Post-merger strategies of multiplatform monopolies*

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Abstract

Mergers and acquisitions are on the rise in platform industries leading to an increase in market power. We investigate the impact of post-merger strategies on the market. We develop a model where two different platforms coexist and a merger is under consideration. We then analyse various post-merger strategies, including integrating the two platforms and using advanced pricing strategies like bundling. Our findings indicate that in most cases, a multiplatform monopoly created by the merger reduces users' overall surplus, especially when bundling is employed. However, when there is multihoming and the platforms are highly different, a multiplatform monopoly without bundling can result in a higher surplus compared to competition. We provide antitrust guidance on mergers of horizontally differentiated platforms, taking in consideration post-merger strategies.

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1 Introduction

The role of platforms, which facilitate interactions between different user groups, is crucial in our digital economy. Platforms exhibit a positive cross-group network effect, where the value for users on one side of the market increases as the number of users on the other side(s) grows. This phenomenon is a driving force behind the emergence of dominant companies like Amazon in e-commerce, Google in the online search market, and Meta in social networking. For example, Amazon's network effect is evident in its customer reviews, which attract more buyers, and Google's network effect is found in how the accuracy of the search algorithm increases with the number of users. Network effects are a significant driver of company growth, but the deliberate strategy of mergers and acquisitions is another compelling force propelling market concentration. This strategy involves the integration of multiple substitute or complementary businesses, a trend that has gained momentum in recent years.

Following mergers or acquisitions, the parent firm typically takes one of three approaches: eliminating the acquired platform, integrating its features into other platforms, or maintaining multiple platforms in the market. For instance, Meta has acquired 91 companies since 2009. Of these, many have been to acquire talent and have been terminated; others have been for the purpose of acquiring technology and have been integrated into Meta's products.[1] Finally, other companies acquired by Meta have been kept as affiliates such as Instagram and WhatsApp, even if Meta already operated substitute platforms (like Facebook and Messenger).[2] Companies in other industries have pursued similar strategies. For example, Amazon integrated Lexcycle and Touchco with Kindle, while maintaining Whole Foods Market alongside Amazon Fresh. Google acquired and maintained Google Maps and Waze, and Paypal acquired Venmo and now operates both Paypal and Venmo. These examples illustrate the diverse strategies that parent firms employ for mergers and acquisitions in digital markets.

Contrary to common concerns, mergers and acquisitions can lead to more than just reduced competition, higher prices for consumers, and potential job losses. The existing merger literature suggests that high concentration in multi-sided markets, where the value of a product or service depends on the number of users on both sides of the market, can actually benefit users. This optimistic perspective highlights that increased concentration allows for more user interactions on both sides, thus generating higher surpluses due to positive cross-group network effects. These conclusions are based on the idea that companies keep only one firm post-merger. However, as the above examples illustrate it is possible that after the merger/acquisition, the parent company keeps multiple platforms in the market, integrates the acquired platform or eliminates it. These different post merger strategies have different implications for consumer surplus and profits and need to be evaluated.

[1] For example, Zenbe and Beluga were integrated into Facebook Messenger, and Zurich Eye has been integrated into Oculus VR.

[2] See \href{https://en.wikipedia.org/wiki/List_of_mergers_and_acquisitions_by_Meta_Platforms} for a complete list of mergers and acquisitions by Meta.

Several issues emerge when a company operates multiple platforms. Notably, firms will have an expanded toolset of cross platform strategies to choose from and an analysis of the implications of these cross-platform strategies is lacking in the literature. One such strategy is the bundling of substitute platforms. Bundling is naturally targeted to users who would multihome platforms, ie.e users who acquire both platforms like Hulu and Disney+ or Facebook and Instagram [3].

Several examples of bundling of platforms arise: for instance Amazon bundles prime video and prime shipping, Hulu and Disney+ are sold as a bundle by. Given this pervasive strategy, it seems crucial for policymakers, when deciding whether or not to support a acquisition and merger to understand whether upon the merger firms will pursue cross platform strategies and what are their implications for consumers. Both the study of the post-merger market positioning strategies and the post-merger pricing are absent from previous literature and are novel in this article.

When a company operates multiple platforms, several issues emerge. Notably, firms will have an expanded toolset of cross-platform strategies to choose from, and there is a lack of analysis of the implications of these strategies in the literature. One such strategy is the bundling of substitute platforms, which targets users who use multiple platforms. Several examples of platform bundling exist. For instance, Amazon bundles Prime Video and Prime Shipping, and the Walt Disney Company sells Hulu and Disney+ as a bundle, among others. Given the prevalence of this strategy, it is crucial for policymakers to understand whether firms will pursue cross-platform strategies and their implications for consumers when deciding whether to support an acquisition or merger. The study of post-merger market positioning strategies and post-merger pricing, including advanced pricing like bundling, is absent from previous literature and is novel to this article.

We develop a model in which two substitute platforms are available for adoption by two types of users, buyers and sellers, that use the platform as an intermediary. Users have heterogeneous preferences for the platforms, modeled via a Hotelling model. From the welfare point of view, we then compare different scenarios, namely: 1) different firms operate platforms; 2) platforms are operated by a multiplatform monopoly that can .i) integrate platforms or ii) operate multiple platforms. Whereas the outcome of competing platforms is well-known in the literature, the multiplatform monopoly has yet to be studied. Furthermore, we also allow for different user adoption patterns. Namely, we study the case in which both sides of the market adopt a single platform, i.e., singlehoming, and the case in which one side of the market adopts a single platform and the other adopts both, i.e., multihoming. [4] For the multihoming case, we then explore the consequences of bundling by the multiplatform monopolist.

[3] Meta recently introduced a paid subscription to Instagram and Facebook with added features. Also, Meta offers a bundle to advertisers of Facebook and Instagram.

[4] This case is also known as the competitive bottleneck.

We obtain that the the overall effects of platform mergers and acquisitions are jointly determined by users' adoption patterns (single vs multihoming), the level of platform differentiation, and the magnitude of cross-group network effects. Furthermore, they also depend on the the post-merger strategies of the multiplatform monopoly, namely whether the firm chooses to integrate the acquired platform, or keep it separate and use bundling.

Starting from a setting of singlehoming we obtain that: users are better off under competition for low platform differentiation. Instead, for high platform differentiation, that leads to local monopolies, users are better off under an integrated platform monopoly. Regarding profits, the integrated platform monopoly yields the highest profits. However, if integration is not possible, then the interests of the users and of the firm are at odds: for low platform differentiation, total profits are higher with multiplatform monopoly, but users are worse off than under competition. For high platform differention user surplus and total profits are the same under the two options. In terms of merger evalution, and abstracting from other considerations such as synergies and cost savings, when platforms are less differentiated, users are worse off under the merger, however, when platforms are highly differentiated, users are better off with the merger if the post-merger strategy of the firm is to integrate platforms than with competition.

With multihoming on the seller side, results are different. When the merger or acquisition is approved, the firm has an expanded toolset of options that includes offering a bundle to the multihoming users. We determine that this is the option that maximizes the firm's profit (for most of the levels of platform differentiation, except the very low). In contrast bundling is the worst possible strategy for the users. The intuition is that with bundling, the firm is able to extract all of the sellers surplus. The policy implication of this result is clear. While the merger is not necessarily damaging for users, in particular when there is high platform differentiation, using bundling as a post-merger strategy should be precluded. In addition, with multihoming, users are also generally worse off with the integrated platform than with both competition or the multiplatform monopoly. The reason is that when sellers multihome and there are competing platforms, the motivation to attract multihoming sellers is not as strong (they benefit buyers of both platforms). However, under multiplatform monopoly, attracting one additional seller increases buyers' fees on both platforms simultaneously. Thus, each additional seller moves up the profit from buyers on both platforms, and the multiplatform monopoly is motivated to decrease prices on the multihoming side, attract more sellers, and increase sellers' surplus. Although the multiplatform monopoly obtains lower revenue from the multihoming side, its profit from the singlehoming side is much larger and the industry profit increases overall. As a consequence, we show that high concentration, in this case, may even increase users' surpluses and be beneficial for total welfare. As a policy implication we have that when platforms are differentiated, and abstracting from other considerations, the merger or acquisition should be approved as long as the firm commits to maintaining both

platforms in the market and not engaging in bundling.

