Discussion Paper Series – CRC TR 224

Discussion Paper No. 584
Project B 05

The Economic Theory of Two-Sided Platforms

Martin Peitz[1]

August 2024

[1]University of Mannheim, Email: martin.peitz@gmail.com

Support by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) through CRC TR 224 is gratefully acknowledged.

Collaborative Research Center Transregio 224 - www.crctr224.de
Rheinische Friedrich-Wilhelms-Universität Bonn - Universität Mannheim

The Economic Theory of Two-Sided Platforms[1]

Martin Peitz
University of Mannheim and MaCCI

draft chapter prepared for the
Cambridge Handbook on Digital Platforms
July 2024

Abstract

In this chapter, I review the economic theory of two-sided platforms. First, I elaborate on the prevailing price structure in monopoly and oligopoly and explore the prevailing market structure. Second, I consider the choice of non-price strategies that affect users on the platform and address the horizontal and vertical scope of platforms.

Keywords: Two-sided platform, price theory, digital markets, network effects, platform design

JEL-Classification: L12, L13, L41, L42

[1] Helpful comments by Julian Wright are gratefully acknowledged. The author discloses that he frequently advises competition authorities on issues related to this chapter and gratefully acknowledges support from the Deutsche Forschungsgemeinschaft (DFG) through CRC TR 224 (Project B05).

1 Introduction

Economic theory has contributed to our understanding of the incentives of two-sided platforms and their users. Central to an important stream of works in this literature is the role of network effects between different user groups. Platforms can be broadly defined as orchestrators of interactions between platform users in settings where user benefits depend on the decisions of other users (Belleflamme and Peitz [2018a, 2021]). On two-sided platforms,[2] two groups of users can be distinguished and the benefits of users from at least one of the groups depend on the participation and engagement of users from the other group (*cross-group network effects*). This definition resonates with policymakers. For example, in its revised market definition notice for competition cases, the European Commission writes: "Multi-sided platforms support interactions between different groups of users, creating a situation where the demand from one group of users has an influence on the demand from the other groups" (European Commission [2024], par. 94). Hagiu and Wright (2015) propose a broader definition of what constitutes a two-sided platform: A firm operates as a platform if it enables interaction between the two sides and each side is affiliated with the platform. In this chapter, I mostly but not exclusively focus on platforms featuring network effects.

Whereas the seminal theory papers on two-sided platforms have focused on cross-group network effects (Rochet and Tirole [2003], Armstrong [2006]), many real-world two-sided platforms also feature *direct* or *within-group network effects*. Take app stores as an example.[3] They orchestrate the interaction between application developers and end users. End users may benefit from the increased presence of other end users (for instance, through more precise ratings or steering to better matches), leading to *direct* or *within-group network effects*. Here end users do not care about the presence of other users but from the footprint that other users leave thanks to the data the platform can draw on. This is a case in which network effects are data-enabled (Hagiu and Wright [2023]). For example, recommender systems lead to such data-enabled network effects when they provide valuable information to users based on data collected from other users (Belleflamme and Peitz [2021, Chapter 2]).

On app stores, end users may also benefit from a larger variety and higher quality of application developers, leading to positive cross-group network effects from app developers to end users. On the other side of the platform, developers may benefit from a larger number of and more engagement by end users, leading to positive cross-group network effects from end users to platform developers. Mutual positive cross-group network effects then generate positive *indirect network effects*. The term "indirect" refers to the fact that end users care only indirectly about the participation and usage of other end users because more end users attract more developers (or make developers offer higher quality), which is beneficial for every end user. Correspondingly, developers also experience positive indirect network effects.

Platforms may solve or mitigate market failures: They may help users to easily find good matches and thus provide information to users. They may also generate trust among users and thereby remove or mitigate asymmetric information problems. In a broad sense, platforms can be seen as reducing transaction costs. Here, network effects come into play: The value that

[2] In some examples, more than two sides can be identified. In this chapter, I will not separately address multi-sided platforms that cater to more than two sides.

[3] This chapter reuses material in large parts from Peitz (forthcoming), part of it verbatim without quotation marks.

platforms create for their users tends to grow with their success: For instance, more participation may increase the likelihood of encountering a good match or allow the platform to put mechanisms in place that foster trust (like reputation mechanisms). Platforms often devise complex strategies to manage network effects to generate economic value but also partly sacrifice them in their quest for profit.

In the theory literature on two-sided platforms, most of the early efforts aimed at a better understanding of pricing strategies. Two-sided platform can use the price structure to manage participation and interactions by users. Many platforms also use non-price strategies and economic theory contributions reflect this (most of this work is more recent). Platforms can set rules on how transactions can be enabled and contracts are enforced. Part of its activity is to police the ecosystem that has formed around it. For example, in an e-commerce setting, the platform may devise and enforce rules on how to deal with sellers who offer counterfeit products or sell products in a way that does not comply with certain quality standards. The platform may also set contractual terms that constrain in particular sellers outside the platform: Exclusivity and price-parity clauses prevent sellers from offering the product elsewhere or giving better terms.

