App Store Competition

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App stores and fees

- Apple and Google charge 15-30% fees for in-app purchases (paid downloads, subscriptions, content).
- They have traditionally prevented or hindered third-party app store installation,
- Have also prohibited or hindered steering and side-loading by app developers.
- This has lead to complaints from developers over what they see as excessive fees, and to extensive litigation.
  - E.g., Epic vs. Apple and Google in 2020, and Epic vs. Samsung in 2024.

Third-party competition

- EU: In 2023 the EC designated Apple's App Store and Google's Play Store as *Core Platform Services* under the Digital Markets Act (DMA).
  - Article 6 requires them to allow third-party app stores.
  - Article 5 requires them to allow for steering free of charge.
  - Expected outcome: increased competition and lower fees
- US: Following Epic's "wins" against Apple and Google, these firms cannot prevent steering.
  - Court of Appeals: partial reversal. Apple can charge for steering, but commission fee should not be *prohibitive*.
  - Apple can force developers to use the store's system.

Observed effects

- EU:
  - Limited entry of third-party app stores.
  - Mostly specialized (niche) or superstar-backed stores (e.g., Epic Games).
  - Third-party stores have not attracted many users (and developers).
  - Apple and Google allow for steering but charge fees to do so.
  - Probably does not conform with the DMA.
  - Limited steering has been observed.
- US:
  - Limited steering.
  - Apps that have implemented it have maintained (or increased) prices.
  - Exception: apps that allow for multiple payment channels.


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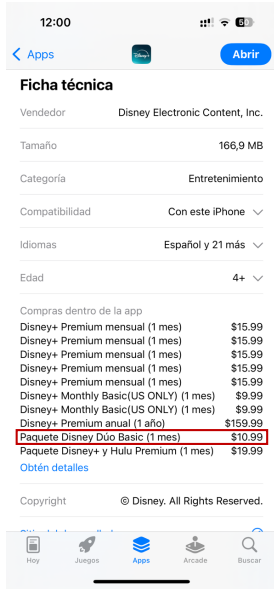
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Our paper

- We study the effects of within-device third-party app store competition and steering (sideloading).
- Head-to-head competition from a third-party store is unlikely to succeed in lowering fees.
  - Vertical restrictions allow the third-party store to compete and are procompetitive.
- Steering (sideloading) can lower fees, but app prices may not change and can even increase.
  - If sellers offer multiple payment channels, app prices are more likely to decrease.

Related Literature

- Competition between app ecosystems
  - Etro 2023, Jeon and Rey 2024, Teh and Wright 2024
- Monopoly app stores
  - Anderson and Bedre-Defolie 2024, Gans 2024
- Freemium pricing models
  - D'Annunzio and Russo 2024
- Platform fee regulation
  - Bisceglia and Tirole 2024, Gomes and Mantovani 2024, Wang and Wright 2024
- Edgeworth Paradox
  - Luco and Marshall 2020, Armstrong and Vickers 2024, D'Annunzio and Russo 2024, Karle, Preuss and Reisinger 2025

Baseline model

Agents

- Two-sided market:
  - Mass 1 of consumers, each owning a device
  - Mass 1 of developers may develop and sell apps through app stores
  - Store A is an integrated store, pre-installed on user devices
  - Store B is a third-party store, which requires user installation

Actions

- Users choose whether to install B and which apps to consume.
  - Valuation $v_i \sim F$ for app i (different across apps, common across stores)
  - Cost $\sigma \sim G$ for installing store B
- Developer i charges p_{iA}, p_{iB} (possibly different) in A and B.
  - Earns "untaxed" complementary revenue λ per consumer (e.g. ads, data)
  - Has cost $k \sim H$ for developing the app, costless multihoming
- Stores charge ad valorem fees on transaction revenues
  - a for store A and b for store B

Timing

1. App stores set commission fees, which become publicly observable.
2. Each developer decides whether to develop and on which store to sell. These decisions become publicly observable.
3. Each consumer decides whether to install store B.
4. Each developer i sets app prices p_{iA} and p_{iB}.
5. Consumers observe prices and learn their valuations. Each consumer decides which apps to consume, and from which store to buy each. Consumers pay prices to developers, which pay commission fees to app stores.