Our model provides some guidance for antitrust authorities in analyzing whether to proceed with cases against acquisitions and mergers of platforms. Indeed we show that absent other effects, most of the time, multiplatform monopolies reduce the user surplus. This is worsened by post-merger market strategies such as the bundling of platforms or in certain cases, the integration of the platforms. To name an example where this analysis can be useful, the FTC is pursuing a case against Meta regarding the acquisition and subsequent monopolization of Instagram and WhatsApp. The concern is whether these companies should be separated from the conglomerate. Given our analysis and based solely on the traditional user surplus definitions, our results indicate that unless the conglomerate is able to show that there is sufficient differentiation between platforms or users all multihome, then the multiplatform monopoly market structure harms the users. Given the bundling of platforms, the argument of sufficient differentiation of platforms cannot be applied as bundling always lowers the total user surplus.

Related Literature Our paper contributes to the literature on digital platforms and two-sided markets, initiated by (Rochet & Tirole, 2004a,b, 2006). These seminal papers considered the pricing strategies of a single platform that serves as an intermediary between buyers and sellers. Instead, Armstrong (2006) introduced platform competition in a two sided market. To the best of our knowledge, our work is the first to consider multiplatform monopolies and their particular market strategies. We maintain the usual assumptions of previous literature that take the matching process between two sides of the market as given and focus on the cross-network effects or externalities in the two-sided market. ((Hagiu, 2007; Caillaud & Jullien, 2003; Loginova & Mantovani, 2019)) In line with traditional literature, we assume that each member benefits more from the transactions in the two-sided market when more members from the other side are available (Tremblay, 2016; Rochet & Tirole, 2003).
Our work also contributes to the discussion of the differences between single and multihoming users of platforms. As shown in Armstrong (2006), whether agents join one platform or several platforms greatly influences the platform's pricing strategy in competition and its welfare implications. Also, Belleflamme & Peitz (2019) provides a complete analysis of the effect of multihoming, challenging the conventional wisdom that multihoming hurts the side that can multihome, while benefiting the other side. In our work, whether users are single or multihoming affects the optimal post-merger strategies of the firms and ultimately has implications for user surplus and welfare. Our paper contributes to the literature of mergers of platforms. We highlight that besides the single vs multihoming, also the post-merger strategies of the firms are determinant on the outcomes of a merger. In particular we compare the cases in which the multiplatform monopoly keeps all platforms in the market, possibly using bundling as a pricing tool, to the case in which platforms are integrated. Related papers are

Leonello (2010); Baranes *et al.* (2014) who analyze a merger between two platforms, such that users on two platforms are fully compatible and the marginal cost is lower after the merger. In this context, they show that a merger in the two-sided market may lower prices when the network effects are sufficiently strong. Correia-da Silva *et al.* (2019) also analyzed horizontal "average-marginal-cost-preserving" mergers between multi-sided platforms, but used a Cournot competition approach to study the welfare effects of mergers on consumers. The majority of those papers, except a few about advertising (Anderson *et al.*, 2019, 2012), focus on singlehoming users, while our paper is among the first to study a multiplatform monopoly with different user adoption patterns. Our study of bundling of platforms is also novel. However, it relates to several empirical papers: For instance, De Cornière & Taylor (2021) highlight the implications of bundling between the Play Store and Google Search. The paper primarily focuses on analyzing the vertical relations between the two bundled products, while our research approaches the topic by focusing on horizontally differentiated platforms offered in a bundle by a multiplatform monopoly

The remainder of the paper is organized as follows. Section 2 describes our model and characterizes how changing the ownership from two competing firms to a multiplatform monopoly affects the market when users are all singlehoming. Section 3 then considers the scenario when one side of the market is allowed to multihome and reports corresponding welfare analysis. Concluding remarks are offered in Section 4.

2 Benchmark

Consider a market where there are two platforms facilitating the interaction between two distinct groups of users. Without loss of generality, we call these two groups buyers and sellers respectively. Users derive value from interacting with the other group and generate cross-group network externalities. In other words, the higher the number of sellers joining the platform, the higher the utility of the buyers, and vice-versa. We assume that the two platforms are horizontally differentiated and located at two extreme points of a Hoteling line, as modeled in (Armstrong (2006), Belleflamme & Peitz (2019)).

Users derive a stand-alone value u from visiting each platform. Additionally, the users obtain a benefit of $\alpha > 0$ for each user on the other side of the the market. Users are uniformly distributed on the unit interval of the Hoteling line and incur a transportation cost of t per distance traveled to the platform that they adopt. Within this model setup, a user in group $k = \{s, b\}$, located at $x \in [0, 1]$ will obtain the following utility if he adopts platform $g \in \{0, 1\}$:

$$U_g^k(x) = u + \alpha q_g^{-k} - p_g^k - td(x, g),$$

where q_g^k is the mass of users in group k that adopt platform g, and p_g^k is the corresponding

membership fees that platform g charges from group k.

We consider a two-stage model in which the owner(s) of the platform(s) first choose(s) the membership fees on each side of the market, and then users make their entry decisions. In the benchmark, we study the singlehoming case where all users adopt only one platform. Based on the results, we then extend the analysis to the competitive bottleneck (or one-sided multihoming) case in Section 3, where the buyers singlehome while sellers can multihome. In each case, we investigate different market structures: either the platforms are owned by two competing firms, or they belong to the same monopoly firm. We refer to these two scenarios as the competitive scenario and the multiplatform monopoly respectively and are interested in comparing the market outcomes and welfare when two platforms are operated separately by two competing firms, or operated by a multiplatform monopoly firm.

Throughout the paper, we maintain the following assumption:

Assumption 1 (SOC) $t > \alpha$

Assumption 1 restricts our attention to parameter constellations where the two platforms are sufficiently differentiated such that the profits of the firm(s) remain concave throughout. Two options are available to the firms: either cover the market or leave a portion of the market uncovered. We obtain that for $t \leq \alpha + u$, it is optimal for the firms to cover the market, and for $t > \alpha + u$, it is optimal to keep it uncovered. [5]

In this context, the indifferent users of group k are given by

$$x^k = \frac{\alpha\left(q_g^{-k} - q_{-g}^{-k}\right) + p_{-g}^k - p_g^k}{2t} + \frac{1}{2}$$

where $-k$ is the side other than k, and $-g$ is the platform other than g. Assuming a fulfilled expectations equilibrium regarding the size of the networks on each side and each platform, the number of buyers and sellers that adopt each platform is given by

$$q_g^k = \frac{1}{2} + \frac{\left(p_{-g}^k - p_g^k\right)t + \alpha\left(p_{-g}^{-k} - p_g^{-k}\right)}{2(t-\alpha)(t+\alpha)} \tag{1}$$

[5] Note that when the transportation cost is high, i.e. $t > \alpha + u$, it is optimal for two platforms to operate as local monopolies. In this case, the market is not fully covered and there is no actual competition in the market. As a consequence, changing the ownership of the two platforms should not affect the market outcomes or welfare as shown in Appendix A.1. For the purpose of our analysis, our paper follows existing literature and focuses on the fully covered market.

2.0.1 Duopoly

We first study the competitive scenario where the two platforms are operated by two competing firms. Since we focus on the fully covered market, the indifferent user between the two platforms must derive a non-negative utility. In other words, the price of each platform must satisfy $u + \frac{\alpha}{2} - \frac{t}{2} - p_g^k \geq 0$.

Thus, the owner of platform g maximizes its profit with corresponding restrictions on both sides of the market:

$$\begin{aligned} &\max_{p_g^k,\ p_g^{-k}} p_g^k q_g^k + p_g^{-k} q_g^{-k} \\ &s.t. \\ &p_g^k \leq u + \alpha q_g^{-k} - t q_g^k \\ &p_g^{-k} \leq u + \alpha q_g^k - t q_g^{-k} \end{aligned}$$

Optimization of the profit obtains the following optimal pricing strategies for platform g:

$$p_g^k = \begin{cases} t - \alpha & \text{if } \alpha \leq t \leq \alpha + \frac{2u}{3}, \\ u - \frac{t}{2} + \frac{\alpha}{2} & \text{if } \alpha + \frac{2u}{3} \leq t \leq \alpha + u. \\ \frac{u}{2} & \text{if } t > \alpha + u \end{cases}$$

When the transportation cost is low, the market coverage restriction is not binding at equilibrium. Thus the optimal prices for the platform are determined by corresponding first-order conditions of the optimization problem. When the transportation cost exceeds $\alpha + \frac{2u}{3}$, the market coverage constraint is binding. At the symmetric equilibrium, the two platforms always share the market equally, such that,

$$q_g^k = \begin{cases} \frac{1}{2} & \text{if } \alpha \leq t \leq \alpha + u, \\ \frac{u}{2(t-\alpha)} & \text{if } t > \alpha + u. \end{cases}.$$