Complementary works: This chapter complements several other overviews and surveys. I mostly ignore the empirical literature on the topic and focus on contributions in economic theory. I draw on Peitz (forthcoming), which is broader in scope. Relatedly, Belleflamme and Peitz (2021) cover monopoly pricing and platform design in a monograph. The following are complementary surveys: Belleflamme and Peitz (2018a) give an introduction to platform economics with a particular focus on monopoly pricing; Jullien, Pavan, and Rysman (2021) provide a detailed technical survey on platform pricing covering monopoly and oligopoly settings.

Organization of the chapter: In Section 2, I analyze a platform's pricing decisions, covering monopoly and oligopoly settings. In Section 3, I turn to non-price decisions. This includes platform strategies that directly affect competition between platforms or competition with trading outside the platform. Section 4 concludes.

2 Platform Pricing

Prices set by the platform allow the platform to monetize its service; at the same time, the choice of the price structure can be seen as an instance of managing participation and interaction of the platform.

2.1 Monopoly Pricing

A monopoly platform offers a service with stand-alone value $r_i \geq 0$ for users from group i and may offer benefits that depend on the usage and participation decisions of other users. To fix ideas, suppose that the platform caters to two user groups a and b, and that each user cares about the number of users from the same and/or the other group in a linear fashion. For example, one may set the outside option to zero and write a user's valuation on the platform in an additively separable form with linear network effects; that is

$$v_a = r_a + \alpha_a n_a + \beta_a n_b - A_a \quad (1)$$
$$v_b = r_b + \alpha_b n_b + \beta_b n_a - A_b \quad (2)$$

for group-a and group-b users respectively, where α_i is the strength of the within-group network effects, β_i is the strength of the cross-group network effect operating on group i, n_i is the number of participating users from group i, and A_i is the access or participation fee charged to users of group i.

For the given network effect parameters α_a, α_b, β_a, and β_b and stand-alone parameters r_a and r_b, the platform can manage participation through its participation fees. The work following Armstrong (2006) focuses on the pricing of access to a platform in the presence of cross-group network effects only (i.e. $\alpha_b = \alpha_b = 0$). For any given access fees, there may exist multiple consumer participation equilibria including two stable equilibria: one with zero participation in both user groups and the other with positive participation by both user groups. If consumers tend to coordinate on the outside option, the platform owner may then choose an asymmetric price structure, even in a symmetric environment, to make sure that users in the group with the lower price (say group a) will participate. If all users observe the full price structure, users in group b then infer that (many) users in group a participate. This induces many users in group b to join even when they face a higher price. This is an instance in which the platform owner uses an asymmetric price structure to solve the chicken-and-egg problem (also sometimes referred to as the mutual baiting problem). The asymmetric price strategy in response to this problem is called a divide-and-conquer strategy.

If the two user groups are different, a profit-maximizing platform owner is not indifferent as to which group to use as bait. When applying a divide-and-conquer strategy, a monopoly platform tends to subsidize the group that exerts the largest cross-group network effect on the other group and monetizes users in the other group (irrespective of the relative size of the two groups).[4] The fear of user miscoordination may also make it more attractive to monetize through transaction fees rather than access fees. With access fees, users may not be confident to find counterparts in the other group. Hence, they may be reluctant to pay a membership fee upfront, as they fear not being able to conduct any transaction once subscribed to the platform. If instead the platform resorts to transaction fees, the fear is unwarranted as transaction fees are only paid if an effective transaction takes place.

Suppose instead that the platform does not have to deal with the coordination problem of users; that is, consumers are assumed to coordinate on the participation equilibrium that is most favorable to the platform. To understand the monopolist's pricing incentives, one can compare how the price structure chosen by the monopolist differs from the one chosen by a social planner who maximizes total surplus. With positive cross-group network effects, the welfare-maximizing solution features access fees below the marginal cost of serving an additional user. For several reasons, a profit-maximizing platform chooses a price structure that differs from the one that would maximize total surplus, but has some resemblance: the monopoly platform restricts output (market-power distortion), cares about marginal users

[4] For a formal investigation see Belleflamme and Toulemonde (2009). For the use of divide-and-conquer strategies under Bertrand competition between two platforms, see Caillaud and Jullien (2003). Here, the result will be market tipping and the only active firm may not make any profit. See also Jullien (2011).

rather than about average users (Spence distortion), induces different interaction benefits (displacement distortion) and different participation rates (scale distortion) – see Weyl (2010) and Tan and Wright (2018, 2021). Depending on the specifics of the environment (strengths of the cross-group network effects, costs, and stand-alone benefits), the combined impact of these distortions may lead the monopoly platform to set prices that are below or above the efficient level on either side. However, the monopoly platform will never set prices below the efficient level on both sides.