This timing makes sense if developers are *"small"* (do not affect adoption of B).
In an extension, we invert 3 and 4 for *"superstar apps"* that can affect adoption.

Analysis of the baseline model

Stage 5. App Purchase

- Suppose for the moment that developers multihome.
- If a consumer has installed B, she will either consume the app from the store with the lowest price or not consume it.
- If a consumer has not installed B, she will either consume the app from A or not consume it.

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- If p is the lowest available price for an app, demand and consumer surplus are

$$d(p) = 1 - F(p), \qquad s(p) = \int_p^\infty (v - p) dF(v).$$

Stage 4. Price Setting

- Suppose m consumers have installed store B (which implies that $1-m$ consumers can only access apps through A).
- If $p_{iB} \leq p_{iA}$, m consumers buy from B and $1-m$ from A, and developer i's profit is

$$m\left[(1-b)\,p_{iB}+\lambda\right]d(p_{iB})+(1-m)\left[(1-a)\,p_{iA}+\lambda\right]d(p_{iA}).$$

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- If $p_{iB} > p_{iA}$, all consumers buy through A, and i's profit is

$$\left[(1-a)\,p_{iA}+\lambda\right]d(p_{iA}).$$

Optimal prices

- Suppose $b < a$ and $\lambda > 0$, and consider the prices $\hat{p}_{iA}, \hat{p}_{iB}$ that maximize the profits coming from each store, assuming $\hat{p}_{iB} < \hat{p}_{iA}$.

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  - As the fee increases, the seller turns to increasing revenue in the "untaxed" market, for which it lowers the price in the taxed market.

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- **Price parity holds even more directly if $\lambda = 0$.**
- If $b > a$, the seller prefers not to sell through B, and sets $p^*_{iB} > p^*_{iA}$

Natural monopoly

- Stage 3. Installation of store B
  - If $b > a$, consumers anticipate that prices will be larger in B.
  - If $b < a$, consumers anticipate that developers will choose price parity.
  - In either case, they have no incentive to install store B.
- Stage 2. Development
  - Developers anticipate that no consumer will install store B.
  - Thus, they only care about fee a.
  - No equilibrium with singlehoming on B. Multihoming or SH on A are equivalent
- Stage 1. Fee setting
  - The integrated store behaves as a monopolist.
  - The equilibrium fee is the same as in the monopol.

Result caused by three factors

1. Default advantage of integrated store.
2. Intra-brand competition.
3. Edgeworth paradox.

Alternative policies and strategies

- Exclusive content provision by the third-party store allows for market sharing but does not necessarily lower fees.
- Competition for superstar apps decreases the fees for these apps, but not necessarily the fees for small developers. App prices may increase.
- A net price parity clause by the third-party store (a type of vertical restraint) leads to lower fees and app prices, benefiting developers and consumers.
- The third-party store can also succeed by targeting apps with positive marginal cost, or freemium business models.

Findings

- App store competition may not lead to lower fees.
- Even if fees go down, app prices may not.
- Cases in which app prices go down:
  - Vertical restraints from third-party app stores.
  - Apps with positive marginal costs or freemium business models.

Thank you!

