Dominant Ecosystems and Innovation Slowdown

Pietro Azzali (Compass Lexecon) **Vincenzo Denicolò** (University of Bologna) **Michele Polo** (Bocconi University)

CRESSE Conference 2023 - Rodhos

Motivation

- Growing concerns about **market power of big tech**
  - Turn-over larger than the GDP of many countries, access to personal and business data
  - Enhanced enforcement: DMA in EU, several bills under discussion in the US Parliament.
- A more specific concern that such market power is maintained through a strategy of systematic **acquisitions of potential competitors** while they are still small
- Acquisitions of innovative start-ups by tech giants is indeed a **common phenomenon**
  - 42 acquisitions by Amazon, 33 by Apple, 21 by Facebook, 48 by Google, and 53 by Microsoft in the period 2015-2020.
- A **policy failure**?
  - the phenomenon is largely undetected by competition authorities («**stealth consolidation**»)
  - and when it is not, acquisitions are often **cleared**

Two conflicting views on the effects of acquisition of start-ups

- **Pro-competitive** (**invention-for-buyout**)
  - Transferring innovations to large firms increases their value and incentivizes the innovative effort of start-ups
- **Anti-competitive**
  - Killer acquisitions, kill zone, substitute vs. complements to avoid the incumbent's reaction

This paper

- A different anti-competitive mechanism that may take place in the long-run, the **entrenchment of monopoly**
- **Incumbent's strength** depends on the value of its ecosystem and **reduces the innovative effort** of start-ups
- Today's acquisitions **strengthen** the incumbent's dominance (i.e., its competitive advantage vis-à-vis rival platforms) and thus **stifle** tomorrow's innovation of start-ups

Literature

- **Static models (single innovation)**
  - Invention-for-buyout (+): Mason and Weeds (2013), Phillips and Zhdanov (2013), and Letina et al. (2020), Fumagalli et al. (2022)
  - Killer acquisitions (-): Cunningham et al. (2021)
  - Kill zone (-): Kamepalli et al. (2020)
  - Direction of innovation (+/-) Letina et al. (2020), Shelegia and Motta 2021, Dijk, Moraga-Gonzàlez and Motchenkova (2021), Bryan and Hovenkamp (2020)
- **Dynamic models (sequence of innovations)**
  - Segal and Whinston (2007), Cabral (2018, 2021), Katz (2021), Hollenbeck (2019), Mermelstein et al. (2020)
  - **Denicolò and Polo (2022)**, market dominance evolves over time (entrenchment of monopoly): **substitute products**
  - This paper: acquisition of **complementary products** developed by start-ups.

Preview of set-up and results

Set-up

- **two platforms** offering a primary product, homogeneous consumers, Bertrand competition, **start-ups** choose value of complementary products, platforms compete to **acquire** the start-ups >> **ecosystems:** bundles of integrated products**.**

Two periods model: short run/ long run.

- Firms ex-ante symmetric, acquisition creates an advantage to the first acquirer.
- **Increasing dominance:** the winner of the first auction wins also the second.
- **Decreasing innovation:** innovation falls down as dominance consolidates
- **Welfare**: inefficiently low innovation in the second period.
- A restrictive **policy** (the dominant firm cannot bid for the second start-up): no impact on innovations, lower utility in the second period.

The set-up

2 firms a,b: homogeneous **primary product** of stand-alone value 1, marginal cost k;

2 start-ups: s_t offering a **new product** of value v_t, marginal cost 0, development cost $C(v_t) = v_t^2$

Timing: 2 periods; in each period:

1. Start-up s_t chooses the **value** v_t of the product
2. Firms **bid** B_t^i for acquisition:
   - if s_t **accepts** the bid, the acquirer can sell separately the primary and new product or **combine** them exploiting their complementarity σ, with utility:
   $$U^i = 1 + v_t(1 + \sigma);$$
   - if s_t **rejects** both offers it sells directly to the consumers at the stand alone value $U^s = v_t$
3. Firms post the **prices**.

Continuation equilibrium in the second period

- **Price equilibria:** (focus on the equilibrium path); let w be the winner and l the loser of the first auction
  - if w acquires also the second start-up, it offers $(\mathbf{1}, \mathbf{v}_1, \mathbf{v}_2)$ while l offers $(\mathbf{1}, \mathbf{0}, \mathbf{0})$: w offers the products in a **bundle**

$$\begin{aligned} p_2^{ww}(1, v_1, v_2) &= (v_1 + v_2)(1+\sigma) + k \\ p_2^{ll} &= k. \end{aligned}$$

  - If l acquires the second start-up, w offers $(\mathbf{1}, \mathbf{v}_1, \mathbf{0})$ and l offers $(\mathbf{1}, \mathbf{0}, \mathbf{v}_2)$. If $v_1 \geq v_2$, both firms adopt mixed bundling. Consumers buy the bundle from w and product v_2 from firm l:

$$\begin{aligned} \hat{p}_2^{wl}(1, v_1, 0) &= v_1(1+\sigma) - \sigma v_2 + k \\ \hat{p}_2^{lw}(1, 0, 0) &= k, \\ \hat{p}_2^{lw}(0, 0, v_2) &= v_2, \\ \hat{p}_2^{lw}(1, 0, v_2) &= k + v_2 \end{aligned}$$

- **Equilibrium profits**:
  - if w **wins the second auction**

$$\begin{aligned} \hat{\Pi}_2^{ww} &= (v_1 + v_2)(1+\sigma) \\ \hat{\Pi}_2^{ll} &= 0 \end{aligned}$$