To analyze how the monopoly platform sets its participation fees, I return to the specific setting presented above and derive the "demands for participation" for each user group. Because of network effects, participation decisions are interdependent and demands are derived by solving for the Nash equilibrium of the "participation game" users play. Suppose for simplicity that, in each group, the value of the outside option is uniformly distributed over some sufficiently large interval. Then, the number of users who decide to participate in group i, n_i, is equal to v_i.[5] Setting $v_a = n_a$ and $v_b = n_b$ in equations (1) and (2) above and rearranging terms, gives:

$$(1 - \alpha_a)n_a = r_a + \beta_a n_b - A_a \text{ and } (1 - \alpha_b)n_b = r_b + \beta_b n_a - A_b.$$

Thus, participation in one group depends on participation in the other group, and vice versa. The next step is solving this system of two equations in n_a and n_b. A useful shorthand notation for the solutions is $n_a(A_a, A_b)$ and $n_b(A_a, A_b)$. Participation on each side depends on *both* participation fees: If the network effect parameters respect some conditions, participation decreases in each fee. The intuition is straightforward. Fewer users decide to participate if they or the users from the other group are charged a larger fee. The first effect is standard (this is the expression of the Law of Demand). The second effect is specific to platforms catering to more than one group, as it follows from the presence of positive cross-group network effects: If a fee increase leads to fewer users participating in, say, group b, then users in group a are less keen to participate as interacting on the platform becomes less valuable.

The platform internalizes these effects when choosing its fees. As explained by Armstrong (2006), if users in group a exert a positive cross-group network effect on users in group b, then the platform has an incentive to lower the price on side a because attracting more users on side a also allows the platform to raise more revenues from group b (and not just from group a as would be the case in the absence of network effects). Note that, if the two groups are not symmetric, this logic may drive the platform to subsidize the participation of one group of users (that is, to set the price below the marginal cost, which can be implemented, e.g., through cash-backs or in-kind payments). This is likely to be the case when one group exerts a positive cross-group network effect on the other, whereas the other does the opposite – media platforms that cater to advertisers and consumers are often a case in point if consumers experience advertising as a nuisance.

The previous reasoning relies on two important conditions. First, the platform must be able to set its fees freely. This is not always the case as platforms may face constraints that prevent them from setting their optimal prices. For instance, below-cost prices may be prohibited or

[5] A user of group i participates if and only if $v_i \geq X$, where X denotes the user's outside option. Given the uniform distribution of X with density 1, the number of users such that $X \leq v_i$ is just equal to v_i.

infeasible. Then, a platform may be limited in its ability to internalize cross-group network effects.[6]

Second, users on each side can observe the price on the other side. The previous reasoning indeed relies on the fact that users in group b react to a change in A_a, which supposes that they can observe such a change. For instance, in the case of app stores, end-users may not observe how much the platform charges app developers. In such a context, end-users must base their participation decision on some predictions of what the participation level of app developers will be. Since users do not observe the price charged to the other group, the platform is tempted to raise this price too much for its own good – this is an instance of the classic opportunism problem (Hart and Tirole [1990]). The platform may then want to devote resources to make prices charged to the other group observable, for instance, through dedicated advertising. Gross of the associated costs, this yields higher profits but also higher surpluses for all users.[7]

The result that a platform adjusts its prices to internalize network effects does not require the presence of easily distinguishable groups of users. For example, social networks may be able to segment a single user group into subgroups that differ along some characteristics and condition prices on these user characteristics. Then a social network catering to a single – but segmented – audience chooses prices very much like a multi-sided platform (Belleflamme and Peitz [forthcoming]).[8]

2.2 Oligopoly Pricing

Our discussion focused on monopoly platforms; several contributions study competition between differentiated two-sided platforms such that more than one platform serves the two user groups.

One set of articles focuses on the users' participation decisions and platform competition in participation fees. Assuming that users are either single-homers (i.e. they join at most one platform) or (potential) multi-homers (i.e. they consider joining more than one platform), one can distinguish between three oligopoly settings of two-sided platforms: single-homing by both groups, single-homing by one group and multihoming by the other, multihoming by both groups.

A good starting point is the analysis by Armstrong (2006) explaining the pricing incentives under (i) two-sided single-homing and (ii) single-homing on one side and multi-homing on the other (an environment he labels competitive bottleneck). Consider the familiar Hotelling environment for each user group that is enriched by linear cross-group network effects (for

[6] See Belleflamme and Peitz (2021, Section 5.3.1) for a formal treatment. The zero-price constraint is of high relevance in the case of ad-funded media platforms (including social networks) because often the cross-group network effect exerted by advertisers on consumers is negative (i.e., consumers consider advertising to be a nuisance).

[7] Hagiu and Halaburda (2014) and Belleflamme and Peitz (2019c) study this issue. They also show that competition among platforms may attenuate or reverse the platforms' incentives to advertise non-observed prices.