Thus, the resulting profit of each competing firm equals

$$\pi_g = \begin{cases} t - \alpha & \text{if } \alpha \leq t \leq \alpha + \frac{2u}{3} \\ u - \frac{t}{2} + \frac{\alpha}{2} & \text{if } \alpha + \frac{2u}{3} \leq t \leq \alpha + u \\ \frac{u^2}{2(t-\alpha)} & \text{if } t > \alpha + u, \end{cases}$$

and the equilibrium surpluses are

$$S^b = S^s = \begin{cases} u - \frac{5t}{4} + \frac{3\alpha}{2} & \text{if } \alpha \leq t \leq \alpha + \frac{2u}{3} \\ \frac{t}{4} & \text{if } \alpha + \frac{2u}{3} \leq t \leq \alpha + u \\ \frac{tu^2}{4(t-\alpha)^2} & \text{if } t > \alpha + u. \end{cases}$$

2.0.2 Multiplatform Monopoly

We then study the multiplatform monopoly scenario where two platforms are both operated by a firm M. The ownership change does not affect users' adoption decisions, but the profit maximization problem becomes different. We will start with the covered market solution, which occurs for $t \leq \alpha + u$. Since both platforms are operated by the same firm, it is optimal for the firm to simultaneously move up prices on both platforms until the indifferent users on both sides receive zero surpluses. Plugging the demand function 3.0.3 in the market restriction $U_0^k(q_0^k) = 0$ for both $k \in \{b, s\}$, the firm's profit maximization problem could be simplified as:

$$\begin{aligned} &\max_{p_0^b, p_0^s, p_1^b, p_1^s} p_0^b q_0^b + p_0^s q_0^s + p_1^b q_1^b + p_1^s q_1^s \\ &s.t. \\ &p_0^b = 2u - (t - \alpha) - p_1^b \\ &p_0^s = 2u - (t - \alpha) - p_1^s \end{aligned}$$

Solving the system of first-order conditions, we derive the equilibrium pricing strategy as:

$$p_g^k = \frac{2u - (t - \alpha)}{2}$$

for both sides and both platforms. With the same equilibrium prices on both platforms, the market is also equally shared on both sides, i.e. $q_g^k = \frac{1}{2}$. Thus, the monopolist's total profit at equilibrium equals

$$\Pi = 2u - (t - \alpha)$$

and the surpluses of buyers and seller are equal to

$$S^b = S^s = \frac{t}{4}$$

Total user surplus is given by $US = S^b + S^s$

$$US = \frac{t}{2}$$

As for the uncovered market solution ($t > \alpha + u$), it is the same as for the competitive case.

To summarize we have

$$p_g^k = \begin{cases} \frac{2u-(t-\alpha)}{2} & \text{if } \alpha \leq t \leq \alpha + u. \\ \frac{u}{2} & \text{if } t > \alpha + u \end{cases}$$

$$q_g^k = \begin{cases} \frac{1}{2} & \text{if } \alpha \leq t \leq \alpha + u. \\ \frac{u}{2(t-\alpha)} & \text{if } t > \alpha + u \end{cases}$$

$$\Pi = \begin{cases} 2u - (t-\alpha) & \text{if } \alpha \leq t \leq \alpha + u. \\ \frac{u^2}{t-\alpha} & \text{if } t > \alpha + u \end{cases} \tag{2}$$

$$US = \begin{cases} \frac{t}{2} & \text{if } \alpha \leq t \leq \alpha + u. \\ \frac{tu^2}{2(t-\alpha)^2} & \text{if } t > \alpha + u \end{cases} \tag{3}$$

2.0.3 Integrated platform monopoly at the center

In this case, upon the acquisition of the second platform, the monopoly firm integrates both platforms into one that locates in the middle of the line. The intuition is that the firm is able to compile features of both platforms into a unique platform that is now closer to the individual preference of the users.[6] We denote this platform M . Here we analyse the outcomes for the firm, users and welfare of that strategy. Note that we focus on the market interactions resulting from integrating the platforms and abstract from possible costs stemming from that strategy.

In case the monopoly decides to shut down platforms 0 and 1 and creating an integrated platfom M located in , the middle of the Hotelling line, the utility of the consumers of type k from buying from platform M is given by

$$U_M^k(x) = \begin{cases} u + \alpha q_M^{-k} - p_M^k - t\left(\frac{1}{2} - x\right), & \text{if } x < \frac{1}{2} \\ u + \alpha q_M^{-k} - p_M^k - t\left(x - \frac{1}{2}\right), & \text{if } x > \frac{1}{2} \end{cases}$$

The indifferent consumer is:

$$\hat{x} = \begin{cases} \frac{\frac{t}{2} - u - \alpha q_M^{-k} + p_M^k}{t}, & \frac{\left(\frac{t}{2} - u - \alpha q_M^{-k} + p_M^k\right)}{t} < \frac{1}{2} \\ \frac{u + \alpha q_M^{-k} - p_M^k + \frac{t}{2}}{t}, & \frac{u + \alpha q_M^{-k} - p_M^k + \frac{t}{2}}{t} > \frac{1}{2} \end{cases}.$$

[6] We can show that any other location for the unique platform brings lower profits to the monopolist.

The demands are:

$$q_M^k = \frac{u + \alpha q_M^{-k} - p_M^k + \frac{t}{2}}{t} - \frac{\frac{t}{2} - u - \alpha q_M^{-k} + p_M^k}{t} = 2\frac{u + \alpha q_M^{-k} - p_M^k}{t},$$
$$q_M^{-k} = 2\frac{u + \alpha q_M^k - p_M^{-k}}{t}.$$

With rational expectations on the network size, we get

$$q_M^b = 2\frac{u + \alpha\left(2\frac{u+\alpha q_M^b - p_M^s}{t}\right) - p_M^b}{t}$$

Rational Expectations

$$q_M^b = \frac{2\left((2\alpha + t)u - tp_M^b - 2\alpha p_M^s\right)}{(t - 2\alpha)(t + 2\alpha)}, t > 2\alpha.$$
$$q_M^s = \frac{2\left((2\alpha + t)u - tp_M^s - 2\alpha p_M^b\right)}{(t - 2\alpha)(t + 2\alpha)}, t > 2\alpha.$$

The firm chooses the prices that maximize the profit:

$$\max_{p_M^b, p_M^s} \Pi_M = \frac{2\left((2\alpha + t)u - tp_M^b - 2\alpha p_M^s\right)}{(t - 2\alpha)(t + 2\alpha)} p_M^b + \frac{2\left((2\alpha + t)u - tp_M^s - 2\alpha p_M^b\right)}{(t - 2\alpha)(t + 2\alpha)} p_M^s$$
$$-\frac{2}{4\alpha^2 - t^2}\left(2u\alpha - 2tp_M^s - 4\alpha p_M^b + tu\right) = 0 \iff \left(2u\alpha - 2tp_s - 4\alpha p_M^b + tu\right) = 0$$
$$-\frac{2}{4\alpha^2 - t^2}\left(2u\alpha - 2tp_M^b - 4\alpha p_M^s + tu\right) = 0 \iff \left(2u\alpha - 2tp_M^b - 4\alpha p_M^s + tu\right) = 0$$
$$p_M^b = \frac{1}{2}u, p_M^s = \frac{1}{2}u$$

The demands are

$$q_M^s = \max\{\frac{u}{t - 2\alpha}, 1\}$$
$$q_M^b = \max\{\frac{u}{t - 2\alpha}, 1\}$$

The profits are

$$\Pi_M = \begin{cases} 2u + 2\alpha - t, \alpha < t < u + 2\alpha \\ \frac{u^2}{t-2\alpha}, t > u + 2\alpha \end{cases} \tag{4}$$

As for user surplus, we have:

$$US_M = \begin{cases} \frac{t}{2}, \alpha < t < u + 2\alpha \\ \frac{u^2 t}{2(t-2\alpha)^2}, t > u + 2\alpha \end{cases} \tag{5}$$

2.0.4 Results

Here we summarize the results of the single-homing case.

Proposition 1 (Competition vs multiplaform monopoly) *In a market where there are two horizontally differentiated platforms and users are all singlehoming, the comparison between duopoly and multiplatform monopoly depends on: the level of platform differentiation t, the cross-side network effects α, and the stand-alone value of the platforms u. Namely,*

- *When $t < \alpha + \frac{2u}{3}$, i.e. the platforms are similar or the network effects are high, a multiplatform monopoly charges higher prices than a duopoly on all users. This results in lower user surplus and higher industry profit. However, the total welfare is the same.*
- *When $t > \alpha + \frac{2u}{3}$, i.e. the two platforms are sufficiently differentiated or the network effects are low, the duopoly and multiplatform monopoly yield the same prices, quantities, user surplus, total profits and welfare*

Our results indicate that when all users are singlehoming and platforms provide similar services, market concentration enables the monopoly firm to extract additional surplus from users.

