Competition in the ad-tech stack and integration

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March 2, 2023

Abstract

In this paper, we study competition in the ad-tech stack and in online display advertising. More precisely, we study the ability of an ad-tech stack incumbent to leverage a downstream position in the display advertising market to increase market power, thanks to integration. We consider competing display advertising platforms that use some ad-stack services to offer their ad-space. We show that integration is a way for the ad-tech stack incumbent to deter entry more easily through offering softened competition on the consumers' side. Overall, integration is detrimental to both competition and consumers.

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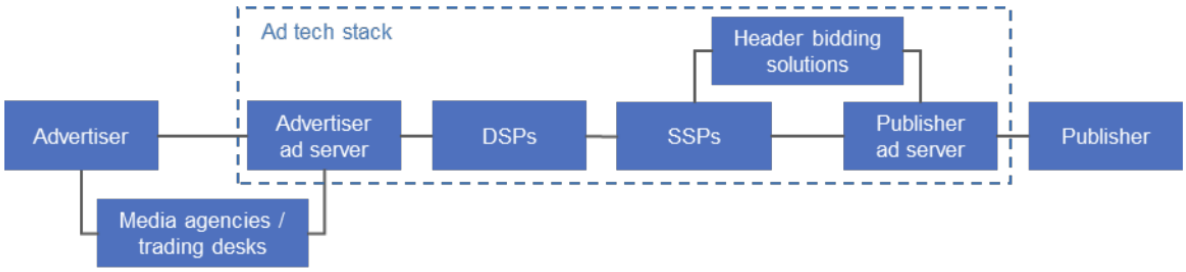
1 Introduction

Big Tech companies like the GAFAMs have managed to become some of the most, if not the most, influential companies in the world. They operate in highly concentrated markets, in which they usually are the dominant players. While concerns regarding their dominance is nothing new, competition policy has yet to catch up to digital markets.

One of the key features of the digital economy is the increased importance placed in a firm's business model. Most of the revenue in Big Tech, for example, comes from advertising. Often acting as gate keepers, Big Techs control major flows of revenues and information online. This raises concerns about potential anti-competitive practices that they may engage in. These concerns proved relevant, judging from the 2017 Google Shopping decision by the European Commission for example, which resulted in a 2.42 billion euros fine. Google has been under competition authorities' scrutiny for its search advertising activities but not only... The so-called "ad-tech", in which Google is dominant, is also a matter of concern.

The Competition and Market Authority (2020) issued a report on online advertising that includes a detailed overview of both search and display advertising. They also importantly analyse Google's dominance in the "ad-tech stack", which is the chain of intermediaries between online advertisers and ad publishers. The following figure outlines its composition:



Source: CMA.

According to interviews conducted by the CMA, there is strong trend of vertically integration in the ad-tech stack and of market concentration. They state: "The case of Google is noteworthy because not only does it operate along the entire value chain, but it also has the largest shares of supply among providers at each level of the chain." (p.271).

These concerns are shared with the French Competition Authority. In 2021, they fined Google for abuse of dominant position in the ad-tech stack after committing several anti-competitive behaviours. The Department of Justice of the United States of America is also currently suing Google, with an even more exhaustive list of anti-competitive violations.

The CMA, however, does not solely focus on Google's dominance in the ad-tech stack alone, but also relates it to its own display advertising solutions (mainly on YouTube). They write "[Google] also has a strong position in display advertising [...] through its

YouTube platform." (p. 280), then continuing with: "Google can leverage the importance of YouTube to increase its market power [...]" (p. 280).

This concern about Google's ability to leverage its downstream position with YouTube will be the focus of this paper by assessing whether integration with a downstream display advertising platform can increase the market power of an ad-tech stack incumbent.

In this paper, we build a model accounting for vertical relations in the display advertising market. We consider two two-sided platforms (or publishers), that display ads to their consumers and thus competing for consumers' attention. However, as the revenues of these platforms solely come from advertising, they must tread carefully as to how many ads they show as their consumers dislike receiving them. We assume that these platforms do not own their advertising technology and need to use the ad-tech stack to be able to reach advertisers and offer their ad-space. We consider an incumbent in the ad-tech stack, threatened by the entry of a more efficient entrant.

As we want to examine the ability of an ad-tech stack incumbent to leverage a downstream position in display advertising, we will consider two situations: a separated incumbent and an integrated incumbent. We discovered that, consistent with the CMA's claim, that integration with a downstream platform indeed allows the incumbent to leverage this position and deter entry more easily, as well as increase market power, to the detriment of both consumers and display advertising platforms.

Our paper relates to two strands of literature: the literature on vertical relations and foreclosure (Ordover, Saloner and Salop (1990), Rey and Tirole (2007), Salinger (1988)...) and the literature on platforms and advertising business models (Caillaud and Jullien (2003), Rochet and Tirole (2003), Armstrong (2006)...). This paper relates more closely to an analysis of Anderson and Coate (2005) adding a vertical dimension, and to De Corniere and Taylor (2014), who focus on similar research questions but in the search advertising market.