[8] A two-sided platform may second-degree or third-degree price discriminate among users within a group, as analyzed by Jeon, Kim, and Menicucci (2022) and de Cornière, Mantovani, and Shekhar (forthcoming).

details, see Belleflamme and Peitz [2018, 2019b]). Platforms simultaneously set participation fees for both user groups. Under two-sided single-homing, the price each platform charges to a group-a user is marginal cost plus the standard Hotelling markup minus the value the platform obtains from group b by attracting an additional group-a user. Thus, because of (positive) cross-group network effects competition is more intense than in the traditional Hotelling setting. By contrast, under competitive bottleneck, each platform offers the group of multi-homing users[9] monopoly access to its single-homing users. Thus, each platform sets monopoly prices on the multi-homing side, and both platforms compete in prices for the single-homing user group, which may lead to low – and even below marginal costs – prices for this user group.[10]

The two-sided single-homing platform duopoly has been extended to multiple symmetric platforms with general network effects (Tan and Zhou [2021]), multiple asymmetric platforms (Peitz and Sato [2023]), and dispersed user information regarding the distribution of preferences (Jullien and Pavan [2019]). The competitive bottleneck model, modified by assuming that platforms set participation levels on the multihoming side, has been extended to multiple asymmetric platforms (Section 6 in Anderson and Peitz [2020]). It has been often used to analyze purely ad-funded media (when consumers are modeled as single-homers and care about the volume of advertising), as in Anderson and Coate (2005) and Anderson and Peitz (2020). Two-sided multihoming has been introduced in the Armstrong setting by Bakos and Halaburda (2020). Multi-homing consumers have also been introduced into models with ad-funded media. Here, multi-homing consumers are less valuable than single-homing consumers because the interaction benefits they provide is lower, leading to the incremental pricing principle (Ambrus and Reisinger [2006], Ambrus, Calvano and Reisinger [2016], Anderson, Foros, and Kind [2018]).

Another set of articles focuses on competition in transaction fees. Rochet and Tirole (2003, 2006) characterize the fee structure when platforms charge transaction fees and users have different inclinations to use a platform. Teh et al. (2023) consider a symmetric platform oligopoly in which users in both groups can multi-home, as in the case of payment systems, which facilitate transactions between merchants and consumers. In the first stage, platforms set transaction fees to both user groups; in the second stage, users in both groups make their participation decision; and in the third stage, group-b users decide which of the available platforms to use for the transaction with a group-a user (e.g., each consumer chooses which card to use from among the cards they hold and that the merchant accepts). If neither group-a nor group-b users have any opportunity cost from participating, group-b users will join all platforms in the second stage 2. By contrast, group-a users face a tradeoff when platforms do not charge them the same fee. If they join all platforms (including the platform with the highest fee) they will not sacrifice any transactions. However, by delisting from the highest fee platform (and other high-fee platforms), group-a users benefit from a lower fee, by diverting group-b users to only pick from options for which group-a users pay lower fees. Whether group-a users want to delist from high-fee platforms then depends on the "loyalty" of group-b users, which

[9] To be precise, multi-homing users have the option to multi-home. In equilibrium, some or all may not take the option and instead accept one or none of the offers.

[10] As Belleflamme and Peitz (2019b) show, it is not necessarily the case that under competitive bottleneck users in the single-homing group experience lower prices and users in the multi-homing group experience higher prices than under two-sided single-homing – the opposite may hold.

measures the group-b users' inclination to transact via a different platform if an offer is not available on a specific platform (given prices). With little loyalty of group-b users, group-a users lose few transactions when dropping high-fee platforms and are therefore more inclined to do so.

In Teh et al. (2023) more intense platform competition (e.g. because of exogenous platform entry) leads to a lower total fee and an adjustment of the fee structure: Group-a users tend to benefit from a lower fee, whereas group-b users tend to experience a fee increase (and, in effect, there is less cross-subsidization of group-b users). Now suppose that a fraction of group-b users single-homes.[11] If there are more single-homing group-b users, it becomes more costly for group-a users to drop a platform. As a result, group-a users face higher fees (the total fee goes up as well), whereas group-b users benefit from lower fees.

3 Non-Price Decisions and Platform Design

3.1 Competition on the Platform and Other Platform Design Decisions

Competition on the platform. The strength of network effects is endogenous and depends on the degree of seller competition (Nocke, Peitz, Stahl [2007], Hagiu [2009], Belleflamme and Peitz [2019a], Teh [2022]). E-commerce marketplaces, which enable trade between sellers and buyers, are a case in point. To fix ideas, let us take a specific example.[12] Suppose that a number n_s of sellers and a number n_b of buyers join the platform. Single-product sellers offer horizontally differentiated products (which they produce at zero marginal cost) and compete à la Cournot.[13] All buyers have the same set of demand functions for the sellers' products: the inverse demand for product k is given by $p_k = 1 - q_k - \gamma q_{-k}$, where p_k and q_k denote the price and quantity of product k, q_{-k} denotes the sum of the quantities of all the other products, and γ measures the degree of substitutability among the products (with $0 \leq \gamma \leq 1$). Solving for the Nash equilibrium of the Cournot game for $k = n_a$ sellers, we find the profit for each seller, u_a, and the surplus for each buyer, u_b, gross of any payments to the platform as:

$$u_a(n_a, n_b) = n_b \frac{1}{(2+\gamma(n_a-1))^2} \text{ and } u_b(n_a, n_b) = n_a \frac{1+\gamma(n_a-1)}{2(2+\gamma(n_a-1))^2}.$$

