Chapter I – Two-Sided Markets

Competition Policy and Strategy

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Two-Sided Markets – Basics

- One-sided market: downstream firm as retailer of good produced upstream
- Two-sided market:
  - Also called platform market
  - Platform matches agents (e.g., buyers and sellers)
  - Platform internalizes **indirect** network effects/externalities
- Indirect network effects: utility on one market sizes depends on the size of the other market side
  - More stores accept credit card $\Rightarrow$ credit card becomes more attractive for consumers and vice versa.
  - More users of operating system/gaming console/... $\Rightarrow$ operating system/console/... becomes more attractive for developers (more applications/games etc.) $\Rightarrow$ operating system/console/... becomes more attractive for users

Two-Sided Markets – Basics

- Features of two-sided markets
  - Set prices such that both sides participate
  - Competition between platforms: single- vs. multi-homing
  - Difficult to apply "traditional" concepts of competition policy
- Belleflamme und Peitz (2015: 662–683).
  - Two market sides $k \in \{b, s\}$, buyers b and sellers s
  - Platform $i \in \{1, 2\}$
  - Per unit price (usage fee) P_k^i
  - Fixed fee (access/membership fee) M_k^i
- We start with monopoly case (drop index i)
- Pairs of buyers and sellers are matched on platform
- Each buyer has demand function $q(p)$, $q' < 0$
- Sellers have constant marginal cost c.

Two-Sided Markets – Monopolistic Platform

- Seller charges price $p_M = \arg\max_p \ (p - c)q(p)$.
- Surplus/monopoly profit of each seller $\pi = (p_M - c)q(p_M)$.
- Surplus/utility of each buyer $u = \int_{p_M}^{\infty} q(p)\mathrm{d}p$.
- Surplus
  - Sellers realize $v_s = n_b\pi - M_s$, with n_b as the number of buyers on platform
  - Buyers realize $v_b = n_s u - M_b$, with n_s as the number of sellers on platform
  - Number of buyers as function of utility $n_b = N_b(v_b)$
  - Number of sellers as function of utility $n_s = N_s(v_s)$
- Platform incurs constant cost C_b and C_s per buyer and seller, respectively.
- Platform profits $\Pi = n_S(M_s - C_s) + n_b(M_b - C_b)$.

Two-Sided Markets – Monopolistic Platform

- Fixed fees:
  - Buyer: $M_b = N_s(v_s)u - v_b$
  - Seller: $M_s = N_b(v_b)\pi - v_s$
- From platform's optimality condition,

$$\max_{v_s, v_b} \Pi(v_s, v_b) = (N_b(v_b)\pi - v_s - C_s)N_s(v_s) + (N_s(v_s)u - v_b - C_b)N_b(v_b),$$

- we get profit-maximizing fixed fees:

$$M_s = C_s - un_b + \frac{N_s(v_s)}{N_s'(v_s)}, \;\; M_b = C_b - \pi n_s + \frac{N_b(v_b)}{N_b'(v_b)}. \tag{1}$$

- Fixed fees consist of:
  - Cost of access C_k, $k \in \{b, s\}$
  - Minus positive externality un_b and πn_s
  - Measure on participation sensitivity $\frac{N_s(v_s)}{N_s'(v_s)}$ and $\frac{N_b(v_b)}{N_b'(v_b)}$

Two-Sided Markets – Monopolistic Platform

- For a given number of agents on each side of the market, n_k, $k \in \{b, s\}$, we can compute access elasticities for platform,

$$\eta_s(M_s|n_b) = M_s \frac{N_s'(n_b\pi - M_s)}{N_s(n_b\pi - M_s)}, \ \eta_b(M_b|n_s) = M_b \frac{N_b'(n_s u - M_b)}{N_b(n_s u - M_b)}.$$

- Profit-maximizing fixed fess in (1) are thus

$$\frac{M_s - (C_s - un_b)}{M_s} = \frac{1}{\eta_s(M_s|n_b)}, \ \frac{M_b - (C_b - un_s)}{M_b} = \frac{1}{\eta_b(M_b|n_s)}. \tag{2}$$

- The term in (2) is comparable to Lerner-Index (cf. Chapter E).
- Markup per market side reduced by positive externalities
  - Market sides that generates strong network externalities c. p. pays less
  - Fees can even be negative (subsidies)
- Possibly subsidize one market side to increase sales on platform, thereby increasing profits on other market side