We present our paper in the following four sections. In Section 2, we present the model. In Section 3, we study the case of a separated incumbent, and then, in Section 4, compare it with the integrated incumbent. Lastly, in Section 5, we provide concluding remarks on our analysis.

2 Model set-up

Platforms. We consider two competing platforms (or publishers), P_1 and P_2, that are both ad-financed. These two platforms compete downstream for consumers' attention, in the display advertising market. Access is granted for free to consumers and revenues solely come from advertising. We assume that platforms serve consumers at zero marginal cost.

Advertisers can run a advertising campaign on platforms. If they do so, an ad is displayed to every consumer of the platform. Platform P_i chooses its campaign price $p_i \geq 0$.

On the consumer side, these platforms compete for consumers' attention in the advertising-level dimension. Platforms can choose their ad-level i.e. the number of advertisers they want to run ad campaign. We denote this level by $0 \leq a_i \leq 1$ for P_i. We assume that ad-space is provided at zero marginal cost. When a_i is low, it means that there is very little ad-space offered on P_i, hence a higher perceived quality for consumers on P_i because of an enhanced consumer experience. However, note that offering this low ad-level to consumers deprives the platforms from advertising revenues since there is fewer ad-space to sell.

Platforms can choose the ad-tech stack through which they want to offer their advertising-space. They choose the one that maximizes their profit. If the profits are the same, they choose the most efficient of the two ad-stack.

Platform P_i's gross revenues:

$$\Pi_i = a_i \cdot p_i$$

Ad-tech stack incumbent. The Ad-tech stack incumbent take a commission α_I on the advertising revenues of the platform(s) who decide to use its services, with $0 \leq \alpha_I \leq 1$. We assume that it does not price-discriminate between the platforms.

It has an advertising technology which allows it to offer a value of an impression $k > 0$ to advertisers. This parameter can capture the level of accuracy of targeting of the advertising technology leading to potentially higher conversion rates.

Ad-tech stack entrant. The ad-tech stack entrant, if it enters, takes a commission α_{NE} on the advertising revenues of the platform(s) which decide to use its services. We assume that it does not price-discriminate between the platforms as well.

The entrant has a superior advertising technology than the incumbent (e.g. better targeting) which allows it to offer a value of an impression $k(1 + \Delta)$ to advertisers, with $\Delta \geq 0$.

The new entrant has to pay an entry cost $e \geq 0$. This cost may be the one for developing its advertising technology, acquiring data to train its algorithms etc.

Advertisers. There is a mass 1 of homogeneous multi-homing advertisers. An advertisers runs an advertising campaign on P_i if it gets positive utility:

- If P_i offers its ad-space through I:

$$k \cdot n_i^C - p_i \geq 0$$

- If P_i offers its ad-space through NE:

$$k(1+\Delta) \cdot n_i^C - p_i \geq 0$$

Consumers. There is a mass 1 of single-homing consumers, uniformly distributed along an Hotelling line. Platforms are located at the extremes of the line. This allows us to account for consumers' taste. For instance, if we think of our platforms as news provider, some consumer may prefer to inform themselves by consuming content made available on YouTube and some others may have a preference for content available on *The Guardian*. We denote the differentiation parameter by $t > 0$.

Each platform brings a baseline utility $v > 0$ from joining to its consumers. It is assumed high enough for the market to be covered.

As in Anderson and Coate (2005), we consider that consumers dislike ads. The higher the number of ads they are being displayed, the worse is their consumer experience. The ad-nuisance parameter $\gamma > 0$ captures this negative network effect exerted by advertisers on consumers. We assume $\gamma > 2t$.

A consumer who joins platform P_i gets utility:

$$v - \gamma a_i - t d_i$$

with d_i its distance from P_i on the Hotelling line.

We consider two scenarios. First, we assume that the ad-tech stack incumbent is separated from downstream platforms. Then, we consider that the incumbent acquires one of the downstream platform to study the effect on competition in the ad-tech stack and in the display advertising market of such acquisition.

In each of these settings, we will study a benchmark where entry is not allowed and then consider entry possible.

Timing of the games will be detailed in each specific section.

3 Separated ad-tech stack incumbent

In this section, we assumed the incumbent to be fully separated from all the downstream platforms serving consumers.