These expressions represent the net gains from trade for any seller and any buyer on the platform. Positive cross-group network effects continue to exist between the two groups ($u_a(n_a, n_b)$ increases in n_b and $u_b(n_a, n_b)$ increases in n_a). However, the strength of network effects is not constant and depends on the number of active sellers n_a. We also see that there are negative within-group network effects exist in the group of sellers ($u_a(n_a, n_b)$ decreases in n_a because of seller competition). The net gains from trade depend on the parameter γ, which can be seen as a measure of the intensity of competition among sellers (competition is fiercer for closer substitutes): tougher competition leads to lower profit per buyer for each

[11] These single-homers are assumed not to observe the fee charged on the other side.
[12] This is an adaption of Example 1 in Belleflamme and Peitz (2019a).
[13] In the sellers' participation decision, we ignore the integer constraint and treat sellers as atomless.

seller.[14] A monopoly marketplace would want to increase the horizontal differentiation among the products that it lists (by selecting the appropriate sellers, removing the visibility of some sellers, steering consumers to a subset of sellers, or by influencing how buyers perceive the differentiation).[15]

Teh (2022) develops a reduced-form approach to analyzing a platform's non-price strategy and its effects on the strength of network effects (see also Choi and Jeon [2023]). The platform may take some, possibly costly, action that affects $\alpha_a, \alpha_b, \beta_a$, and/or β_b in equations (1) and (2) as well as stand-alone benefits. For example, in an e-commerce setting in which a platform charges a mix of participation fees and ad valorem transaction fees and each seller is a monopolist in its product category, with linear demand $1-p$ and zero marginal costs of production, the profit-maximizing seller makes a per-buyer profit of $\beta_a = 1/4$ and each consumer obtains a per-seller surplus of $\beta_b = 1/8$ under uniform pricing, while the corresponding values under perfect price discrimination would be $\beta_a = 1/2$ and $\beta_b = 0$ (gross of any fees). Thus, by disclosing consumer valuations to sellers, the platform affects the strength of network effects.[16] Teh and Wright (2024) analyze a competitive bottleneck model with platform spillovers and multi-dimensional platform design choices and explore their welfare effects.

Valenzuela-Stookey (2024) considers a general mechanism design problem and analyzes how the monopoly platform matches buyers and sellers in many-to-many matching environments with seller competition where buyers and sellers differ in their attractiveness to the other group.[17]

Other platform design decisions. Several works have looked at specific environments in which a platform (or competing platforms) makes decisions that manage the interaction between the different user groups and thereby affect the strength of network effects. A platform may reduce seller competition by discouraging search[18] or by limiting the number of offers that are visible to consumers (Hagiu and Wright [forthcoming]).[19] Dinerstein et al. (2018) theoretically and empirically analyze a platform's decision on how much to steer consumers to their most desired product anticipating the sellers' response in their pricing decision. Johnson, Rhodes, and Wildenbeest (2023) consider a platform's demand-steering rules that reward sellers when they cut prices. A platform may decide on delisting or demoting low-quality sellers or to delist

[14] If products become closer substitutes, surplus per seller for each buyer is reduced (that is, $u(n_b, n_s)/n_s$ decreases in γ). While consumers benefit from lower product prices (because competition intensifies), they suffer from the exogenous reduction in product variety and, as it turns out, the latter effect dominates the former.

[15] Limiting seller competition by a platform can also be its response to platform competition and explain the coexistence of profitable non-differentiated platforms (Karle, Peitz, and Reisinger [2020]).

[16] For other examples of the impact of a platform's non-price strategy on network effects, see Section 4.3 in Belleflamme and Peitz (2021).

[17] He adds seller competition to the framework of Gomes and Pavan (2016) who analyze how matching patterns reflect optimal cross-subsidization between groups and provide conditions on the primitives such that the optimal matching rule has a threshold structure: A user in one group is matched with all users of the other group above a threshold type.

[18] This can be achieved by placing more attractive offers early in the search order (Hagiu and Jullien [2011]) or adding unattractive options in between (Chen and He [2011]; Eliaz and Spiegler [2011]).

[19] In Hagiu and Wright (forthcoming) each of two sellers brings some buyers to the platform. Buyers are interested in both products with positive probability whereas they perceive them to be identical with the remaining. Depending on this probability, the platform decides on the degree of visibility of the second seller.

sellers of counterfeits (Casner [2020]; Hua and Spier [2023]; Jeon, Lefouili, and Madio [2022]). Short of delisting, a platform may design its rating and recommendation systems such that inferior sellers are more easily identified or become less visible (Belleflamme and Peitz [2018b]). It may introduce deceptive features (Johnen and Somogyi [forthcoming]) or engage in content moderation (Liu et al. [2022]; Madio and Quinn [2023]). Instead of disclosing consumer valuations to sellers, the platform may give consumers the possibility to voluntarily disclose some information on their valuation to sellers. Here, the platform chooses a disclosure technology that affects the strength of network effects (Gambato and Peitz [2023], building on Ali, Lewis, and Vasserman [2023]). A monopoly platform with a fixed advertising fee may optimally reduce targeting accuracy. Doing so induces buyers to search less, which deteriorates the match quality and relaxes competition between sellers (de Cornière [2016]). Another instance is Karle and Peitz (2017) in which a platform that taxes seller profits may want to enlarge the consumers' consideration set by including irrelevant options. If consumers are expectation-based loss-averse it thereby manipulates consumers' reference points leading to less intense competition.