Two-Sided Markets – Monopolistic Platform

- Compare monopoly to social optimum:

$$\max_{v_s, v_b} W = \Pi(v_s, v_b) + \underbrace{PS(v_s)}_{\text{Aggregate surplus seller with } PS' = n_s} + \underbrace{CS(v_b)}_{\text{Aggregate surplus buyer with } CS' = n_b}.$$

- From here, we get welfare-maximizing surplus per market side,

$$v_s = (u + \pi)n_b - C_s, \; v_b = (u + \pi)n_s - C_b.$$

- Taking into account surplus per market side ($v_s = n_b\pi - M_s$ and $v_b = n_s u - M_b$), we get the membership-fees:

$$M_s = C_s - un_b, \; M_b = C_b - \pi n_s.$$

- From welfare-maximizing fixed fees correspond to cost of access C_k minus externalities (un_b from viewpoint of sellers and πn_s from viewpoint of buyers).
- A monopolistic platform internalizes externalities as well, but market power enables markups on marginal cost, which is influenced by elasticities/access sensitivity

Two-Sided Markets – Competition Between Platforms

- Platforms 1 and 2 available to both market sides
- Normalize number of buyers and sellers to 1, i.e., $n_k^i + n_k^j = 1,\ k \in \{b, s\},\ i \in \{1, 2\}$
- We get the following surplus for buyers and sellers, resp.,

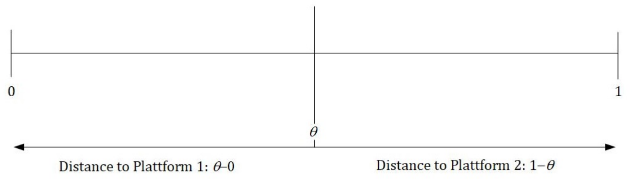
$$v_b^i = n_s^i u - M_b^i,\ v_s^i = n_b^i \pi - M_s^i.$$

- Buyers and sellers are uniformly distributed on interval $[0, 1] \subset \mathbb{R}$
- Platforms are located at endpoints, i.e., $i = 1$ at 0 and $i = 2$ at 1.
- Assume full market coverage
- Opportunity cost of accessing platform increase linearly with rate τ_b and τ_s in traveling distance
- Number of buyers and sellers accessing platform i:

$$n_b^i = \frac{1}{2} + \frac{v_b^i - v_b^j}{2\tau_b},\ n_s^i = \frac{1}{2} + \frac{v_s^i - v_s^j}{2\tau_s},\ \ i, j \in \{1, 2\}, i \neq j.$$

Two-Sided Markets – Competition Between Platforms

- Seller with position $\theta \in [0,1]$ has traveling distance θ $(1-\theta)$ to Platform 1 (2)



- Net-utility of seller θ reads $v_s^1 - \tau_s(\theta - 0)$ $(v_s^2 - \tau_s(1-\theta))$, when accessing Platform 1 (2)
- Seller at $\hat{\theta} \equiv \frac{1}{2} + \frac{v_s^1 - v_s^2}{2\tau_s}$ is indifferent between patronizing platform 1 and 2
- Number of sellers at Platform 1 and Platform 2 resp. read $n_s^1 = \hat{\theta} - 0 = \frac{1}{2} + \frac{v_s^1 - v_s^2}{2\tau_s}$ and $n_s^2 = 1 - \hat{\theta} = \frac{1}{2} + \frac{v_s^2 - v_s^1}{2\tau_s}$

Two-Sided Markets – Competition Between Platforms

- Given that $n_k^1 + n_k^2 = 1$, we have $n_k^j = 1 - n_k^i$.
- It follows that:

$$n_s^i(n_b^i) = \frac{1}{2} + \frac{1}{2\tau_s}\left((2n_b^i - 1)\pi - (M_s^i - M_s^j)\right), \; n_b^i(n_s^i) = \frac{1}{2} + \frac{1}{2\tau_b}\left((2n_s^i - 1)\pi - (M_b^i - M_b^j)\right).$$

- One additional buyer (seller) c. p. attracts $\frac{\partial n_s^i}{\partial n_b^i} = \frac{\pi}{\tau_s}$ ($\frac{\partial n_b^i}{\partial n_s^i} = \frac{u}{\tau_b}$) additional sellers (buyers).
- The ratio $\frac{u\pi}{\tau_b \tau_s}$ measures the relative intensity of indirect network effects. If that ratio is too high ($\frac{u\pi}{\tau_b \tau_s} \geq 1$), only one platform is active.
- For $\frac{u\pi}{\tau_b \tau_s} < 1$, the perceived degree of differentiation between platforms in relation to indirect network effects, measured by u and π, is sufficiently high to support two platforms in the market.