3.1 Benchmark I - Impossible entry

First, we assume entry to be impossible. Both platforms have to offer their ad-space through the incumbent's ad-tech stack, since it operates as a monopolist without any threat of entry. This situation can be represented as follows:

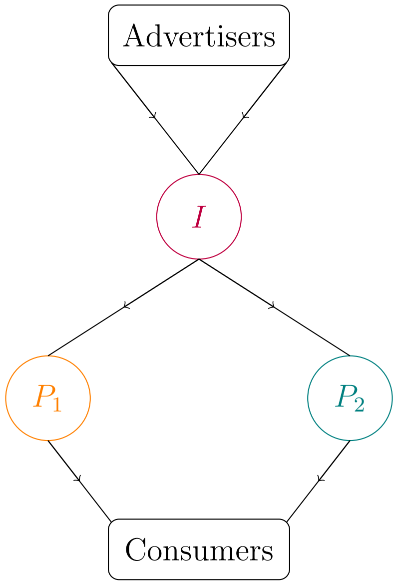


Figure 1: Separated Monopolistic Ad-tech stack

Timing The timing of the game is as follows:

- I commits to an α_I
- Platforms P_1 and P_2 observe α_I and choose their ad-levels a_1 and a_2
- Consumers observe a_1 & a_2 and and decide which platform to join
- Given their number of consumers, platforms set p_1 and p_2. Advertisers observe it and decide whether to run campaign or not. If more advertisers want to join than ad-space offered, those who get the ad-space are randomly chosen

The equilibrium concept is sub-game perfect Nash equilibrium.

Advertising price and advertisers' decision. Advertisers are willing the run a campaign on P_i if:

$$k \cdot n_i^C - p_i \geq 0$$

Since P_i's profit is increasing in p_i, we easily get that the profit-maximizing advertising price is $p_i = k \cdot n_i^C$. At this level of price, all advertisers want to run a campaign on both platforms. They get all of their surplus extracted.

Whether they actually can or not will depend on the number of ads platforms are willing to display. If, let us say, P_i chooses an ad-level $a_i < 1$, then it will randomly pick amongst the advertisers the ones that will be allowed to buy a campaign.

Consumers' decision Consumer demand is an Hotelling demand and can be computed easily. Demands are as follows:

$$n_i^C = \frac{1}{2} + \gamma \cdot \frac{a_j - a_i}{2t}$$

Advertising-level decision. Platforms observe the commission rate of the monopolist α_I. They maximize their profits w.r.t. their ad-level a_i:

$$\begin{aligned}\Pi_i &= (1-\alpha_I) \cdot a_i \cdot p_i \\ &= (1-\alpha_I) \cdot a_i \cdot k \cdot n_i^C\end{aligned}$$

The first order conditions yield:

$$\begin{aligned} n_i^C - \frac{\gamma}{2t} \cdot a_i = 0 \\ \Leftrightarrow a_i(a_j) = \frac{t}{2\gamma} + \frac{a_j}{2}\end{aligned}$$

And intersecting best responses, we find the profit-maximizing ad-level:

$$a_i = \frac{t}{\gamma} \quad (< 1)$$

This ad-level can be considered as the competitive ad-level.
Sub-game equilibrium is, as expected, symmetric, with:

$$n_1^C = n_2^C = \frac{1}{2}$$

Platforms making profits:

$$\Pi_i = (1-\alpha_I) \cdot \overbrace{\frac{t}{\gamma} \cdot \frac{k}{2}}^{\pi_b}$$

With π_b a new notation to designate the baseline profit platforms would make under duopoly if they were to own advertising technology with efficiency k, or their profit absent commission rate.

Monopolist's commission rate decision. The profit of the monopolist is as follows:

$$\begin{aligned}\Pi_I &= \alpha_I \cdot a_1 \cdot p_1 + \alpha_I \cdot a_2 \cdot p_2 \\ &= \alpha_I \cdot 2 \cdot \pi_b\end{aligned}$$

The monopolist profit is increasing in its commission rate α_I, hence, the profit-maximizing level is $\alpha_I = 1$ so that the platforms make exactly zero profit. The monopolist makes profit:

$$\Pi_I = 2 \cdot \pi_b$$

3.2 Separated Incumbent vs. Entrant

We now allow for a new entrant to enter the ad-tech stack and try and compete with the incumbent as described in Figure 2:

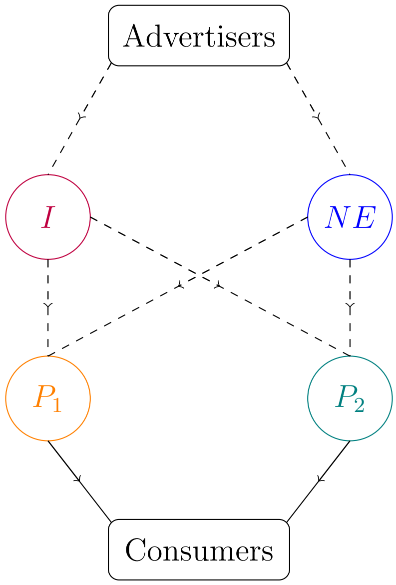


Figure 2: Ad-tech stack entry vs. Separated Monopoly

Timing The modified timing is as follows:

- I commits to an α_I
- NE observes α_I and decide whether to enter or not. If it does, it sets its α_{NE}
- Platforms P_1 and P_2 observe α_I & α_{NE}. They choose the ad-stack that they will be using and set their ad-levels a_1 and a_2 accordingly
- Consumers observe a_1 & a_2 and and decide which platform to join
- Given their number of consumers, platforms set p_1 and p_2. Advertisers observe it and decide whether to run campaign or not. If more advertisers want to join than ad-space offered, those who get the ad-space are randomly chosen

The equilibrium concept is sub-game perfect Nash equilibrium.