Depending on the type of non-price strategy and the environment in which the platform operates, for given platform prices, either one or both groups benefit if the choice of the non-price strategy does not affect platform costs. In these environments, one can study whether and to which extent platform incentives are aligned with buyer and/or seller incentives – the finding may depend on the price instruments available to the platform.

3.2 Platform Scope, Dual Mode, and Disintermediation

Platform scope. In general, firms may use certain assets or capabilities broadly (e.g., the brand and the associated consumer trust, proprietary data, certain software components, or AI capabilities). A large scope as the result of the multiple use of these assets across different activities may then be also observed in the case of platforms. A platform may take a central position in an ecosystem and decide on how much to extend its reach, both in terms of its horizontal scope (e.g., which product categories to cover and which consumer segments to address) as well as its vertical scope (which added service to integrate or offer through complementors).[20] For example, given Amazon's investments in its logistics network, it can easily add new product categories with FBA offers (fulfilled by Amazon) to its marketplace. In ad tech, Google and Facebook have (partially) vertically integrated and are active in multiple layers of the value chain (possibly relying on the same capabilities).

However, there may be more to it than just using some assets or capabilities for different activities. The increase of the platform's scope may constitute an envelopment strategy by which "a provider in one platform market can enter another platform market and combine its functionality with that of the target in a multi-platform bundle that leverages shared user relationships" (Eisenmann, Parker, and Van Alstyne [2011, p. 1270]). Here, a platform may strategically use bundling and tying after increasing its scope (as discussed in Section 3.3).

[20] Such an extension may be realized through internal growth or acquisitions.

Increasing the scope may lead to data-enabled network effects across different services or consumer segments (de Cornière and Taylor [forthcoming]). The increased scope may allow the platform to improve the matching of offers to consumers and facilitate personalized pricing (Chen et al. [2022]).[21]

Consumers may find it more convenient to interact with the same firm for different activities (one-stop shopping). This provides a theory of conglomerate mergers (Chen and Rey [2023]). As Heidhues, Köster, and Kőszegi (2024) formalize, firms at points where consumers initiate their digital journey are in a privileged position to extend their scope, as consumers may use this firm's related offers as their default when continuing their journey. They may do so through conglomerate mergers or internal growth.

Dual mode. A platform may not fully vertically integrate certain products or services, but operate in *dual mode*; that is, the platform admits third-party providers, but also offers first-party services or products.[22] Consider a setting in which a platform charges sellers for the transactions on a platform. A possible rationale for the practice of introducing first-party offers is that a platform may want to provide an anchor for retail prices of third-party sellers. This is relevant in markets with little competition between third-party sellers.[23] In this case, the platform as a guardian of the ecosystem may be worried about consumers receiving a bad deal and therefore introduce a first-party product to stimulate competition.[24]

In Anderson and Bedre-Defolie (forthcoming), a monopoly firm can operate as a pure retailer, as a platform running a marketplace with third-party sellers, or as a platform in dual mode running a marketplace on which it also sells products as a retailer itself. A platform in dual mode sets the retail price of its own product and a percentage transaction fee; third-party sellers observe these prices and decide whether to enter and, if so, set their retail prices; finally, buyers make purchasing decisions. In that setting, prohibiting the dual mode increases consumer surplus if and only if the prohibition leads to a pure marketplace (see also Etro [2023]).

If the marketplace includes product categories in which innovative sellers may appear, the marketplace helps consumers in the discovery process and limits the market power of an innovative seller. According to Hagiu, Teh, and Wright (2022), this implies that the dual mode always gives higher consumer welfare than the pure marketplace. Furthermore, a ban on the dual mode never increases consumer welfare.[25]

---

[21] Relatedly, the platform may have an incentive to engage in tying its privacy policies. Such a strategy relies on overlapping users and monetization of user data also for the activity that is subject to envelopment (Condorelli and Padilla [2020, 2024]).

[22] The exposition on the dual mode is taken partly verbatim from Peitz (2022).

[23] Take as an extreme case a situation of full seller collusion and step demand, which implies that sellers will charge the monopoly price that is independent of the level of the fee charged by the platform.

[24] This may be a more attractive option for the platform than lowering fees charged to sellers; in particular, if such fee reductions are not fully passed through to consumers. In such a case, a platform is particularly inclined to introduce those first-party offers for which it has a cost or quality advantage over third-party sellers.

[25] Etro (2021b) and Jeon and Rey (2021) investigate how the platform's monetization model affects its incentives to enter with first-party content and the incentives of third-party developers. The latter features platform spillovers. See also Teh and Wright (2024) cited above. Other contributions include Hagiu and Spulber (2013) and Etro (2021a).

When operating in the dual mode, the platform may use information on the success of third-party sellers to decide which product category to enter.[26] A third party may anticipate the platform's imitation decision in the case of high demand and hide information related to demand (Jiang et al. [2011]). Alternatively, third-party sellers may reduce investment[27] or opt for product categories for which it is known that demand is low so that the risk of the platform entering with a first-party product is also low. To address the concern of underinvestment and distorted entry by third-party sellers because of the imitation threat, a possible remedy is to ban the platform (or at least its first-party division) from having access to any private information generated by the third-party seller (Hagiu, Teh, and Wright [2022]). However, a platform with access to this information may operate more efficiently and just banning the first-party division from accessing this information may be difficult to enforce. Another possible remedy is to prohibit the platform from entering new product categories with first-party products for a certain amount of time (Madsen and Vellodi [forthcoming]).