Corollary 1 *The difference in user surplus between competition and multiplatform monopoly is increasing in α.*

This corollary indicates that for industries with stronger network effects, concentration has a stronger negative impact on user surplus. The intuition is as follows. As α increases, the multiplatform monopoly increases the prices, extracting any extra surplus that could be obtained from increasing in cross-side network effects. Instead, in competition, the prices decrease with an increase of α, reinforcing the increase in user surplus.

The next proposition concerns the case in which, upon acquisition of the second platform, the monopolist decides to integrate the platforms into a unique platform in the middle.

Proposition 2 (multiplatform monopoly vs single platform monopoly - profits) *The firm has always higher profits by integrating the platforms into a unique platform located in the middle.*

Proof. Simple comparison of the profits given by (2) and (4) yields the result. ■

This result indicates that, excluding any cost and technical considerations, upon acquisition of the second platform, the firm is better-off by integrating the two platforms into a single platform. These considerations are driven by the cross-side network effects and reflect the usual intuition that concentration in network industries increases the willingness to pay of users, to whom the firms can charge higher prices.

Proposition 3 (multiplatform monopoly vs single platform monopoly - user surplus) *If the transportation cost is low, ($\alpha < t < \alpha + \frac{2}{3}u$), competition generates higher user surplus*

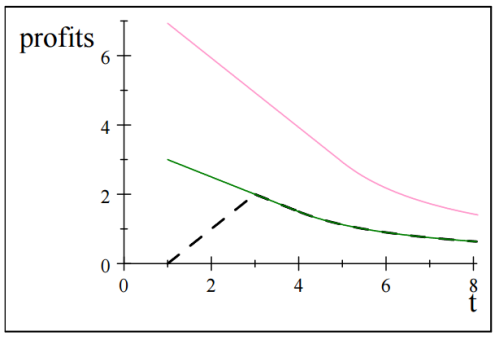
than monopoly. For $\alpha + \frac{2}{3}u \leq t < \alpha + u$ *the user surplus is the same under competition, multiplatform monopoly and single platform monopoly. For* $t \geq \alpha + u$*, single platform monopolys generates higher user surplus than both competition and multiplatform monopoly.*

Proof. Follows from direct comparison of the user surplus. ■

The intuition of the result is as follows. For low transportation cost, firms competition becomes very intense and prices are low. This compensates the loss in network from having two, rather than one, platform. For high transportation cost (namely $t > \alpha + u$) each platform is a local monopoly, as such, they do not compete head-to-head and prices are high. In that case, consumers are better off with a unique platform that concentrates all users (yielding higher cross-side network effects).

To summarize, under singlehoming we have that, for high transportation cost, both the firm and the consumers are better off with a single integrated platform. For low transportation cost, consumers are better-off under competition but a multiplatform monopoly generates higher profits. In this case, we a merger or acquisition should be challenged by the competition authorities.To summarize, under singlehoming we have that, for high transportation cost, both the firm and the consumers are better off with a single integrated platform. For low transportation cost, consumers are better-off under competition but a multiplatform monopoly generates higher profits. In this case, we a merger or acquisition should be challenged by the competition authorities.

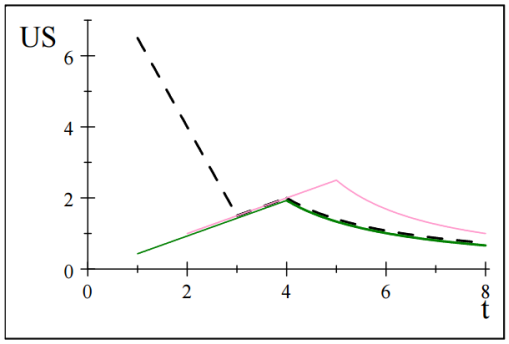
The following graphs depict profits, user surplus and monopoly under the different market structures and post-merger strategies as a function of transportation cost.



Single-homing: profit per platform under competition (black), multiplatform monopoly (green) and single integrated platform (pink). $\alpha = 1, u = 3$

3 Multihoming

In this section, we investigate the competitive bottleneck setting. Here, one side of the market is multihoming, i.e., the users can choose to join both platforms. Without loss of generality,



Single-homing: (US) user surplus under competition (black),
multiplatform monopoly (green) and single integrated platform (pink)
with $\alpha = 1, u = 3$

we assume buyers remain to be singlehoming while sellers multihome (in the payment systems example, this would amount to sellers using both Venmo and Paypal and buyers just using one or to drivers using both Lyft and Uber and users just one of the platforms. Following the same steps, we first analyze the market when two platforms are a duopoly and then a multiplatform monopoly and finally a single integrated platform.

Within the multiplatform monopoly, we also discuss the use of bundling by the firm and its corresponding effects on market outcomes and welfare.

Since sellers have the possibility to join both platforms, they can be divided into three intervals within the Hotelling line: sellers on the left subscribe only to platform 0, sellers on the right subscribe only to platform 1, and sellers in the middle subscribe to both platforms (or multihome). The thresholds of these intervals are the indifferent sellers given by the following equations:[9]

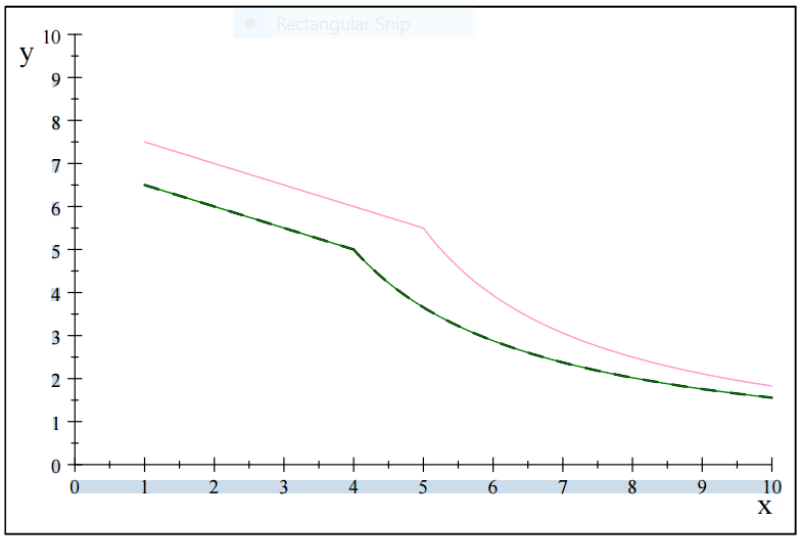
$$\bar{x} = 1 - \frac{u - p_1^s + \alpha q_1^b}{t},$$
$$\bar{\bar{x}} = \frac{u - p_0^s + \alpha q_0^b}{t}.$$

As for buyers, they continue choosing solely one platform and the indifferent buyer remains to be located as

$$x^b = \frac{t - p_g^b + p_{-g}^b + \alpha q_g^s - \alpha q_{-g}^s}{2t}.$$

Assuming fulfilled expectations regarding the size of the networks on each side and each platform, we obtain buyers' and sellers' demands for each platform as shown in Appendix A.2

[9]Under the assumption $t \leq u + \alpha$, we also have that $0 < \bar{x} < \bar{\bar{x}} < 1$



Single-homing: Welfare under competition (black), multiplatform monopoly (green) and single integrated platform (pink) with $\alpha = 1, u = 3$

3.0.1 Duopoly

When the two platforms are operated by two competing firms, each firm maximizes its platform's profit under the restriction such that the marginal buyer has to derive non-negative utility at equilibrium:

$$\max_{p_g^k,\ p_g^{-k}} p_g^k q_g^k + p_g^{-k} q_g^{-k}$$

$$s.t.$$

$$p_g^k \leq u + \alpha q_g^{-k} - t q_g^k$$

$$p_{-g}^k \leq u + \alpha q_{-g}^{-k} - t q_{-g}^k$$

In addition, we operate under the assumption that the market is covered (otherwise multihoming does not occur). This assumption is that $t < \alpha + u$.[10]

At equilibrium, the buyers' membership fee on each platform equals:

$$p_g^b = \begin{cases} \frac{2(t-\alpha)(t+\alpha)-\alpha u}{2t} & \text{if } \alpha \leq t \leq \alpha + \frac{2u}{3} \\ \frac{((2t-\alpha)(2t+\alpha)(2u-(t-\alpha))-4t\alpha u)}{8(t-\alpha)t} & \text{if } \alpha + \frac{2u}{3} \leq t \leq \alpha + u \end{cases}$$