  - *If* l **wins the second auction** *(and* $v_1 \geq v_2$*)*:

$$\begin{aligned} \hat{\Pi}_2^{wl} &= v_1(1+\sigma) - \sigma v_2 \\ \hat{\Pi}_2^{lw} &= v_2. \end{aligned}$$

- **Equilibrium bids**: maximum bid: difference in profits when winning or losing the auction.
  - w has a **higher willingness to bid**:

$$\bar{B}_2^w = \hat{\Pi}_2^{ww} - \hat{\Pi}_2^{wl} = v_2(1+2\sigma) > \bar{B}_2^l = \hat{\Pi}_2^{lw} - \hat{\Pi}_2^{ll} = v_2$$

  - w wins the second auction (**increasing dominance**) posting $\bar{B}_2^l$:

$$\hat{B}_2^w = v_2 = \Pi_2^s.$$

- **Start-up development choice**:

$$\hat{v}_2 = \arg\max_{v_2} \pi_2^s = \hat{B}_2^w - v_2^2.$$

Hence:

$$\hat{v}_2 = \frac{1}{2}.$$

Period 1

- **Price equilibria**:

$$\begin{aligned} p_1^w &= k + v_1(1+\sigma) \\ p_1^l &= k, \end{aligned}$$

with **profits**

$$\begin{aligned} \Pi_1^w &= v_1(1+\sigma) \\ \Pi_1^l &= 0. \end{aligned}$$

- **Value of the game** at the bidding stage if winning or losing the first auction:

$$\begin{aligned} V_1^w(v_1, \hat{v}_2) &= \hat{\Pi}_1^w(v_1) + \delta \hat{\pi}_2^w(\hat{v}_2(v_1)) = (1+\sigma)v_1(1+\delta) + \frac{\delta\sigma}{2} \\ V_1^l(v_1, \hat{v}_2) &= 0. \end{aligned}$$

Period 1

- **Equilibrium bids**: since firms are initially symmetric both post the entire value of winning the first auction

$$\hat{B}_1(v_1) = V_1^w(v_1, \hat{v}_2) = (1+\sigma)v_1(1+\delta) + \frac{\delta\sigma}{2}.$$

- First start-up **development choice**: $\pi_1^s = \hat{B}_1 - v_1^2$ and therefore:

$$\hat{v}_1 = \frac{(1+\sigma)(1+\delta)}{2} > \hat{v}_2.$$

Proposition 1: *When both firms at the start offer a primary product of equal value, there exists a unique Subgame Perfect equilibrium in the two-period model in which the winner of the first auction wins also the second one, entrenching its dominance and realizing zero net profits; the pattern of values of the products developed by the two start-ups is decreasing:* $\hat{v}_1 > \tilde{v}_2$.

Comments:

- **Increasing dominance and decreasing innovation**
- The loser of the first auction cannot commit to reward a high value of the second product (**hold-up problem**)
- Competition intense in the first period: high innovation (**invention-for-buyout**), all profits dispersed, rents to the first start-up;
- Competition relaxed in the second period due to uncontestable dominance: low innovation (**entrenchment of dominance**).

State-contingent (restrictive) policy: a dominant firm cannot acquire a start-up

- Hence, the winner of the first auction cannot bid for the second start-up. Period 2 changes.
- **Price equilibrium**: as in the baseline model: firm *I* mixed bundling:

$$\begin{aligned}
\hat{p}_2^{wI}(1, v_1, 0) &= v_1(1+\sigma) - \sigma v_2 + k \\
\hat{p}_2^{Iw}(1, 0, 0) &= k, \\
\hat{p}_2^{Iw}(0, 0, v_2) &= v_2, \\
\hat{p}_2^{Iw}(1, 0, v_2) &= k + v_2
\end{aligned}$$

- **Equilibrium bidding**: firm *I* bids the **start-up outside option**

$$\hat{B}_2^w = v_2 = \Pi_2^s.$$

- **Development choice**:

$$\hat{v}_2 = \frac{1}{2}$$

- **Equilibrium bidding** for the first start-up:

$$\hat{B}_1 = V_1^w(v_1, \tilde{v}_2) - V_1^l(v_1, \tilde{v}_2) = (1+\sigma)v_1(1+\delta) + \frac{\delta}{2}(\sigma - 1)$$

- **Development choice**:

$$\hat{v}_1 = \frac{(1+\sigma)(1+\delta)}{2} > \hat{v}_2.$$

- The equilibrium values of the new products **do not change**
- But the second product is sold separately, **reducing** gross utility and **total welfare** since **complementarity is not exploited**.

Proposition 3 (**Welfare comparisons):** *The comparison of the first best outcomes and the equilibrium outcomes in the unrestricted and restricted regimes gives the following rankings:*

$$\begin{aligned} \hat{v}_1^{FB} &= \hat{v}_1^U = \hat{v}_1^R > \hat{v}_2^{FB} > \hat{v}_2^U = \hat{v}_2^R, \\ \hat{W}^{FB} &> \hat{W}^U > \hat{W}^R. \end{aligned}$$

Conclusions

- The equilibrium displays a patters of **increasing dominance and decreasing innovation**;
- The possibility of **taking the market leadership** through superior ecosystems stimulates high bids, which in turn incentivize the start-up to develop valuable innovations;
- Until the market is **contestable** firms bid all the value of becoming the market leader, dispersing the overall profits to the advantage of the first start-up;
- Once dominance becomes **non contestable**, bids fall down to the outside option of the second start-up, driving down innovation.
- The loser of the first auction cannot commit to reward a high innovation that would allow to catch-up (**hold-up problem**)
- A policy that gives **a second chance to the loser** of the first auction does not affect the innovation and reduces welfare due to a **suboptimal bundling of products**.