If a platform operates in dual mode, the platform internalizes the profits it makes from its vertically integrated activities and may engage in self-preferencing; that is, it steers consumers to first-party products or services when this is not in consumers' (and/or third-party sellers') best interest. Some recent empirical and theoretical works have looked at self-preferencing practices.[28]

Disintermediation. A platform faces a threat to its revenues from transaction fees when some users meet on its marketplace but complete the transaction off the platform – this phenomenon is called *platform leakage*. Platforms can combat leakage through several measures: they may make it more difficult for users to transact off the platform (e.g., on AirBnB by hiding the identity and contact information of the transaction partner), by delisting or demoting sellers that use the platform as a showrooming service, by removing consumers' incentives to transact off the platform through price-parity clauses (which are discussed below), and/or by offering additional benefits for completing a transaction on the platform (e.g., on Amazon Marketplace through superior logistics or payment options). The platform may also adjust its monetization model and rely less on transaction fees and more on advertising or referral fees.[29]

3.3 Selected Platform Practices: Platform Exclusivity, Price Parity Clauses, Bundling and Tying

Platform exclusivity. A platform may want to make some sellers (or their products and services) exclusive.[30] In some environments this may serve as a facilitating device and lead to higher prices. Yet, in other environments, there may be efficiencies associated with granting platform exclusivity. What is more, exclusivity may affect incumbent and entrant platforms

[26] Platforms like Amazon marketplace obtain information on which products or product categories are particularly successful. Zhu and Liu (2018) provide empirical evidence that Amazon is more likely to enter as a first-party seller into more-successful product spaces.

[27] For some evidence in the mobile app market, see Wen and Zhu (2019).

[28] For surveys on self-preferencing, see Kittaka, Sato, and Zennyo (2023) as well as Etro (forthcoming). See also the discussion in Peitz (forthcoming).

[29] For a formal analysis of a monopoly platform's responses to the leakage problem, see Hagiu and Wright (2024).

[30] Exclusive content may serve as a substitute to first-party content and the incentives to sign exclusivity contracts may depend on the presence of first-party content.

differently – it may serve as an entry deterrent or provide a long-lasting market share advantage (Weeds [2016]).

Platform exclusivity can be addressed in standard models of platform competition (such as the one by Armstrong [2006]). By imposing exclusivity agreements upon sellers, a platform can force them to single-home.[31] If at least a fraction of sellers are exclusives, this has the potential to increase the differentiation between platforms in the eyes of the buyers and this may reduce the pressure on prices for buyers, but it also affects the platform's pricing incentives regarding the sellers, as discussed in Section 2.2. Endogenizing the choice of exclusivity (in a setting with linear demand), whenever platforms benefit from imposing exclusivity, doing so may benefit or hurt sellers depending on the model parameters, but always hurts buyers (Belleflamme and Peitz [2019b]). Another important observation is that the use of exclusivity contracts in one group changes the incentives of users in the other group to become multi-homers (Armstrong and Wright [2007]).

Exclusive content may be offered by "large" content providers such that platforms bid for such exclusive content. Such a strategic content provider partly internalizes the impact of its own price on platform demand and, depending on the characteristics of the content, the content provider signs an exclusive agreement or multi-homes (Hagiu and Lee [2011]). In the presence of a single strategic content provider, this content tends to be exclusive if platform competition is intense (Carroni, Madio, and Shekhar [2024]). The reason is that the platform with the exclusive content attracts a large number of consumers (implying that exclusivity does not sacrifice much of the network size).[32]

Exclusivity may be used to deter entry of a more efficient platform (Doganoglu and Wright [2010]). The incumbent platform can sign exclusivity contracts before entry and divide the interests of sellers and consumers by offering attractive conditions to sellers such that they never have an incentive to reject the offer. Knowing this, consumers will join the incumbent subsequently. With homogeneous consumers, through the use of exclusivity contracts, the incumbent platform is able to extract the full consumer surplus.

In contrast to platforms striving for exclusive content or services, platforms may make their use compatible and thereby remove platform-specific network effects. Compatibility is often costly and leads to higher prices. Symmetric firms then have a socially excessive interest in providing two-way compatibility (Doganoglu and Wright [2006]).[33]

Price parity clauses. Price parity clauses stipulate that sellers on a platform cannot set higher retail prices on this platform than in a certain set of alternative sales channels. This may include

[31] To be precise, this holds under platform duopoly. If more than two platforms are active and one platform imposes exclusivity, this would not restrict users from multihoming on the other platforms.

[32] The content provider can appropriate surplus through an auction with a reserve price.