[10] Also, the objective function is concave as long as $t > \alpha$. To see this note that the Hessian matrix is given by $\begin{bmatrix} -\frac{t}{(t-\alpha)(t+\alpha)} & \frac{-\alpha}{(t-\alpha)(\alpha+t)} \\ \frac{-\alpha}{(t-\alpha)(\alpha+t)} & -\frac{t}{(t-\alpha)(t+\alpha)} \end{bmatrix}$, which is negative semidefinite for $t > \alpha$.

and the sellers' membership fee on each platform is:

$$p_g^s = \begin{cases} \frac{u}{2} & \text{if } \alpha \leq t \leq \alpha + \frac{2u}{3} \\ \frac{3\alpha(t-\alpha)+2(2t-3\alpha)u}{8(t-\alpha)} & \text{if } \alpha + \frac{2u}{3} \leq t \leq \alpha + u \end{cases}$$ [11]

The firms' optimal pricing depends on the transportation cost, as the restrictions are not binding when $t \leq \alpha + \frac{2u}{3}$, and binding otherwise. On the buyer side, the two platforms share the market equally as users can only choose one platform. On the seller side, the number of users is the same on both platforms. Precisely, the numbers of users at equilibrium are:

$$q_g^b = \frac{1}{2}$$

$$q_g^s = \begin{cases} \frac{\alpha+u}{2t} & \text{if } \alpha \leq t \leq \alpha + \frac{2u}{3} \\ \frac{\alpha^2-\alpha t+2\alpha u-4tu}{8(\alpha-t)t} & \text{if } \alpha + \frac{2u}{3} \leq t \leq \alpha + u \end{cases}$$

for both platforms. The resulting profit for platform g equals

$$\pi_g = \begin{cases} \frac{u^2+2(t-\alpha)(t+\alpha)}{4t} & \text{if } \alpha \leq t \leq \alpha + \frac{2u}{3} \\ \frac{(\alpha-t)^2(7\alpha^2-16t^2)+4(\alpha-t)(5\alpha^2-8t^2)u+4(\alpha-2t)(3\alpha-2t)u^2}{64(\alpha-t)^2t} & \text{if } \alpha + \frac{2u}{3} \leq t \leq \alpha + u \end{cases}$$

and the equilibrium surpluses are

$$S^b = \begin{cases} \frac{3\alpha^2}{2t} - \frac{5t}{4} + u + \frac{\alpha u}{t} & \text{if } \alpha \leq t \leq \alpha + \frac{2u}{3} \\ \frac{t}{4} & \text{if } \alpha + \frac{2u}{3} \leq t \leq \alpha + u \end{cases}$$

$$S^s = \begin{cases} \frac{(u+\alpha)^2}{4t} & \text{if } \alpha \leq t \leq \alpha + \frac{2u}{3} \\ \frac{(\alpha^2-\alpha t+2\alpha u-4tu)^2}{64(\alpha-t)^2t} & \text{if } \alpha + \frac{2u}{3} \leq t \leq \alpha + u \end{cases}$$

With user surplus equal to:

$$US = \begin{cases} \frac{u^2+(4t+6\alpha)u+\left(7\alpha^2-5t^2\right)}{4t} & \text{if } \alpha \leq t \leq \alpha + \frac{2u}{3} \\ \frac{((t-\alpha)\alpha+2u(2t-\alpha))^2+16t^2(t-\alpha)^2}{64(t-\alpha)^2t} & \text{if } \alpha + \frac{2u}{3} \leq t \leq \alpha + u \end{cases}$$

[11] We obtain the following results that are aligned with Belleflamme and Peitz (2019): If $t > t^*$, then $p_g^s > p_g^b$ -the firms charge higher prices to the multihoming side if the platforms are more differentiated, but lower prices if they are less differentiated. If $t > t^*$ the sellers are charged less if they single-home and more if they multihome.

3.0.2 Multiplatform Monopoly

We next study the multiplatform monopoly scenario where two platforms are operated by a multiplatform monopoly. Like in the setting where users are all singlehoming, the ownership does not influence users' adoption decisions, but the optimal pricing strategy chosen by each platform changes. The multiplatform monopoly faces the restriction that the indifferent buyer receives non-negative utility ($U_0^b(q_0^b) = 0$). This restriction guarantees a fully covered market. Plugging in the demand functions 6, the firm's profit maximization problem simplifies as:

$$\begin{aligned} \max_{p_0^b, p_0^s, p_1^b, p_1^s} \quad & \textstyle\sum_{k,g} p_g^k q_g^k \\ \text{s.t.} \quad & p_0^b = \frac{\alpha^2 - \alpha(p_0^s + p_1^s - 2u) - t(p_1^b + t - 2u)}{t} \end{aligned}$$

Solving the system of first order conditions, we obtain the following equilibrium prices

$$\begin{aligned} p_g^b &= \frac{\alpha^2 - t^2 + (\alpha + 2t)\, u}{2t} \\ p_g^s &= \frac{u}{2} \end{aligned}$$

for both platforms.[12]

Correspondingly, both platforms share the market equally on the buyer side and attract the same number of sellers. Precisely, the number of users at equilibrium are:

$$\begin{aligned} q_g^b &= \frac{1}{2} \\ q_g^s &= \frac{\alpha + u}{2t} \end{aligned}$$

on both platforms and the resulting total profit and user surpluses are equal to

$$\begin{aligned} \Pi &= \frac{\alpha^2 - t^2 + 2\alpha u + 2tu + u^2}{2t} \\ S^b &= \frac{t}{2} \\ S^s &= \frac{(\alpha + u)^2}{2t} \end{aligned}$$

$$US = \frac{t^2 + (\alpha + u)^2}{4t}.$$

[12] The second order condition is satisfied via Assumption 1.

3.0.3 Bundling

Compared with competitive firms, the multiplatform monopoly has the additional ability to use some instruments and further optimize its profit. One illustrating example could be Meta, which also introduced a new subscription bundle on Instagram and Facebook in February 2023. This new bundling provides customers with protection, account verification support, and visibility for a monthly fee, both on Instagram and Facebook.[13]. Bundles for advertisers on multiple platforms are also common. To investigate how bundling affects the welfare in the multiplatform monopoly setting, we now allow the monopoly firm to practice discount prices by bundling its two platforms on the multihoming side.

A seller's utility for adopting solely one platform is the same as the previous analysis. However, its utility for choosing a bundle equals

$$U^s(x) = 2u + \alpha(q_0^b + q_1^b) - p^s - t,$$

where p^s is the price of the bundle. Since the sum of distances to two platforms is always equal to 1, the bundle's value does not depend on the seller's location x. The seller, who is indifferent between choosing platform g and the bundle, must satisfy $U_g^s(x) = U^s(x)$. Solving the equation, we derive the distance $\overline{d}(x,g)^s$ between the indifferent seller and its nearest platform:

$$\overline{d}(x,g)^s = \frac{t - u + p^s - p_g^s - \alpha q_{-g}^b}{t}.$$

Thus the number of sellers joining each platform and purchasing the bundle are respectively given by

$$\begin{aligned} q_g^s &= \overline{d}(x,g)^s = \frac{t - u + p^s - p_g^s - \alpha q_{-g}^b}{t}, \text{ and} \\ q_s &= 1 - q_0^s - q_1^s = \frac{p_0^s + p_1^s - 2p^s + \alpha q_0^b + \alpha q_1^b - t + 2u}{t}. \end{aligned}$$

where q_s is the number of sellers purchasing bundles.

On the buyer side, a user located at $x \in [0,1]$ obtains the following utility from adopting platform g

$$U_g^b(x) = u + \alpha(q_g^s + q^s) - p_g^b - td(x,g)$$

Buyers are singlehoming and join only one platform, thus the number of buyers on platform

[13] See `https://www.analyticsinsight.net/meta-launches-a-new-subscription-bundle-on-instagram-and-facebook/`.

g equals

$$q_g^b = \frac{1}{2} + \frac{p_{-g}^b t + \alpha q_g^s - \alpha q_{-g}^s - p_g^b t}{2t}$$

for $g \in \{0, 1\}$. Solving the implicit demand functions on both sides, we derive the explicit demands on both sides of the market as shown in Appendix A.2.

