Platform Competition with Endogenous Homing

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NEtwork media Management & Optimization

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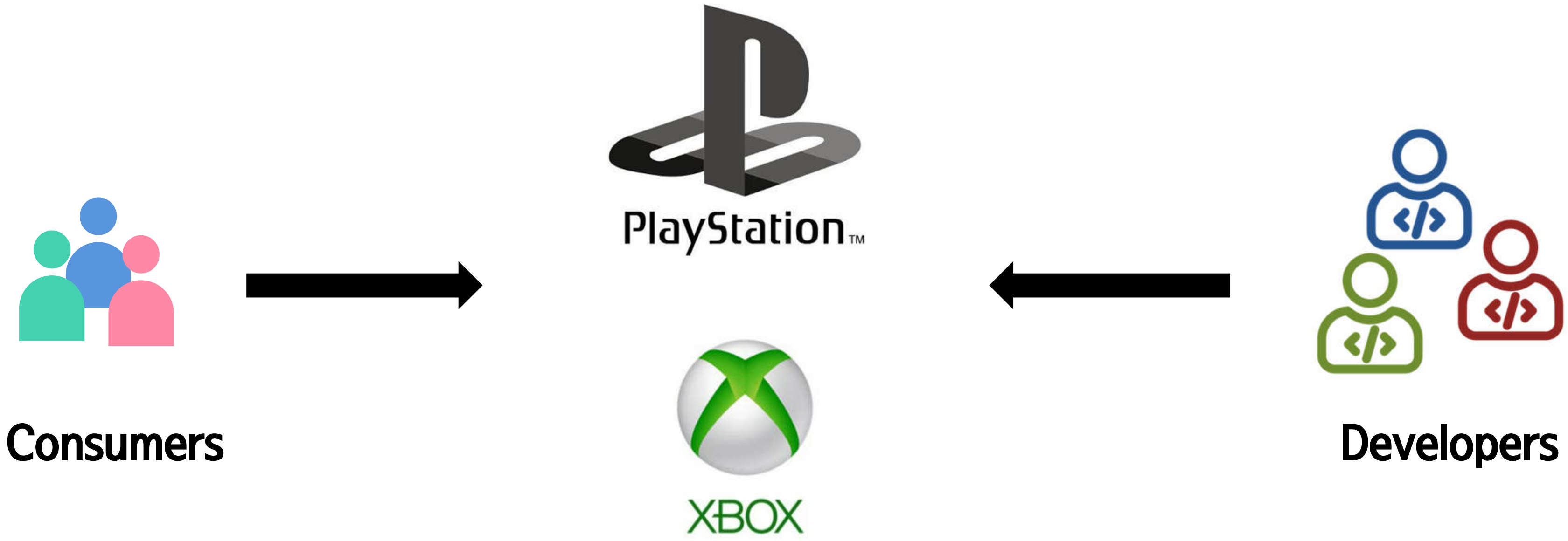
Introduction

What makes people to choose multihoming?

Example : Gaming Console



What is the impact of platform competition on price with agents who choose between single-homing and multi-homing?

Model

Agents and Strategies

Consumers
with different type τ
$(0 \leq \tau \leq 1)$

PlayStation™ XBOX

Platforms = { A, B }

Firms
with different type θ
$(0 \leq \theta \leq 1)$

Consumer's Strategy $s^{\tau} : (p_1^A, p_2^A, p_1^B, p_2^B) \rightarrow \{\varnothing, A, B, M\}$

Firms' Strategy $s^{\theta} : (p_1^A, p_2^A, p_1^B, p_2^B) \rightarrow \{\varnothing, A, B, M\}$

