

A Theory of Digital Ecosystems

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Today: develop a theory of ecosystems connecting both observations.

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Shazam* → Apple Music* / Google's alternative → YouTube*

Facebook → WhatsApp* / Facebook Messenger / Instagram*

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- Apple Maps became the dominant iPhone maps application.

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III. Implications for regulating digital ecosystems:

- Ecosystems consolidate — and steer users to — good services.
- But: often reduced entry (for buyout) and innovation incentives.

Model

Basic setup

There are two markets $s \in \{a, b\}$.

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Firms can be (weakly) ranked in terms of the quality they offer.

- All else equal, we assume a better firm has a higher market share.

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→ Ecosystems can **steer consumers across markets** (via defaults).

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Today: I'll impose this assumption throughout to simplify exposition.

Preliminaries

Default advantage (α_i^s): increase in firm i 's demand in s when it is the default (rather than the default being randomly drawn).

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Lemma (Default Advantage and Externalities)

I. If i is better than i' , then $\alpha_i^s > \alpha_{i'}^s > 0$.

II. If i is j 's strongest competitor, then $\eta_{ji}^s < 0$.

Emergence of Ecosystems

Cross-market leverage increases the incentive to grow

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- Larger increase when G has more demand in market a .

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This also means that G gets a **discount** on the takeover price.

Takeover of the market leader in equilibrium

When taking over t , firm G 's net profit in market b is given by

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- Discount makes takeover preferable to self-development. [Details](#)

Endogenizing the acquirer and the emergence of ecosystems

Now every firm in markets a and b can “apply” to be the acquirer.

- The selected acquirer plays the same takeover game as before.

The firm that generates the highest takeover profits is selected.

- Reduced form for most willing to bear the costs.

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Proposition (Forward-Integration by Market Leaders)

The market leader at the access point a earns most from a takeover.

Four lessons on ecosystem growth

1. **Lesson:** market leaders at access points grow through takeovers.
 - Examples: Google – YouTube, ITA Software (Flights), Where 2 Technologies (Maps); Microsoft – Hotmail, Skype, LinkedIn; Meta – WhatsApp, Instagram; ...
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3. **Lesson:** grow through self-development if takeover not possible.
 - Default advantage increases profits from self-development.
 - Examples: Google – Gmail; Microsoft – Edge; Uber – UberEats; ...
4. **Lesson:** possibly backward-integration by existing ecosystems.
 - Backward integration generates strictly positive profits.
 - Examples: Google – Fitbit; Meta – Oculus VR.

Access-Point Markets

Default assignment at the access point

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Proposition (Benchmark: Efficient Default)

With only single-market firms, the best product becomes default in a .

- Complementarity: firm with best product values default most.

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Losing consumers to another ecosystem is particularly bad.

- Helps to justify Google's huge payment for the search default.

Welfare and Policy

Policy: motivation and basic assumptions

Variety of recent laws with the aim to curb the power of “big tech”

- DMA 6(5), 6(6): limits to self-preferencing (**leverage policies**).
- DMA 6(3), 6(4): easy-to-change defaults (**access-point policies**).

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Valuable services: consumers benefit from finding best provider.

- E.g., search, maps, audible, ...
- Arguably not social media (Allcott et al 2020, Bursztyn et al 2023)

Forced choice not optimal: consumers benefit from a better default.

- Seems plausible in online setting with many low-stake decisions.
- Rules out some “as-if switching costs” (Goldin and Reck 2022).

Short-run (convenience) benefit vs. long-run harm

Short-run benefit: ecosystems consolidate and steer to good services.

Short-run (convenience) benefit vs. long-run harm

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Both leverage and access-point policies increase incentives for entry.

- **Double dividend**: (good) entry in *a* raises entry incentives in *b*.

Some concluding remarks

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Obvious (final) question: why don't we see offline ecosystems?

- Some do exist: e.g., tropical hotels offering many services.
- But steering might often be harder in offline settings than online.

Competition does not necessarily help and may hurt targets

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Look for [subgame perfect equilibrium](#) in which bidders [bid cautiously](#).

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All acquirers up to the one with the n^b -highest default setting power, but no other potential acquirer, complete a takeover and pay $f^* < V^b$.

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- Thus, the default advantage α^b to any firm in b is equal to minus the sum of the default externality to others: $\alpha^b - (n^b - 1)|\eta^b| = 0$.
- Competition means targets get $q_{n^b+1}^a \alpha^b$, but suffer $(n^b - 1)|\eta^b|$ times the higher default setting power of the rivals.

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2. Require bidders to play iteratively weakly undominated strategies in that reduced game.

[▶ Back to Takeover Game](#)

Takeovers are more profitable than self-development

Suppose G could hire a team and self-develop service b at c , or let the team start a company offering the service and take over the company.

- Maybe weird, but fair comparison because number of firms fixed.

Firm G prefers the takeover if c is above the takeover price.

Hence, G may use a takeover even if c is well below the extra profits.

- Note: this would never happen without cross-market leverage.

Even if G makes a takeover in equilibrium, its option to self-develop the product remains relevant → threatening outside option.

▶ Back

Related literature

Literature on ecosystems.

- Mostly informal (e.g., Eisenmann et al 2011, Condorelli & Padilla 2020).
- One formal theory of conglomerate mergers: **Chen & Rey (2023)**.
 - We derive endogenous convenience benefit to consumers.
 - Direction of takeovers + importance of access-point markets.
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“Default effects” in a single digital market (e.g., [Chen & Schwartz 2023](#), Ostrovsky 2023, [Hovenkamp 2023](#), Decarolis et al 2022, Denicoló and Polo 2024).

- Some analogs of our efficient default with single-market firms.

Literature on digital markets (e.g., Jeon et al 2023, Teh and Wright 2020, Hidir and Vellodi 2020, Heidhues et al 2023, Bryan and Hovenkamp 2020, ...).