In this context, the multiplatform monopoly faces several restrictions. First, its membership fees cannot be too high such that the market becomes not fully covered:

$$p_0^b \leq \frac{\alpha^2 + \alpha(p_0^s + p_1^s - 2p^s + 2u) - t(p_1^b + t - 2u)}{t} \text{ and } p^s \leq \alpha - t + 2u$$

In addition, the number of sellers who are singlehoming must be non-negative such that $q_A^s \geq 0$ and $q_B^s \geq 0$. Thus, the firm's profit maximization problem is:

$$\begin{aligned} \max_{p_0^b, p_0^s, p_1^b, p_1^s, p^s} \quad & \textstyle\sum_{k,g} p_g^k q_g^k + p^s q^s \\ \text{s.t. } p_0^b \leq \quad & \tfrac{\alpha^2 - \alpha(p_0^s + p_1^s - 2u) - t(p_1^b + t - 2u)}{t} \\ p^s \leq \quad & \alpha - t + 2u \\ p_0^s \leq \quad & \tfrac{-\alpha^2 + \alpha(p_B^b + t - u) + tu}{t} \\ p_1^s \leq \quad & \tfrac{\alpha^2 - \alpha p_B^b + \alpha u + tu}{t} \end{aligned}$$

At equilibrium, the firm's optimal pricing strategy is:

$$\begin{aligned} p_g^b &= \frac{2\alpha - t + 2u}{2}, \\ p_g^s &= \frac{\alpha + 2u}{2}, \\ p^s &= \alpha - t + 2u.^{14} \end{aligned}$$

With mixed bundling, the multiplatform monopoly increases the prices of the single platforms on the multihoming side, pushing all users to purchase the bundle. Note that the utility of the sellers of acquiring separately the platforms or acquiring only one is lower than the utility obtained by acquiring the bundle. The multiplatform monopoly uses the bundle pricing to extract all the surplus of the sellers.[15] The resulting equilibrium numbers of users equals:

$$\begin{aligned} q_g^b &= \frac{1}{2} \\ q_g^s &= 0 \\ q^s &= 1 \end{aligned}$$

[15] Although we focus on bundling, we expect the same equilibrium when the multiplatform monopoly ties two platforms. With tying, all sellers will join both platforms and derive zero surplus at equilibrium.

and the equilibrium profit and buyer and seller surpluses are

$$\Pi = 2\alpha - \frac{3t}{2} + 3u$$
$$S^b = \frac{t}{4}$$
$$S^s = 0$$

$$US = \frac{t}{4}$$

3.0.4 Results

Here we summarize the results of the multihoming case.

Proposition 4 (Multihoming - profit) *For low transportation cost, $t < \left(1 + \frac{\sqrt{2}}{2}\right)(u + \alpha)$ the monopoly has higher profit by keeping two platforms and not employing bundling. For high values of the transportation cost, $t > \left(1 + \frac{\sqrt{2}}{2}\right)(u + \alpha)$, the firm has higher profit by engaging in bundling once they acquire a second platform.*

Proof. We obtain the results by direct comparison of the profits. ■

When t is very low, buyers will all multihome without the need for the firm to employ an aggressive pricing strategy. This increases the utility of buyers and subsequently the firm can charge higher prices and obtain higher profits.

Proposition 5 (multi-homing - user surplus) *For low transportation cost, $t < \alpha + \frac{2}{3}u$, users are better off under competition than multiplatform monopoly. As t increases, namely $t > \alpha + \frac{2}{3}u$ the users are better off under multiplatform monopoly. Bundling is the worst possible scenario for the users for all t.*

Proof. We obtain the results by direct comparison of the user surpluses. ■

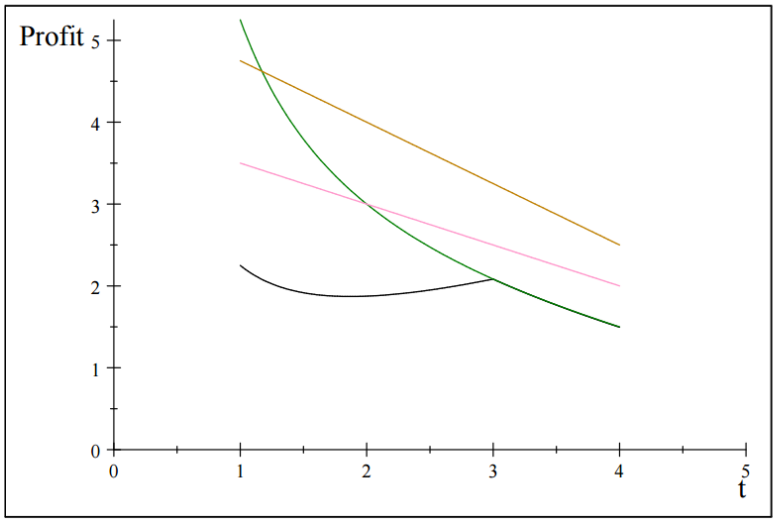
When the two platforms are similar (low transportation cost), the market is more competitive on the singlehoming side. Market concentration allows the firm to coordinate prices and and charge more. This reduces the surplus of the singlehoming users who are better off under competition. On the multihoming side, the demand for a platform's participation is solely determined by its own price and there is no actual competition between the two platforms. As a consequence, changing the ownership from two competitive firms to a multiplatform monopoly does not affect the price or user surplus.

When two platforms are more differentiated $t > \alpha + \frac{2}{3}u$, the profit-maximizing prices on the singlehoming side are not accessible due to market coverage restrictions. Thus, the optimal strategy of the two platforms is to charge the highest price such that the indifferent

buyer receives zero surpluses. In other words, the buyers' fee increases in the number of sellers due to the network effect. When the two platforms are operated by two competing firms, their motivation to attract multihoming sellers is not as strong as when they are operated by the multiplatform monopoly. This is because competing platforms maximize individual profit, and thus each additional multihoming seller can increase a firm's revenue from buyers only from its own platform. However, when the platforms are operated by a multiplatform monopoly, attracting one additional seller increases buyers' fees on both platforms simultaneously. Thus, each additional seller moves up the profit from buyers on both platforms, and the multiplatform monopoly is motivated to decrease prices on the multihoming side, attract more sellers, and increase sellers' surplus. Although the multiplatform monopoly obtains lower revenue from the multihoming side, its profit from the singlehoming side is much larger and the industry profit increases overall. As a consequence, we show that high concentration, in this case, may even increase users' surpluses and be beneficial for total welfare.

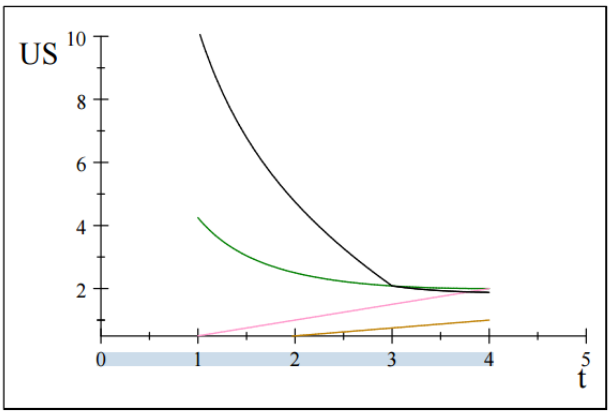
Finally, the introduction of bundling enables the firm to attract all sellers to join both platforms, maximize the network effects, reach the highest profit, and possibly move up total welfare. However, when the multiplatform monopoly employs bundling, users on the multihoming are striped of their surplus which leads to a steep reduction in total user surplus.

The following graphs illustrate our results.



Profits under multihoming: multiplatform monopoly (green), bundling (yellow), competition (black), single-platform monopoly (pink). ($\alpha = 1, u = 3$)

Corollary 2 *There is a misalignment on the profits and consumer surplus. For* $t < \alpha + \frac{2}{3}u$, *users are better off under competition, whereas the firm is better-off under multiplatform*



User surplus under multihoming: multiplatform monopoly (green), bundling (yellow), competition (black), single-platform monopoly (pink). ($\alpha = 1, u = 3$)

monopoly (particularly with bundling); for $t \geq \alpha + \frac{2}{3}u$*, the users are better-off with multiplatform monopoly. Bundling is always detrimental for users.*

4 Conclusion

As digital markets evolve, firms adapt by finding more complex market strategies. It is important to understand the welfare impact of these strategies to assess whether firms abuse market power. Digital markets are natural environments for the flourishing of large firms, frequently controlling multiple platforms where users interact. These firms exploit the fact that users on one side of the market enjoy having a large pool of users on the other side. In other words, cross-network effects are a feature of these markets and large dominant firms provide just the appropriate environment to exploit these economies of scale on the consumer side. This is one of the reasons that we frequently observe antitrust agencies condoning market concentration in these markets. However, although users benefit from a large network, post-merger market strategies, may hinder these benefits. In this work, we provide a simple model to study the effects of a merger of two horizontally differentiated platforms. We analyse different post-merger strategies for the merged firm, including the integration of the platforms and the use of bundling. We show that while welfare remains unchanged or even is possibly higher after the merger, the effects for the buyers and sellers are different and depend on whether users are singlehoming or multihoming, the level of differentiation of the platforms, the post-merger strategies and the network effects.

