $V(n)$, *gross surplus* for each user created by n applications:

$$V(n) = u(n) + n\pi(n)$$

- **Example 1:** *unitary* demand for applications; gross surplus $V(n)$, with $V'(\cdot) > 0$, $V''(\cdot) < 0$; developers have 0 marginal costs
- In equilibrium developers charge $p = V'(n)$ and sell to *all* platform users:

$$\pi(n) = V'(n)$$

$$u(n) = V(n) - nV'(n)$$

Platform's pricing problem

- Developer demand n :

$$\pi(n) F(\theta^m) - P^D - H^{-1}(n) = 0 \implies n = N \left(\begin{matrix} \theta^m, P^D \\ (+) (-) \end{matrix} \right)$$

- User demand $F(\theta^m)$:

$$u(n) - P^U - \theta^m = 0 \implies \theta^m = \Theta \left(\begin{matrix} n, P^U \\ (+) (-) \end{matrix} \right)$$

- Platform profits:

$$\Pi^P = P^U F(\theta^m) + nP^D = (V(n) - \theta^m) F(\theta^m) - nH^{-1}(n)$$

- First-order conditions over (θ^m, n) :

$$\left. \begin{aligned} \frac{V(n) - \theta^m}{\theta^m} &= \frac{1}{\varepsilon_F} \\ V'(n) F(\theta^m) &= nH^{-1'}(n) + H^{-1}(n) \end{aligned} \right\} \implies (\theta_p^m, n_p)$$

- Note that given (θ_p^m, n_p) , (P_p^U, P_p^D) are *uniquely* determined
- Need some assumptions to ensure the converse is also true, i.e., given (P_p^U, P_p^D) , (θ_p^m, n_p) are *uniquely* determined (cf. session 1 slides - multiple equilibria)

Optimal platform pricing structure

- Platform profits:

$$\Pi^P = P^U F(\theta^m) + nP^D = \underbrace{\Pi^{PU}}_{\text{profits made on users}} + \underbrace{\Pi^{PD}}_{\text{profits made on developers}}$$

- Platform "pricing structure":

$$\frac{\Pi^{PD}}{\Pi^{PU}}$$

i.e. how much money derived from developers *relative to* users

Optimal platform pricing structure

- Using the first-order conditions):

$$\frac{\Pi^{PD}}{\Pi^{PU}} = \frac{\varepsilon_V (1 + \varepsilon_F) (1 - (1 - \lambda) (1 + \varepsilon_H))}{(1 + \varepsilon_H) (1 - \lambda \varepsilon_V (1 + \varepsilon_F))}$$

$\varepsilon_F(\theta) = \frac{\theta f(\theta)}{F(\theta)}$ and $\varepsilon_H(\phi) = \frac{\phi h(\phi)}{H(\phi)}$ "elasticities of demand" for platform

$\lambda(n) = \frac{\pi(n)}{V'(n)}$ developer rent extraction power

$\varepsilon_V(n) = \frac{nV'(n)}{V(n)}$ consumer preference for variety

- If $\lambda \leq \frac{\varepsilon_H}{1+\varepsilon_H}$ then developers subsidized ($P^D < 0$)
- If $\lambda \geq \frac{1}{\varepsilon_V(1+\varepsilon_F)}$ then users subsidized ($P^U < 0$)
- If $\frac{\varepsilon_H}{1+\varepsilon_H} < \lambda < \frac{1}{\varepsilon_V(1+\varepsilon_F)}$ then $\frac{\Pi^{PD}}{\Pi^{PU}}$ decreasing in ε_H and increasing in ε_F , λ and ε_V .
- **Example 1** ($\varepsilon_V = \beta$ and $\lambda = 1$):

$$\frac{\Pi^{PD}}{\Pi^{PU}} = \frac{\beta(1+\varepsilon_F)}{(1+\varepsilon_H)(1-\beta(1+\varepsilon_F))}$$

- **Example 2:** assume $\pi(n) = \pi$; $u(n) = un$ and $V(n) = (\pi + u)n$, so that $\varepsilon_V = 1$ and $\lambda = \frac{\pi}{u+\pi}$ (share of total surplus captured by the producer; $1 - \lambda$ is what remains to the consumer)

$$\frac{\Pi^{PD}}{\Pi^{PU}} = \frac{\frac{1}{1+\varepsilon_H} - \frac{u}{\pi+u}}{\frac{1}{1+\varepsilon_F} - \frac{\pi}{\pi+u}} = \frac{\frac{1}{1+\varepsilon_H} - (1 - \lambda)}{\frac{1}{1+\varepsilon_F} - \lambda}$$

- Very similar to effects discussed in session 2

- *Can we use this model to explain videogames vs. PCs platform pricing structures?*
- *"[...] Thus, while the personal computer market could bear no more than a few word processors or spreadsheet programs, the teenage videogame market could support an indefinite number of programs in any genre. In this respect, videogames were, again, more like recorded music or books than like corporate software..." [Campbell-Kelly 2003]*