There are two sub-games:

(1) If the platforms chose to offer their ad-space through I's ad-stack

(2) If the platforms chose to offer their ad-space through NE's ad-stack

Let us compute these two sub-game equilibria.

(1) First, we assume that the platforms chose to offer their ad-space through the incumbent's ad-stack.

Advertising price and advertisers' decision. Like before, the advertising price is as follows:

$$p_i = n_i^C \cdot k$$

and all advertisers want to run advertising campaign on both platforms.

Consumers' decision. Consumer demand can be computed as before and is

$$n_i^C = \frac{1}{2} + \gamma \cdot \frac{a_j - a_i}{2t}$$

Advertising-level decision. Platforms' profit writes:

$$\Pi_i = (1 - \alpha_I) \cdot a_i \cdot k \cdot n_i^C$$

The FOCs yield:

$$a_i = \frac{t}{\gamma}$$

They each make the following profit:

$$\Pi_i = (1 - \alpha_I) \cdot \pi_b$$

(2) Second, we assume that the platforms chose to offer their ad-space through the entrant's ad-stack.

Advertising price and advertisers' decision. Profit-maximizing ad-price is very similar as before, the only thing changing is the value of an impression which is higher when the entrant's ad-stack is used:

$$p_i = n_i^C \cdot k \cdot (1 + \Delta)$$

and all advertisers want to run advertising campaign on both platforms.

Consumers' decision. Consumer demand can be computed as before and is

$$n_i^C = \frac{1}{2} + \gamma \cdot \frac{a_j - a_i}{2t}$$

Advertising-level decision. Platforms' profit writes:

$$\Pi_i = (1 - \alpha_{NE}) \cdot a_i \cdot k \cdot (1 + \Delta) \cdot n_i^C$$

The FOCs yield:

$$a_i = \frac{t}{\gamma}$$

They each make the following profit:

$$\Pi_i = (1 - \alpha_{NE}) \cdot \pi_b \cdot (1 + \Delta)$$

New entrant's commission rate decision. To beat the incumbent, the entrant needs to make sure platforms make more profits by using its ad-stack:

$$\begin{aligned} &(1 - \alpha_{NE}) \cdot \pi_b \cdot (1 + \Delta) \geq (1 - \alpha_I) \cdot \pi_b \\ \Leftrightarrow\ &\alpha_{NE} \leq 1 - \frac{1 - \alpha_I}{1 + \Delta} \end{aligned} \tag{WC_{sep}}$$

If NE entered and set α_{NE} such that the condition for it to win (WC_{sep}) is verified, it makes profit:

$$\Pi_{NE} = \alpha_{NE} \cdot 2 \cdot \pi_b \cdot (1 + \Delta)$$

It is straightforward that its profit is increasing in α_{NE}, hence, it is profit-maximizing to set $\alpha_{NE} = 1 - \frac{1-\alpha_I}{1+\Delta}$.

However, entry might not be profitable for the entrant. It chooses to enter as long as:

$$\begin{aligned} &\alpha_{NE} \cdot 2 \cdot \pi_b \cdot (1 + \Delta) - e \geq 0 \\ \Leftrightarrow\ &\alpha_{NE} \geq \frac{e}{2 \cdot \pi_b} \\ \Leftrightarrow\ &\alpha_I \geq 1 - \left((1 + \Delta) - \frac{e}{2\pi_b} \right) \end{aligned} \tag{EC_{sep}}$$

So, (EC_{sep}) is the entry-condition on the commission rate of the incumbent for the entrant to be able to enter. It captures how hard it is for the incumbent to deter entry. We can see for example that the higher the Δ, the smaller is the right-hand term, meaning that it gets harder and harder for the incumbent to deter entry as the entrant's competitive advantage gets larger.

Incumbent's commission rate decision. We have that:

- If there is entry: $\Pi_I = 0$
- If entry is deterred: $\Pi_I = \alpha_I \cdot 2 \cdot \pi_b$

The incumbent always want to deter entry. It does so by just not verifying the entry condition, i.e. by setting $\alpha_I < 1 - \left((1+\Delta) - \frac{e}{2\pi_b}\right)$. More precisely, since its profit increase in α_I it wants to almost bind the constraint.