Exclusive content or standalone functionality

- Suppose users receive an exogenous benefit δ when installing B (similar to assuming some consumers have zero installation cost)
- In equilibrium, some users install store B (although price parity remains)
- B can induce sellers to sell in its store by charging a smaller fee than A
- Mixed strategy equilibrium in the simultaneous-move game
  - Firms mix in an interval that includes the monopoly fee
  - Both firms have positive expected profits
- Similar issue with other extensions (they endogenize B's advantage, but have similar price equilibria)

Consider three extensions

- Free or open source store
  - B charges zero fee
  - A internalizes the effect on developer's profit and increases its fee until the average fee is equal to the monopoly one
  - A's profits decrease. No effects on developer entry, app prices, and consumer surplus
- Price leadership (by A)
  - A sets a price first, then B
  - A sets the monopoly fee, B imitates it. Average fee does not change.
- Penetration pricing (by B)
  - B chooses a fee such that A does not want to exclude it from the market
  - A sets a higher fee than the monopoly one. The average fee increases.

Superstar apps

- Superstar affects adoption of B by consumers.
- Stores charge fees a_S and b_S to the superstar.
- If $b_S < a_S$ the superstar sets a lower price in B. Price parity breaks down (for the superstar).
- As a store lowers its superstar fee, it increases its revenues from other apps.
- A and B compete intensely for the superstar.

Superstar apps: results

- Focus on free third-party store to avoid mixed strategies.
- If the Edgeworth effect is not too large, A sets a smaller fee for the superstar than when it is a monopolist.
- Superstar and entrant benefit, but there is no effect on the average fee of other developers.
- Consumers obtain a higher surplus from the superstar.
- The superstar may lose from auctioning off exclusivity.

Steering: Model

- Developers can steer consumers towards their direct channel for free.
- No third-party store.
- Apps differ in the nuisance cost for consumers of paying outside the app store.
- Nuisance cost includes the cost of registering, entering payment details, etc.
- Nuisance cost differs at the app level, but not at the consumer level.

Steering: Results

- Apps with low steering costs prefer to steer consumers towards their own payment channel.
- Apps with high steering costs prefer to use the store's channel.
- Integrated store lowers its fee to induce more developers to use its payment system.
- This reduction in the fee benefits developers.
- But the Edgeworth Paradox still holds, and thus app prices increase.
- Consumers may still benefit because the number of apps increases (innovation effect).

Steering: Heterogeneous consumer costs (in progress)

- If consumers' nuisance costs for outside payments are heterogeneous, developers may find it optimal to allow for multiple payment channels.
- Reason: developers want to discriminate among consumers.
  - Charge higher price in the store (to target consumers with high costs), and lower price in direct channel (to target consumers with low costs).
- In-store app prices may increase or decrease. Off-store prices may be smaller than prices without steering.

Steering with heterogeneous nuisance costs for consumers

- Consumer valuations fixed at $v > 0$.
- No store B, but developers can offer an alternative payment method.
- Alternative method has nuisance cost $\eta \sim Z$ for consumers.
- Developers set price $p_{iA} = v$ on store A and $\tilde{p}_i < v$ on side-loading channel.
- Store lowers its fee to induce developers to increase their side-loading prices.
- Consumers and developers benefit.

Removing Default Advantage

- Regulatory intervention introduces a choice screen (such as those for web browsers or search engines).
- Device has no pre-installed store. First installation (of A or B) is free, second incurs positive cost.
- If consumers do not multihome, price parity breaks down.
- Multiple equilibria, depending on whether and where consumers and developers singlehome.
- Refinement: integrated store has focal point advantage.
  - Same equilibrium as benchmark model.

Positive marginal costs

- Some developers have positive marginal costs, larger than complementary revenues (e.g., AI-powered apps).
- For these developers, there is positive pass through and no price parity.
- Third-party store has incentives to lower its fee to go after these developers.
- Integrated store does not lower fee much because it focuses on the other developers.
- Third-party store is able to attract these developers, and also captures value from other developers.
- App prices of developers with positive marginal costs decrease, prices of other developers increase.

Developers with freemium business models

- Suppose that developers have a freemium business model:
  - Basic, free, version of the app with ads.
  - Premium version without ads for a positive price.
- Then, an increase in the fee makes the developer want to increase its ad revenues, for which it increases its price (positive pass through).
- This argument works if ads or data revenues are significantly larger in the free version than in the premium version.