Our main result indicates that changing the ownership of two platforms from competing firms to the multiplatform monopoly will hurt users' surpluses in most scenarios. However, when platforms are sufficiently differentiated and one side of the market is multihoming,

changing the market structure from competition to multiplatform monopoly increases the surplus of users and total welfare. The intuition is that, because the monopoly can coordinate prices, by increasing the number of sellers who multihome, the monopoly raises the prices charged on singlehoming buyers on the two platforms that are under its monopoly ownership. The monopoly will then lower the price for sellers and extract more surplus from buyers. This positive result, however, is overturned if the merger firm employs bundling. We find that bundling enables the monopoly to attract all users to be multihoming. With higher participation, the monopoly is able to charge higher prices on the singlehoming side and achieve higher profits. In addition, it collects all the user surplus on the multihoming side.

Our results are in line with the general concerns of antitrust authorites related to the use of bundling in platforms. One illustrating example is the following: In July 2017, the European Commission (EC) fined Google 4.34 billion euros for offering the Google Search app and the Google Chrome browser as a bundle to mobile manufacturers in the European Economic Area. Both of these platforms provide users with a search service and can be considered partial substitutes.[16] In addition, the bundle, known as Google Mobile Services, also included the Google Play Store. Since the value of smartphones depends on the ability to access apps via the Play Store, the bundling strategy left manufacturers with no alternatives but to pre-install Google's search app and Chrome on devices. As pointed out by Tobin Center's report[17] "Google initially complied with the European Commission's prohibition on bundling by continuing to offer Google Android, Google Search, and Chrome for free on a nonexclusive basis, while continuing to group the Play Store, Gmail, Google Maps, and YouTube in a separately licensable bundle."Bundling had substantial implications for adopting alternatives and raised severe antitrust concerns.

Finally, this paper sheds light on the monopolization problem of platform industries. We are able to identify which agents benefit and are harmed when a monopoly owns multiple differentiated platforms and users have different adoption patterns over platforms. Naturally, when it comes to platforms, especially in the digital world, other considerations besides market outcomes must be acknowledged. For instance, digital multiplatform firms can combine information about users from different platforms so that they use sophisticated pricing strategies, they can also share information and large amounts of combined data with third parties. This raises privacy concerns, which are absent from our analysis. Another element that is usually important for the assessment of the increasing concentration of platform industries through the acquisition and mergers with other platforms is the issue of innovation and future competitiveness. Finally, multiplatform monopolies could also provide evidence of scope economies and quality improvements that could justify an increase in welfare as a result of the market concentration. Even though these issues are not being specifically addressed in this paper, this model can certainly serve as a benchmark for future research including all of

[16] https://ec.europa.eu/commission/presscorner/detail/en/IP_18_4581

[17] https://tobin.yale.edu/digital-economy-project/policy-discussion-papers

these questions.

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A Appendix

A.1 Local Monopoly

When two platforms are highly differentiated such that $t > \alpha + u$, it is optimal for two platforms to set the price sufficiently high such that the market is not fully covered. Furthermore, this optimal pricing strategy is not affected by the ownership of these platforms.

In this local monopoly case, the indifferent user is given by $U_g^k = 0$ on both platforms and both sides. Solving the equations, we derive the explicit demand for each platform as

$$q_g^k = \frac{u(\alpha + t) - tp_g^k - \alpha p_g^{-k}}{(t+\alpha)(t-\alpha)},$$

for platform $g \in \{0, 1\}$ on side $g \in \{b, s\}$. When two platforms are owned by competing firms, each firm maximizes its own profit:

$$\max_{p_g^k,\ p_g^{-k}} p_g^k q_g^k + p_g^{-k} q_g^{-k}$$

At equilibrium, the pricing strategy and corresponding quantity on each platform equals:

$$p_g^k = \frac{u}{2} \text{ and } q_g^k = \frac{u}{2(t-\alpha)}$$

for platform $g \in \{0, 1\}$ on side $g \in \{b, s\}$. Since there is no competition between two platforms, the ownership of two platforms does not affect their pricing strategy and equilibrium quantity. However, the profit for the firm depends on the ownership. Specifically, the resulting profit (per platform) equals

$$\pi_g = \begin{cases} \frac{u^2}{2(t-\alpha)}, \text{ competing firms} \\ \frac{u^2}{(t-\alpha)} \text{ multiplatform monopoly} \end{cases}$$

and the user surpluses are

$$S^b = S^s = \frac{tu^2}{4(t-\alpha)^2}$$

A.2 Explicit Demands for Competitive Bottleneck

In the competitive bottleneck setting where one side of the market is multihoming, the demands for platform participation on each side are given as:

$$
\begin{aligned}
q_0^b &= \frac{(t-\alpha)(\alpha+t) - \alpha\left(p_0^s - p_1^s\right) - t\left(p_0^b - p_1^b\right)}{2(t-\alpha)(t+\alpha)} \\
q_0^s &= \frac{(t-\alpha)(\alpha+t)\left(\alpha+2u\right) + \left(\alpha^2 - 2t^2\right)p_0^s + \alpha^2 p_1^s - \alpha t\left(p_0^b - p_1^b\right)}{2t(t-\alpha)(\alpha+t)} \\
q_1^b &= \frac{(t-\alpha)(\alpha+t) - \alpha\left(p_1^s - p_0^s\right) - t\left(p_1^b - p_0^b\right)}{2(t-\alpha)(\alpha+t)} \\
q_1^s &= \frac{(t-\alpha)(\alpha+t)\left(\alpha+2u\right) + \left(\alpha^2 - 2t^2\right)p_1^s + \alpha^2 p_0^s - \alpha t\left(p_1^b - p_0^b\right)}{2t(t-\alpha)(\alpha+t)}
\end{aligned} \tag{6}
$$

Note that all expected comparative statics for the prices holds.

When the monopoly firm practices mixed bundling on the multihoming side, the demands for platform participation on each side can be calculated as:

$$
\begin{aligned}
q_g^b &= \frac{\alpha^2 - t^2 - \alpha p_{-g}^s + \alpha p_g^s - p_{-g}^b t + p_g^b t}{2(t-\alpha)(\alpha+t)} \\
q_g^s &= \frac{\alpha^3 + \alpha^2 p_0^s + \alpha^2 p_1^s - 2\alpha^2 p^s - 2\alpha^2 t - \alpha p_g^b t + \alpha p_{-g}^b t - \alpha t^2 - 2p_g^s t^2 + 2p^s t^2 + 2t^3 + 2\alpha^2 u - 2t^2 u}{2t(t-\alpha)(\alpha+t)} \\
q^s &= \frac{2u + \alpha - t + p_0^s + p_1^s - 2p^s}{t}
\end{aligned}
$$

All of these check the usual comparative statics.

A.3 Multiplatform v.s. Multiproduct

One critical characteristic of a two-sided market is the existence of positive network effects, i.e., $\alpha > 0$. To investigate the impact of network effects, we study in this section the case where cross-group external effects are equal to zero, i.e., $\alpha = 0$. In this context, the two sides are independent of one another, as if each platform constitutes an individual product for each group of users. Naturally this is an abstraction that allows us to understand the role of cross-side network effects on firms incentives and on the effect of the different strategies for user surplus and welfare. Comparing this setting with the previous multiplatform analysis when $\alpha > 0$, we provide insights into the role of network effects in regulatory approaches.

If the users are singlehoming and there are no network effects, the market equilibrium could be summarized as shown in Table A.1. Since the advantages of multi-platform monopoly come mainly from price coordination, the removal of network effects does not affect our conclusion. When the two platforms are similar such that $t < \frac{2u}{3}$, the monopoly charges higher prices, and the user surplus is lower than in the competitive market. When the two platforms are

Table A.1: Two-sided singlehoming market outcomes ($\alpha = 0$)

	Competitive firms ($t < \frac{2u}{3}$)	Competitive firms ($t > \frac{2u}{3}$)	Multiplatform Monopoly
p^b	t	$u - \frac{t}{2}$	$u - \frac{t}{2}$
p^s	t	$u - \frac{t}{2}$	$u - \frac{t}{2}$
q^b	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
q^s	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
π	t	$u - \frac{t}{2}$	$2u - t$
S^b	$u - \frac{5t}{4}$	$\frac{t}{4}$	$\frac{t}{4}$
S^s	$u - \frac{5t}{4}$	$\frac{t}{4}$	$\frac{t}{4}$
W	$2u - \frac{t}{2}$	$2u - \frac{t}{2}$	$2u - \frac{t}{2}$

sufficiently differentiated such that $t > \frac{2u}{3}$, changing the ownership has no impact on market outcomes.