Platforms' Strategy $s^{X} : (p_1^X, p_2^X),\ X = A, B$

Model

Agents and Utilities

Consumers [1]
with different type τ

PlayStation™ XBOX
Platforms = { A, B }

Firms [2]
with different type θ

Consumer's utility (single-homing) : $u_1^X(\tau) = v + \boxed{\alpha_1(\tau)} \cdot n_2^X - p_1^X$

constant for the network effect

Consumer's utility (multi-homing) : $u_1^M(\tau) = \underline{(1+\delta)v} + \alpha_1(\tau) \cdot N_2 - p_1^A - p_1^B$

aggregated value $(0 \le \delta \le 1)$ $N_2 := n_2^A + n_2^B - n_2^M$

Firm's utility (single-homing) : $u_2^X(\theta) = \alpha_2 \cdot n_1^X - \boxed{c\theta} - p_2^X$

cost to provide service on a platform

Firm's utility (multi-homing) : $u_2^M(\theta) = \alpha_2 \cdot N_1 - \underline{(1+\sigma)c\theta} - p_2^A - p_2^B$

$N_1 := n_1^A + n_1^B - n_1^M$

aggregated cost to provide a service on both platforms $(0 \le \sigma \le 1)$

Equilibrium

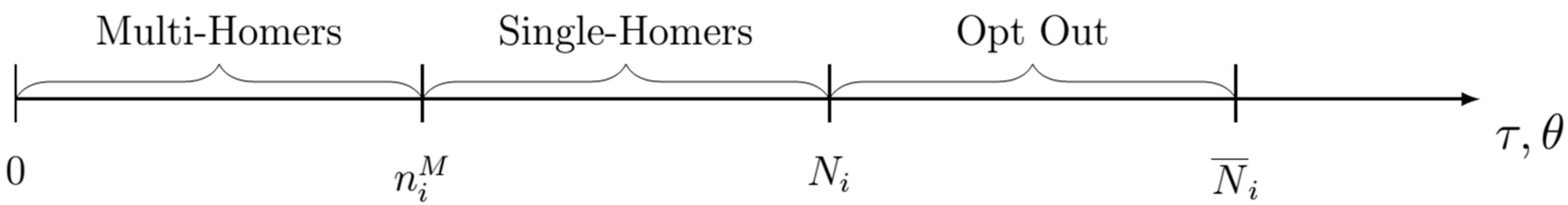
Arbitrary Prices (a. Symmetric Pricing)

Both platforms set the same price $p_i^X = p_i^Y = p_i$

1. Tipping Equilibrium : all participation takes place on one platform

2. Symmetric Participation Equilibrium : participations are equally divided into two

$$n_i^X = n_i^Y = n_i, \; i = 1, 2$$



$$n_1^M = \alpha_1^{-1}\left(\frac{p_1 - \delta v}{n_2 - n_2^M}\right) \quad and \quad N_1 = \alpha_1^{-1}\left(\frac{p_1 - v}{n_2}\right)$$

$$n_2^M = \min\left\{\frac{\alpha_2 \cdot N_1 - 2p_2}{(1+\sigma)c}, \frac{\alpha_2 \cdot (n_1 - n_1^M) - p_2}{\sigma c}\right\} \quad and \quad N_2 = \min\left\{\frac{\alpha_2 n_1 - p_2}{c}, n_2^M\right\}$$

n_i^M N_i depends on the number of agents on the other side

Equilibrium

Arbitrary Prices (b. Price-Undercutting)

One platform sets the lower price $p_i^Y \leq p_i^X$ ➔ All agents participate in platform Y

But consumers multi-home if it guarantees more benefit $p_1^X \leq \delta v$

$$u_1^M(\tau) = (1+\delta)v + \alpha_1(\tau) \cdot N_2 - p_1^A - p_1^B$$

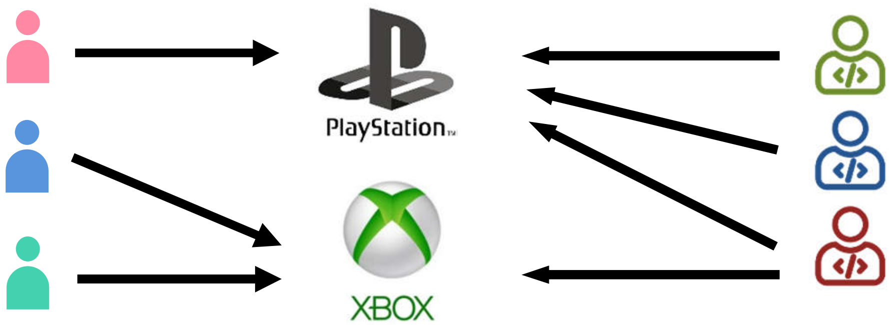
Firms also multi-home if there is a subsidy $p_2^X < 0$