Two-Sided Markets – Competition Between Platforms

- Number of sellers and buyers on platform i:

$$n_s^i = \frac{1}{2} + \frac{\pi(M_b^j - M_b^i) + \tau_b(M_s^j - M_s^i)}{2(\tau_b\tau_s - u\pi)}, \; n_b^i = \frac{1}{2} + \frac{u(M_s^j - M_s^i) + \tau_s(M_b^j - M_b^i)}{2(\tau_b\tau_s - u\pi)}.$$

- The number of sellers on platform i increases when (analogously for buyers)
  - the fixed fee charged from the sellers, M_s^i, decrease
  - the fixed fee charged from the buyers, M_b^i, decrease (indirect network effects)
- We can now compute the profit-maximizing fixed fees of platform i:

$$\max_{M_s^i, M_b^i} \Pi^i = (M_s^i - C_s)\left(\frac{1}{2} + \frac{\pi(M_b^j - M_b^i) + \tau_b(M_s^j - M_s^i)}{2(\tau_b\tau_s - u\pi)}\right) + (M_b^i - C_b)\left(\frac{1}{2} + \frac{u(M_s^j - M_s^i) + \tau_s(M_b^j - M_b^i)}{2(\tau_b\tau_s - u\pi)}\right).$$

Two-Sided Markets – Competition Between Platforms

- Symmetric equilibrium with $M_k^1 = M_k^2 \equiv M_k,\ k \in \{b, s\}$:

$$M_s = C_s + \tau_s - \frac{u}{\tau_b}(\pi + M_b - C_b),\ \ M_b = C_b + \tau_b - \frac{\pi}{\tau_s}(u + M_s - C_s). \tag{3}$$

- Equilibrium fixed fees consist of
  - Marginal cost of access C_k,
  - plus measure of platform heterogeneity, τ_k,
  - minus network effect $\frac{u}{\tau_b}(\pi + M_b - C_b)$ and $\frac{\pi}{\tau_s}(u + M_s - C_s)$: one additional seller attracts $\frac{u}{\tau_b}$ buyers, which induces additional platform profits π from additional seller and $M_b - C_b$ from additional buyers (analogous argument for one additional buyer).
- Stronger network effects $\frac{u}{\tau_b}(\pi + M_b - C_b)$ and $\frac{\pi}{\tau_s}(u + M_s - C_s)$ lead to more intense competition between platforms.

Two-Sided Markets – Competition Between Platforms

- From (3), we get equilibrium fixed fees,

$$M_s = C_s + \tau_s - u, \; M_b = C_b + \tau_b - \pi.$$

- Fixed fees of a given market side decrease in elasticities
  - Market side that exhibits strong indirect network effects c. p. pays lower fixed fees
  - Market side that perceives platform as less differentiated (more homogeneous) c. p. pays lower fixed fees
- If both platforms are active, equilibrium profits read $\Pi^i = \frac{\tau_b + \tau_s - u - \pi}{2}$.
  - Profits increase in degree of differentiation

Two-Sided Markets – Multi-Homing

- Multi-homing: agents are active on multiple platforms at the same time
- Given that multi-homers are active on several platforms, a platform tries to attract single-homers
- Multi-homers' equilibrium surplus is lower because platforms compete for single-homers
- Fixed fees for single-homers might even be lower than marginal cost

Two-Sided Markets – Competition Policy

- Network effects increase tendency for monopolization (Digital Markets Act!)
- Network effects give rise to cross-subsidization similar to multi-product firms
- If network effects are sufficiently strong, it is welfare-maximizing to have a single platform
- Caveats of SSNIP test in two-sided markets
  - Fixed fees and per unit prices $\Rightarrow$ how to asses in SSNIP?
  - Platform internalizes indirect network effects of all market sides $\Rightarrow$ which indirect network effects to take into account with hypothetical increase in price?

Two-Sided Markets – Competition Policy

- Assessment of market power
  - Cost-based analysis of price structure does not make sense due to network effects. Prices above (below) marginal cost not necessarily imply market power (predation)
  - Competition between platforms not necessarily more efficient. Price differences might increase in competition.
  - Exclusivity clauses (Ch. H.3) might harm other market side and competitors (indirect network effects!)
- Collusion between platforms
  - Collusion less stable as prices for each market side have to be affected. Otherwise deviation on other side.
  - Collusion can enhance welfare if indirect network effects are internalized more effectively (NaBanco/Visa)