Table A.2: One-sided multihoming market outcomes ($\alpha = 0$)

	Competitive firms ($t < \frac{2u}{3}$)	Competitive firms ($t > \frac{2u}{3}$)	Multiplatform Monopoly	Bundling
p^b	t	$\frac{2u-t}{2}$	$\frac{2u-t}{2}$	$\frac{2u-t}{2}$
p^s	$\frac{u}{2}$	$\frac{u}{2}$	$\frac{u}{2}$	u
q^b	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
q^s	$\frac{u}{2t}$	$\frac{u}{2t}$	$\frac{u}{2t}$	1
π	$\frac{2t^2+u^2}{4t}$	$\frac{-t^2+2tu+u^2}{4t}$	$\frac{-t^2+2tu+u^2}{2t}$	$-\frac{3t}{2} + 3u$
S^b	$-\frac{5t}{4} + u$	$\frac{t}{4}$	$\frac{t}{4}$	$\frac{t}{4}$
S^s	$\frac{u^2}{4t}$	$\frac{u^2}{4t}$	$\frac{u^2}{4t}$	0
$W(\alpha = 0)$	$\frac{-t^2+4tu+3u^2}{4t}$	$\frac{-t^2+4tu+3u^2}{4t}$	$\frac{-t^2+4tu+3u^2}{4t}$	$-\frac{5t}{4} + 3u$

When sellers are multihoming and there are no network effects, the market equilibrium could be summarized as shown in Table A.2. When the two platforms are similar such that $t < \frac{2u}{3}$, we derive the same conclusion as when there exist positive network effects. The multihoming side is not affected. However, the multiplatform monopoly can coordinate prices on the singlehoming side, and correspondingly, the surplus on the singlehoming side is lower after changing the ownership from competing firms to a monopoly.

When the two platforms are sufficiently differentiated and there are no network effects, i.e. $t > \frac{2u}{3}$ and $\alpha = 0$, changing the ownership has no impact on market outcomes. This is because only with positive network effects, the multiplatform monopoly can derive a larger surplus from attracting each additional multihoming seller than competitive firms. Recall that when $\alpha > 0$, each additional multihoming seller increases the surplus of buyers and thus the firm's revenue from charging buyers on its platform. Since the multiplatform monopoly owns both platforms, the benefit of attracting each additional multihoming seller is doubled. This becomes the main motivation for the multiplatform monopoly to increase their partici-

pation and surplus. When network effects disappear, this underlying mechanism vanishes as well. As a consequence, changing the ownership no longer has any impact on market outcomes.

As for bundling, the conclusions are also similar. When $t < \frac{u}{2}$ so the monopoly already attracts all sellers to be multihoming without bundling, the introduction of bundling does not enable the monopoly to further increase seller participation or increase the total welfare. When $t > \frac{u}{2}$, bundling assists the multiplatform monopoly to further attract all sellers to both platforms and extract all their surplus. However, when network effects are equal to zero, the increase in seller participation no longer affects buyer surplus. As a consequence, the multiplatform monopoly no longer can charge higher fees from buyers and consequently achieve smaller profit increments. Our conclusion is consistent with multiproduct analysis as shown in Chen & Riordan (2013).

A.4 Single platform monopoly (at 0)

Upon the acquisition of the second platform, the monopoly firm could shut down on of the platforms. Here we analyse the outcomes for the firm, users and welfare of that strategy.

In case the monopoly decides to shut down platform 1, the utility of the consumers of type k from buying from platform 0 is given by

$$U_0^k(x) = u + \alpha q_0^{-k} - p_0^k - tx$$

The indifference consumer is

$$\hat{x} = \max\left\{\frac{u + \alpha q_0^{-k} - p_0^k}{t}, 1\right\}$$

The equilibrium demands are:

$$q_0^k = \frac{u + \alpha q_0^{-k} - p_0^k}{t}$$
$$q_0^{-k} = \frac{u + \alpha q_0^k - p_0^{-k}}{t}$$

With rational expectations on the network size, we get

$$q_0^b = \frac{u + \alpha \frac{u + \alpha q_0^b - p_0^s}{t} - p_0^b}{t}$$
$$q_0^b = \frac{\left(1 + \frac{\alpha}{t}\right) u - \frac{\alpha}{t} p_0^s - p_0^b}{\left(t - \frac{\alpha^2}{t}\right)}$$
$$q_0^s = \frac{\left(1 + \frac{\alpha}{t}\right) u - \frac{\alpha}{t} p_0^b - p_0^s}{\left(t - \frac{\alpha^2}{t}\right)}$$

:

$$q_b = \frac{u(\alpha + t) - t p_b - \alpha p_s}{(t - \alpha)(t + \alpha)}$$
$$q_s = \frac{u(\alpha + t) - t p_s - \alpha p_b}{(t - \alpha)(t + \alpha)}$$

Suppose now that the firm wants to max profit

$$\max_{p_b, p_s} \frac{d}{dp_s} \left(\frac{u(\alpha + t) - t p_b - \alpha p_s}{(t - \alpha)(t + \alpha)} p_b + \frac{u(\alpha + t) - t p_s - \alpha p_b}{(t - \alpha)(t + \alpha)} p_s \right)$$
$$\left(1 + \frac{\alpha}{t}\right) u - \frac{\alpha}{t} p_0^s - 2 p_0^b - \frac{\alpha}{t} p_0^s = 0 \iff \frac{1}{t^2 - \alpha^2} (u\alpha - 2 t p_b - 2\alpha p_s + t u) = 0$$
$$\left(1 + \frac{\alpha}{t}\right) u - \frac{\alpha}{t} p_0^b - 2 p_0^s - \frac{\alpha}{t} p_0^b = 0 \iff \frac{1}{t^2 - \alpha^2} (u\alpha - 2 t p_s - 2\alpha p_b + t u) = 0$$
$$p_b = \frac{1}{2} u, p_s = \frac{1}{2} u$$

The demands in equilibrium are given by

$$\left[\frac{u(\alpha + t) - t p_b - \alpha p_s}{(t - \alpha)(t + \alpha)} \right]_{p_b = \frac{1}{2} u, p_s = \frac{1}{2} u} = \frac{1}{2} \frac{u}{t - \alpha}$$

Profits are

$$\pi = \frac{1}{2} \frac{u^2}{t - \alpha}$$

The interior solution is valid when $t > \frac{u}{2} + \alpha$

The consumer surplus of the interior solution is

$$CS = 2 \int_{k=0}^{k = \frac{1}{2} \frac{u}{t - \alpha}} \left(u + \alpha \frac{1}{2} \frac{u}{t - \alpha} - \frac{u}{2} - t k \right) dk$$
$$= \frac{t u^2}{4 (t - \alpha)^2}$$

The welfare is

$$W = \frac{1}{4}u^2 \frac{3t - 2\alpha}{(t-\alpha)^2}$$

Note that this interior solution is valid for $t > \frac{u+2\alpha}{2}$.Otherwise, the monopoly would be in the corner solution

Corner solution - sell to all users:

$$q_b = \frac{\left(1 + \frac{\alpha}{t}\right) u - \frac{\alpha}{t} p_0^s - p_0^b}{\left(t - \frac{\alpha^2}{t}\right)} = 1$$
$$q_s = \frac{\left(1 + \frac{\alpha}{t}\right) u - \frac{\alpha}{t} p_0^b - p_0^s}{\left(t - \frac{\alpha^2}{t}\right)} = 1$$

$$p_0^b = -t + u + \alpha$$
$$p_0^s = -t + u + \alpha$$

$$\pi = 2\left(-t + u + \alpha\right)$$

$$US = t$$

$$W = 2\alpha - t + 2u$$

The profits and user surplus when the firm decides to close one platform as a function of t.

	$t < \frac{u}{2} + \alpha$	$t > \frac{u}{2} + \alpha$
p_k	$-t + u + \alpha$	$\frac{u}{2}$
π	$\left[2\left(-t + u + \alpha\right)\right]_{\alpha=1,u=3}$	$\left[\frac{1}{2}\frac{u^2}{t-\alpha}\right]_{\alpha=1,u=3}$
CS	t	$\frac{1}{4}t\frac{u^2}{(t-\alpha)^2}$
W	$2\alpha - t + 2u$	$W = \frac{1}{4}u^2\frac{3t-2\alpha}{(t-\alpha)^2}$