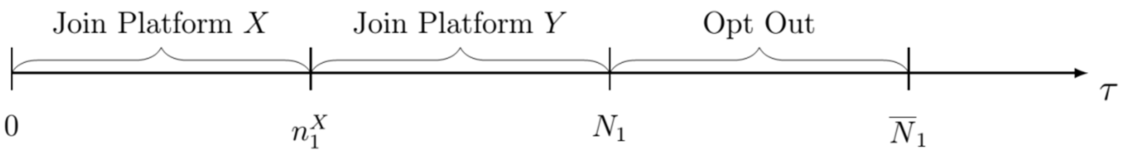
$$u_2^M(\theta) = \alpha_2 \cdot N_1 - (1+\sigma)c\theta - p_2^A - p_2^B$$

Arbitrary Prices (c. Orthogonal Pricing)

Each platform sets the lower price for different groups $p_1^X > p_1^Y$ *and* $p_2^X < p_2^Y$

1. Tipping Equilibrium : all participation takes place on one platform
2. High-valued consumers single-home X, and low-valued consumers single-home Y
   All firms participate in X, and some of them multi-home





Equilibrium

Pricing Game

Platform's profit : $\Pi^X = n_1^X(p_1^X - f_1) + n_2^X(p_2^X - f_2)$

Marginal cost : $f_i \geq 0$

Weak Competition: $f_1 \leq \delta v$

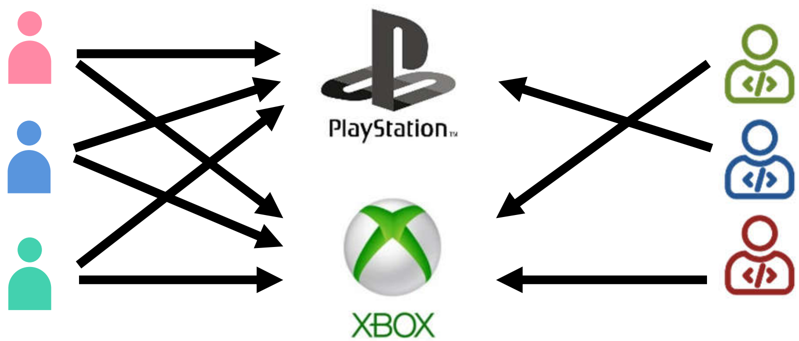
Consumers have incentive to multi-home :

Participating in another platform always gives positive benefit

Unique symmetric equilibrium : $p_1^A = p_1^B = \delta v$ $\quad p_2^A = p_2^B = f_2$

All consumers multi-home *firms that join a platform single-home*

Platform profits are $\Pi^A = \Pi^B = \overline{N}_1(\delta v - f_1)$



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Equilibrium

Pricing Game

Platform's profit : $\Pi^X = n_1^X(p_1^X - f_1) + n_2^X(p_2^X - f_2)$

Marginal cost : $f_i \geq 0$

$\text{Strong Competition; } f_1 > \delta v$

1. **Tipping Equilibrium : all participation takes place on one platform**

2. **Both platforms have participation** $p_1^A = p_1^B = f_1 \; and \; p_2^A = p_2^B = f_2$

   I. **All consumer single-home, all firms multi-home**

   II. **Mix of multi-homing & single-homing consumers with multi-homing & single-homing firms (when network effects are strong)**