However, the incumbent is only able to deter entry if:

$$1 - \left((1+\Delta) - \frac{e}{2\pi_b}\right) > 0$$
$$\Leftrightarrow \frac{e}{2\pi_b} > \Delta$$

So:

- If $\Delta \geq \frac{e}{2\pi_b}$, NE enters and win the market, with $\alpha_{NE} = \frac{\Delta}{1+\Delta}$
- If $\Delta < \frac{e}{2\pi_b}$, entry is deterred, with limit pricing and $\alpha_I = \frac{e}{2\pi_b} - \Delta$
- If $e \geq 2\pi_b \cdot (1+\Delta)$, entry is blockaded because impossible and $\alpha_I = 1$

We can draw the areas where entry occurs, is deterred or blockaded:

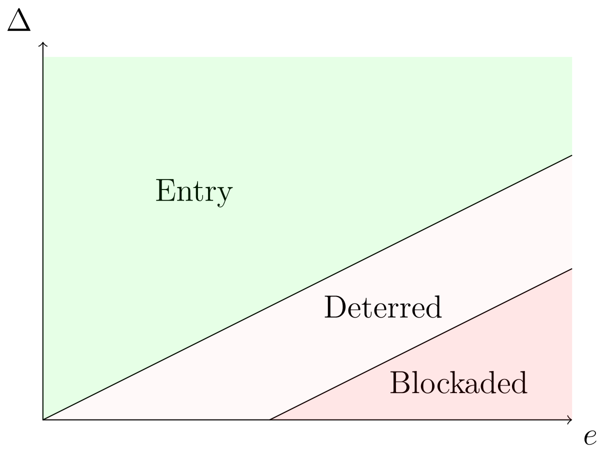


Figure 3: Entry areas with separated ad stack incumbent

We can see that, as long as entry is possible, meaning that the entry cost is not too high, the threat of entry disciplines the incumbent. Consumers and Advertisers are not affected, but the commission rates are (and thus the profits are redistributed to downstream platforms). For high efficiency advantage of the entrant, entry happens. For lower values of Δ, entry is deterred by the incumbent but it is forced to set limited commission rate.

4 Integrated Ad-tech stack incumbent

We assume now that the incumbent acquired one of the downstream platforms, like Google did with YouTube. The acquired platform is P_1. The incumbent is now able to directly display ads to consumers, and still offer, to its now direct competitor, to use its ad-stack.

4.1 Benchmark II - Impossible entry

We first consider entry to be impossible, the incumbent being the only possible ad-stack through which P_2 can offer its ad-space. The situation is represented in Figure 4.

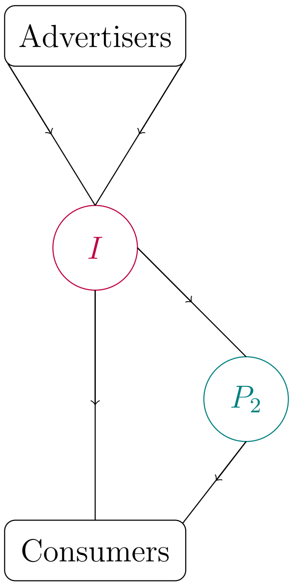


Figure 4: Integrated Monopolistic Ad-tech stack

Timing The timing of the game is the following:

- I commits to an α_I
- P_2 observe α_I. The integrated I and P_2 choose their ad-levels a_I and a_2
- Consumers observe a_I & a_2 and and decide which platform to join
- Given their number of consumers, platforms set p_I and p_2. Advertisers observe it and decide whether to run campaign or not. If more advertisers want to join than ad-space offered, those who get the ad-space are randomly chosen

The equilibrium concept is sub-game perfect Nash equilibrium.

Advertising price and advertisers' decision. Like before, the advertising price is as follows:

$$p_i = n_i^C \cdot k$$

and all advertisers want to run advertising campaign on both platforms.

Consumers' decision. Consumer demand can be computed as before and is

$$n_i^C = \frac{1}{2} + \gamma \cdot \frac{a_j - a_i}{2t}$$

Advertising-level decision. P_2 maximizes its profit and the integrated I maximizes joint profits i.e. the profit it makes from advertising on the acquired downstream platform plus the profit it makes from P_2 offering its ad-space through its ad-tech stack. Profits to maximize are as follows:

$$\begin{aligned}
\Pi_2 &= (1 - \alpha_I) \cdot a_2 \cdot k \cdot n_2^C \\
\Pi_I &= a_I \cdot k \cdot n_I^C + \alpha_I \cdot a_2 \cdot k \cdot n_2^C
\end{aligned}$$

The FOCs yield:

$$\begin{cases} n_2^C - \frac{\gamma}{2t} a_2 = 0 \\ n_I^C - \frac{\gamma}{2t} a_I + \alpha_I \left(a_2 \frac{\partial n_2^C}{\partial a_I} \right) = 0 \end{cases}$$

with $\frac{\partial n_2^C}{\partial a_I} > 0$, which means that I partially internalizes the positive externality it exerts on P_2 through an increase in its ad-level. Hence, the integration leads to softened competition for consumers' attention. Consumers are worse off.