- Platforms differentiated a la Hotelling for users and undifferentiated for developers
- Symmetric equilibrium: users split equally, developers support both platforms (multihome)
- Similar comparative statics (pricing structure) + additional competitive effect on prices charged to users (see paper)

- Developer incentives to invest in product quality (vertical differentiation possible)
- **Timing:**
 - 1) Platform sets fixed fees P^D and *proportional royalties* $\rho \in [0, 1]$ for developers (*no effect on their prices*); developers make entry decisions
 - 2) Active developers invest in product quality
 - 3) Platform sets price P^U for users ; users make adoption decisions
 - 4) Platform users and developers interact

- **Results:**

- If quality contractible in stage 1, then high royalties ($\rho = 1$) \implies first best outcome for the platform
 - If *ex-ante* (stage 1) credible commitment to P^U or *ex-post* (stage 3) renegotiation with all developers then low royalties ($\rho = 0$) \implies first best
 - Otherwise: $0 < \rho < 1 \implies$ second best
- Operating systems vs. videogame consoles
 \implies *ex-ante* commitment value of licensing to competing hardware manufacturers

Royalties and developer innovation incentives - details of model

- "Quality" $q(i)$: proportion of users *interested* in application i
- User preferences i.i.d. and unitary demand: gross surplus from n applications $V \left(\int_0^n q(i) di \right)$
 \implies developer i charges $V' \left(\int_0^n q(i) di \right)$ and sells to a fraction $q(i)$ of platform users
- Developer fixed costs $c(q) + \phi$, where $\phi \sim H, h$ and $c(\cdot)$ strictly increasing and convex, *identical for all developers*
 \implies in equilibrium all active developers choose the same quality

- Stage 4: n application developers with quality $q(i)$; developer $i \in [0, n]$ sells to $q(i) F(\theta^m)$ users and pays royalties to the platform
- Stage 3: platform sets P^U to maximize profits made on users + royalty revenue $\implies \theta^m \left(\int_0^n q(i) di, \rho \right)$
(+)
- Stage 2: active developers choose quality $\implies q(i) = q(n, \rho) \implies \theta^m(n, \rho)$
- Stage 1: developers make entry decisions $\implies n(P^D, \rho)$

- Platform maximizes total profits from the perspective of stage 1:

$$\max_{P^D, \rho} \Pi^P(n, q, \theta^m) \text{ u. c. } \begin{cases} n = n(P^D, \rho) \\ q = q(n, \rho) \\ \theta^m = \theta^m(n, \rho) \end{cases}$$

or:

$$\max_{n, \rho} \Pi^P(n, q, \theta^m) \text{ u. c. } \begin{cases} q = q(n, \rho) \\ \theta^m = \theta^m(n, \rho) \end{cases}$$

- First-best from the perspective of stage 1:

$$\max_{n, q, \theta^m} \Pi^P(n, q, \theta^m)$$

● Results:

- If quality contractible then $\rho = 1 \implies$ first best
- If *ex-ante* credible commitment to P^U or *ex-post* renegotiation with all developers then $\rho = 0 \implies$ first best
- Otherwise: $0 < \rho < 1 \implies$ second best
- Example: if $F(\theta) = B\theta$, $c(q) = \frac{cq^2}{2}$, $V(Q) = AQ^\beta$, $\beta \in]0, 1[$ then
$$\rho = \frac{\beta}{1+\beta}$$

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- 2 Why was Microsoft unsuccessful in its attempt to replicate its business arrangements from the PC industry into the videogame industry (in particular: licensing third-party hardware manufacturers and charging no royalties to third-party developers)
- 3 What are Sony's strategic options for regaining industry leadership? Which one would you recommend Kazuo Hirai to pursue?

- In 1999, Microsoft went to Dell to ask them to produce Xboxes based on Microsoft's "gaming operating system"

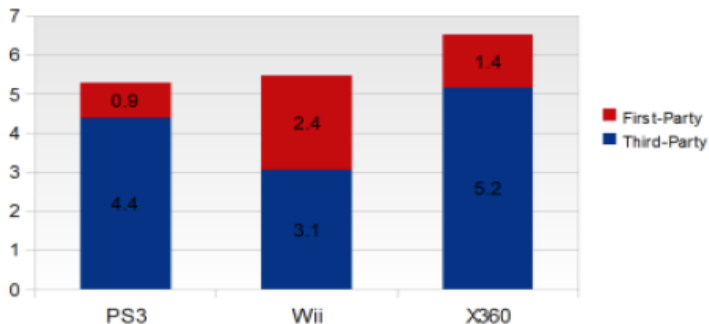
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 - ... Panasonic (Matsushita), Sharp, Toshiba, Mitsubishi and Samsung also declined to manufacture Xboxes.
- *Meaning and logic of these OEMs?*

Tie Ratios for Consoles After 23 Months on the Market



Source: Gamasutra

http://www.gamasutra.com/php-bin/news_index.php?story=20988

Thank you for your attention.