   III. **All consumer multi-home, all firms single-home (when v = 0)**

Equilibrium

Pricing Game

Platform's profit : $\Pi^X = n_1^X(p_1^X - f_1) + n_2^X(p_2^X - f_2)$

Marginal cost : $f_i \geq 0$

$\text{Strong Competition; } f_1 > \delta v$

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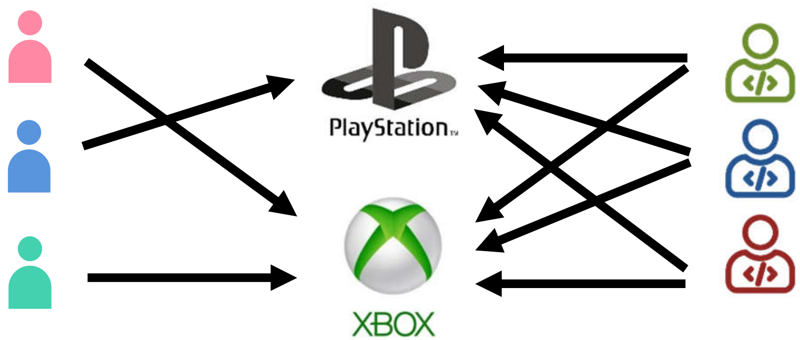
I. All consumer single-home, all firms multi-home



Smartphone Industry

From Symmetric Pricing,

$$n_1^M = \alpha_1^{-1}\left(\frac{p_1 - \delta v}{n_2 - n_2^M}\right) \quad and \quad N_1 = \alpha_1^{-1}\left(\frac{p_1 - v}{n_2}\right)$$

Equilibrium

Pricing Game

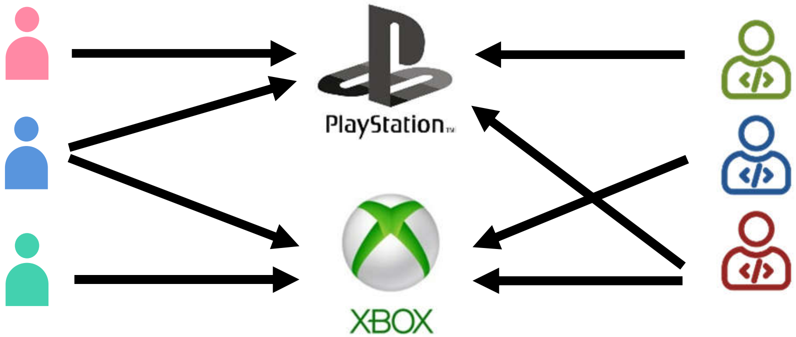
Platform's profit : $\Pi^X = n_1^X(p_1^X - f_1) + n_2^X(p_2^X - f_2)$

Marginal cost : $f_i \geq 0$

$\text{Strong Competition; } f_1 > \delta v$

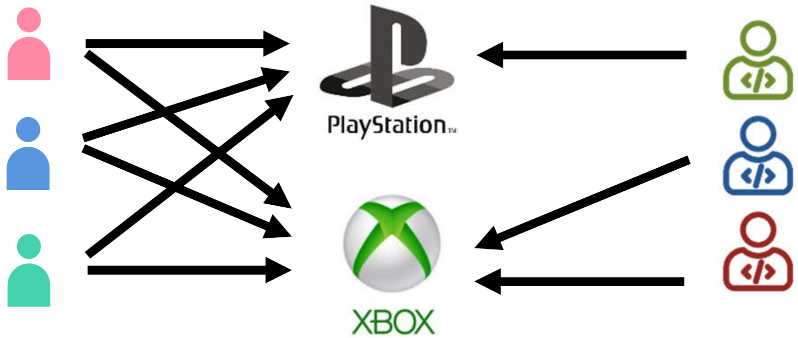
2. Both platforms have participation $p_1^A = p_1^B = f_1 \ and \ p_2^A = p_2^B = f_2$

II. Mix of multi-homing & single-homing consumers with multi-homing & single-homing firms (when network effects are strong)



Game Console Industry

III. All consumer multi-home, all firms single-home (when v = 0)



Ride Sharing Industry (Uber, Lyft)

Conclusion

Contribution

- Consider agents' decision on single/multi-homing endogenously

Main Results

- Reserved value obtained when participating in a platform is large, firms can get multi-homers
- In other case, platforms engage in fierce competition for single-homers (even with zero profit)
- Multiple equilibrium allocations represent real-world market structures