We obtain the following best responses:

$$\begin{aligned}
a_2(a_I) &= \frac{t}{2\gamma} + \frac{a_I}{2} \\
a_I(a_2) &= \frac{t}{2\gamma} + (1 - \alpha_I) \frac{a_2}{2}
\end{aligned}$$

Intersecting them, we find that the sub-game equilibrium quantities are:

$$\begin{aligned}
a_2 &= \frac{3}{3 - \alpha_I} \cdot \frac{t}{\gamma} \quad (\geq \frac{t}{\gamma}) \\
a_I &= \frac{3 + \alpha_I}{3 - \alpha_I} \cdot \frac{t}{\gamma} \quad (\geq \frac{t}{\gamma})
\end{aligned}$$

Consumer demands in sub-game eq. are:

$$n_2^C = \frac{1}{2}\left(1 + \frac{\alpha_I}{3-\alpha_I}\right) = \frac{3}{3-\alpha_I}\cdot\frac{1}{2} \geq \frac{1}{2}$$
$$n_I^C = \frac{1}{2}\left(1 - \frac{\alpha_I}{3-\alpha_I}\right) = \frac{3-2\alpha_I}{3-\alpha_I}\cdot\frac{1}{2} \leq \frac{1}{2}$$

Profits write:

$$\Pi_2 = (1-\alpha_I)\cdot\pi_b\cdot\left(\frac{3}{3-\alpha_I}\right)^2$$
$$\Pi_I = \pi_b\cdot\frac{(3+\alpha_I)(3-2\alpha_I)+9\alpha_I}{(3-\alpha_I)^2}$$

Monopolist's commission rate decision. By computing the derivative, we find that Π_I is increasing in α_I, hence, I wants to set the maximum α_I such that P_2 makes positive profit.

So, in eq., $\alpha_I = 1$, P_2 makes zero profit.

By comparing the two situations where entry is assumed impossible, we can clearly see some negative effects of the integration.

When the upstream incumbent integrated with one of the downstream platforms, consumers are being shown more ads. Hence, because of the softened competition due to a partial internalization of negative externalities competitors exert on each other, consumer surplus decreases compared to when the incumbent was separated.

This allows us to foresee some effects that might be at play as well when we allow for entry, which we will from now on.

4.2 Integrated Incumbent vs. Entrant

We now allow for entry of a new player in the ad-tech stack. What differs from 3.2 is that now, the entrant cannot get the ad-space of the platform acquired by the incumbent. Both the incumbent and the entrant compete for the remaining independent downstream platform to offer its ad-space through their ad-stack, as described in Figure 5.

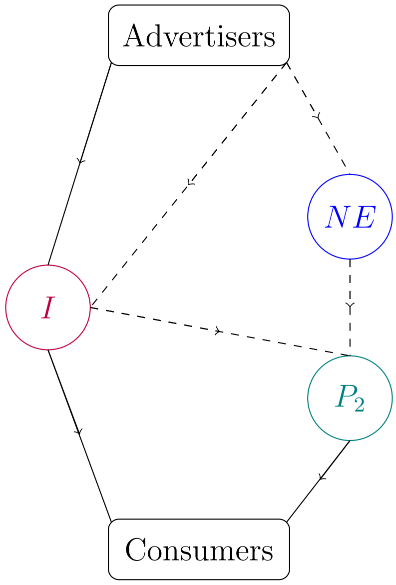


Figure 5: Ad-stack entry vs. Integrated Monopoly

Timing The timing of the game is the following:

- I commits to an α_I
- NE observes α_I and decide whether to enter or not. If it does, it sets its α_{NE}
- P_2 observe α_I & α_{NE}, chooses which one to join. Depending on this choice, the integrated I and P_2 choose their ad-levels a_I and a_2
- Consumers observe a_I & a_2 and and decide which platform to join
- Given their number of consumers, platforms set p_I and p_2. Advertisers observe it and decide whether to run campaign or not. If more advertisers want to join than ad-space offered, those who get the ad-space are randomly chosen

The equilibrium concept is sub-game perfect Nash equilibrium.

Like in the setting with entry and a separated ad-tech stack incumbent, we distinguish two sub-games:

(1) P_2 chose to offer its ad-space through I's ad-stack

(2) P_2 chose to offer its ad-space through NE's ad-stack

Let us compute these two sub-game equilibria.

(1) First, we assume that P_2 chose to offer its ad-space through the incumbent's ad-stack.

Advertising price and advertisers' decision. Both platforms ad-spaces are offered through the incumbent's ad-stack.

The incumbent's technology, bringing value of an impression k to advertisers, the advertising prices are as follows:

$$p_i = n_i^C \cdot k$$

and all advertisers want to run advertising campaign on both platforms.

Consumers' decision. Consumer demand can be computed as before and is

$$n_i^C = \frac{1}{2} + \gamma \cdot \frac{a_j - a_i}{2t}$$

Advertising-level decision. The sub-game perfect equilibrium is the same as when entry is not possible, hence:

$$a_2 = \frac{3}{3 - \alpha_I} \cdot \frac{t}{\gamma}$$
$$a_I = \frac{3 + \alpha_I}{3 - \alpha_I} \cdot \frac{t}{\gamma}$$

In this setting, P_2's profit writes:

$$\Pi_2 = (1 - \alpha_I) \cdot \pi_b \cdot \left(\frac{3}{3 - \alpha_I}\right)^2$$

(2) Second, we now assume that P_2 chose to offer its ad-space through the entrant's ad-stack.

Advertising price and advertisers' decision. The ad-space of the integrated platform is offered through its own ad-stack, bringing value of an impression k to advertisers.

The ad-space of P_2 is offered through the entrant's ad-stack, bringing value of an impression $k(1 + \Delta)$ to advertisers.

Hence, the advertising prices are as follows:

$$p_1 = k \cdot n_1^C$$
$$p_2 = k \cdot (1 + \Delta) \cdot n_2^C$$

Consumers' decision. Consumer demand can be computed as before and is

$$n_i^C = \frac{1}{2} + \gamma \cdot \frac{a_j - a_i}{2t}$$

Advertising-level decision. In this sub-game, profits write:

$$\Pi_2 = (1 - \alpha_{NE}) \cdot a_2 \cdot k \cdot (1 + \Delta) \cdot n_2^C$$
$$\Pi_I = a_I \cdot k \cdot n_I^C$$

Players maximize their profit w.r.t. their ad-level. The first order conditions give us the best responses:

$$\begin{cases} a_2(a_I) = \frac{t}{2} + \frac{a_I}{2} \\ a_I(a_2) = \frac{t}{2} + \frac{a_2}{2} \end{cases}$$

By intersecting them, we get:

$$a_2 = \frac{t}{\gamma}$$
$$a_I = \frac{t}{\gamma}$$

In this setting, P_2's profit writes:

$$\Pi_2 = (1 - \alpha_{NE}) \cdot \pi_b \cdot (1 + \Delta)$$

P_2 chooses the ad-stack that maximizes its profit.

Proposition 1 *In a setting with an integrated ad-tech stack incumbent, consumers are better off if the entrant manages to enter and win the market for the independent downstream platform's ad-space. That is because they get less ads displayed, enhancing their consumer experience.*

We get this result because when the incumbent wins, it both competes for consumer attention and takes a commission on its competitors advertising revenues. Then, it partially internalizes the externalities it has on its competitor, which makes it lower its competitive effort. It shows more ads, and so does the competitor.

The entrant, which does not have any downstream position, cannot offer this relaxed competition to the independent platform.

New entrant's commission rate decision. If NE entered, to get P_2 to offer its ad-space through its ad-stack, it needs to set α_{NE} such that:

$$(1-\alpha_{NE})\cdot\pi_b\cdot(1+\Delta)\geq(1-\alpha_I)\cdot\pi_b\cdot\left(\frac{3}{3-\alpha_I}\right)^2$$

i.e. it needs to ensure that profit of P_2 is higher when using its ad-stack.

We can see that for $\alpha_I=\alpha_{NE}$, the result is unclear on P_2's decision. Both ad-stacks offer their own advantage to the platform if it were use their service:

- The incumbent would impose lower competition for consumers' attention through an increased ad-level.
- The entrant offers higher efficiency, leading to an ability to sell ad-space at a higher price.

In the end, the condition for NE to win is:

$$\alpha_{NE}\leq 1-\frac{1-\alpha_I}{1+\Delta}\left(\frac{3}{3-\alpha_I}\right)^2 \tag{WC_{int}}$$

NE's profit is increasing in α_{NE}, hence its bind the constraint above and we have:

$$\alpha_{NE}=1-\frac{1-\alpha_I}{1+\Delta}\left(\frac{3}{3-\alpha_I}\right)^2$$

However, it is able to do so as long as entry is profitable i.e.:

$$\begin{aligned}&\alpha_{NE}\cdot\pi_b(1+\Delta)-e\geq 0\\ \Leftrightarrow\ &\alpha_{NE}\geq\frac{e}{\pi_b}\\ \Leftrightarrow\ &\alpha_I\geq 1-\underbrace{\left((1+\Delta)-\frac{e}{\pi_b}\right)}_{\leq(1+\Delta)-\frac{e}{2\pi_b}}\cdot\underbrace{\left(\frac{3-\alpha_I}{3}\right)^2}_{\leq 1}\end{aligned} \tag{EC_{int}}$$

By comparing the entry conditions in the separated and integrated settings with entry, (EC_{sep}) and (EC_{int}), we can clearly see that the condition is less easily satisfied in when the incumbent is integrated with a downstream platform.

This is the case for two reasons:

- First, the size of the market the entrant is trying to get is half as big in the integrated case, hence, entry is less profitable

- Second, and more interestingly, the fact that the incumbent would compete less for consumers attention creates an advantage that may compensate for the entrant's efficiency gains.

  The potential softened competition makes the incumbent more attractive to the downstream platform, through a mechanism that harms the consumers (more advertising).

Incumbent's commission rate decision. It is once again always profitable for the incumbent to deter entry. Hence, it will want to set an α_I does not verify the entry condition (EC_{int}).

When entry is deterred, its profit is increasing in α_I, thus, its will set an α_I just below the α_I that verifies:

$$\alpha_I = 1 - \left((1+\Delta) - \frac{e}{\pi_b}\right) \cdot \left(\frac{3-\alpha_I}{3}\right)^2$$

It does so as long as it is able to set non-negative commission rate. Otherwise entry deterrence is not possible. Entry is thus deterred until:

$$0 = 1 - \left((1+\Delta) - \frac{e}{\pi_b}\right) \cdot \left(\frac{3-0}{3}\right)^2$$
$$\Leftrightarrow \Delta = \frac{e}{\pi_b}$$

Which gives us that:

- If $\Delta \geq \frac{e}{\pi_b}$, NE enters and win the market, with $\alpha_{NE} = \frac{\Delta}{1+\Delta}$
- If $\Delta < \frac{e}{\pi_b}$, entry is deterred, with limit pricing, but a larger commission rate that in the separated case.
- If $e \geq \pi_b \cdot (1+\Delta)$, entry is blockaded because impossible and $\alpha_I = 1$

Results, compared with the separated setting ones, can be summed up by the following figure:

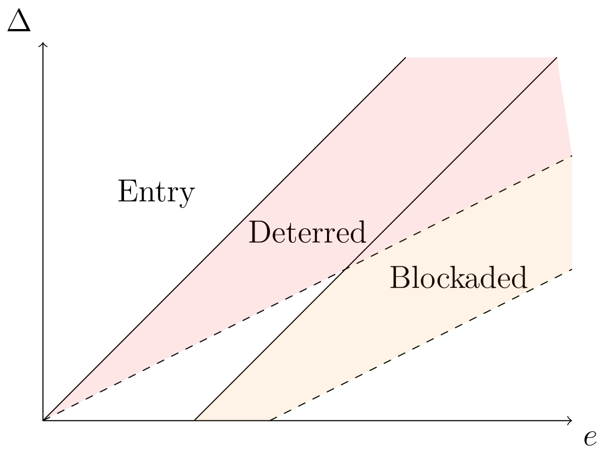


Figure 6: Entry areas with integrated ad stack incumbent compared to a separated one

On this graph, the red area represents the area where entry of a more efficient entrant would occur if the incumbent was separated and where entry does not occur if the incumbent is integrated. We clearly see that integration with a downstream platform allows the ad-tech stack incumbent to deter entry of a more efficient entrant more easily. This results in softened competition for consumers attention and overall degraded consumer experience through more ads being displayed to them.

The orange area represents the area where, in the separated setting, the incumbent was suffering from competitive pressure through the threat of entry but does not suffer from it when integrated. We see that here, due the reduction of the market size that the entrant can compete for, entry is more often impossible, leading the incumbent to not be disciplined at all by potential entry of a more efficient entrant.

Proposition 2 *Integration of the ad-tech stack incumbent with a downstream platform has multiple anti-competitive and harmful effects:*

- *Entry, which is beneficial to the consumers, occurs less often since barriers to entry are higher post-acquisition. In some regions where the incumbent could not avoid entry when separated, entry is now deterred or even impossible (hence no competitive pressure anymore)*

- *With an integrated incumbent, the effort it has to provide to deter entry is lower. Entry is deterred for higher commission rates, which would not have been possible when separated. It is because integration allows it to offer softened competition downstream, creating an anti-competitive advantage. Commission rates are higher and consumer surplus lower because of an higher ad-level.*

5 Conclusion

To conclude, with this model, we show that the concern about an ad-tech stack incumbent leveraging a downstream position in the display advertising market is relevant. Following acquisition of the downstream platform, it can benefit from higher market power.

Entry of a more efficient entrant is deterred more easily and commission rates can be raised, leading downstream platforms to see their profits extracted by the ad-tech stack incumbent considerably more. The advertising level will also be higher, degrading consumer experience and thus consumer surplus. Integration has unambiguously detrimental effects on competition and consumers.

We believe that these results emphasize the views of several competition authorities on ad-tech dominance. Once again, when examining acquisitions like the one of YouTube by Google, competition authorities need to be extremely careful in the sense that outside of acquiring promising businesses, they may become a tool use to strengthen dominant positions.

Finally, the DOJ, in its lawsuit, demands to undo some ad-tech acquisitions made by Google for AdMeld and DoubleClick, and our results may suggest that undoing the acquisitions of YouTube may also be a way to prevent Google from strengthening its already dominant position.

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