[33] Doganoglu and Wright (2006) also study the interaction between multihoming and compatibility and find that the former may be a poor substitute for the latter. For a recent contribution on the potential pitfalls of mandated interoperability, see Bourreau and Krämer (2023). Note that sometimes a single firm may decide to facilitate content becoming available on other platforms (one-way compatibility). A platform may thus decide to be horizontally open (e.g., by publishing its own interface specifications) and let its base of content or services be accessed from users attached to a competing platform (through converters); for a discussion, see Farrell and Simcoe (2012).

certain direct sales channels or other indirect sales channels provided by competing platforms. So-called wide price parity clauses stipulate that sellers must not offer a lower price through any other channel (including direct and indirect channels), while narrow price parity clauses stipulate that sellers must not offer a lower price in the direct sales channel but are allowed to set lower prices on other platforms.[34] Wide price parity clauses are often seen as anti-competitive,[35] while there has been substantial disagreement among competition authorities and courts about the likely effects of narrow price parity clauses.

Consider a single platform that charges fees on the seller side and competes against the direct sales channel. If the platform obliges sellers to adhere to price parity, consumers have no incentive to use the direct channel if the platform offers some convenience benefit. The platform will then set a high fee and extract a large fraction of seller profits. If price parity clauses were prohibited the platform's fee setting would be constrained because the sellers would serve consumers at a low price in the direct channel if the fee were too high.

Under platform competition, the argument applies to wide price parity clauses (Edelman and Wright [2015]). Since sellers' retail prices must be the same across the competing platforms under wide price parity, a seller cannot serve more consumers on a platform that lowers its fee. This reduces the incentive of a platform to offer a reduced fee. This means that wide price parity clauses can be used as a facilitating device to soften platform competition. At the same time, consumers have little reason to try out new look-alike platforms and, thus, barriers to entry are higher with such clauses being in place.

One qualification[36] is that the above reasoning abstracted from the possibility that, absent price parity, consumers may use the platform to obtain valuable information, but with lower retail prices elsewhere, they will leave the platform and finalize the transaction elsewhere. Platforms would then receive no compensation for such showrooming services, which weakens their incentive to provide such a useful service to consumers. Price parity clauses make seller free-riding unlikely since consumers cannot find lower prices elsewhere.[37]

---

[34] Practitioners and academics in the US often call price parity clauses most-favored-customer clauses or "MFNs" (standing for most-favored-nation clauses). Most-favored-customer clauses traditionally stipulate that a seller cannot set different prices to different consumers or different prices over time. Price parity clauses do not contain such restrictions but impose restrictions concerning prices faced by a given consumer across different distribution channels.

[35] For theories of anti-competitive effects of price parity clauses, see e.g. Edelman and Wright (2015), Boik and Corts (2016), and Johnson (2017).

[36] Another possible limitation of the above reasoning is that platform quality has been treated as exogenous. With price parity in place, platforms may have a strong incentive to increase the service quality offered to consumers to attract them to their platform. However, platforms are induced to engage in socially excessive investments in service quality. The net effect of price parity clauses on consumers is negative because the consumer surplus gain from higher service quality is more than offset by higher retail prices (Edelman and Wright [2015]). For further work on platform investments, see Wang and Wright (2023).

[37] Absent price parity, consumers search on the platform and will not transact via the platform if the price differential between the price on the platform and the price on the direct distribution channel exceeds the convenience benefit from transacting on the platform. Sellers may want to set low prices in the direct channel that induce consumers to switch. This constrains the platform's fee setting since the platform will want to avoid free-riding. As shown by Wang and Wright (2020), when price parity clauses are prohibited, consumers are better off if the platform remains viable. With competing platforms and showrooming, wide price parity clauses continue to decrease consumer welfare, while results regarding narrow price parity clauses are less clear-cut: if narrow price parity is needed for the viability of platforms and platform competition is sufficiently intense, narrow

Bundling and tying. While bundling and tying are common business practices, they have some distinguishing features in the context of platforms. Amelio and Jullien (2012) point to the fact that bundling can relax the zero-price constraint that applies if the platform cannot subsidize a user group. Choi and Jeon (2023) show that bundling can be anti-competitive when firms operate as ad-funded platforms that cannot set negative prices to consumers. Through bundling, a less-efficient firm can profitably keep an entrant out of the market.

In Choi, Jeon, and Whinston (2024), a firm is a monopolist in the primary market (where consumers have heterogeneous valuations for this product) and competes against a competitor in a second market in which consumers experience positive direct network effects. Under independent pricing, the firm would set the monopoly price in the primary market and consumers would receive the consumer surplus associated with monopoly pricing. When the firm bundles its two products, consumers with high valuations in the primary market may continue to purchase the bundle even if other consumers were to buy from the competitor in the second market. The existence of such high-valuation consumers guarantees a minimum market share for the firm in the second market. Because of network effects in the second market, this installed-base advantage may induce low-valuation consumers to buy the bundle. This may lead to tipping in the second market in favor of the firm offering the bundle even though the competitor is more efficient in the second market.[38]

4 Conclusion

The economic theory literature on platforms has been growing quickly over the last 20 years. Research questions that have been addressed by oligopoly theory and industrial organization theory in the past have been posed in contexts in which platforms manage the interactions between two groups of users (often buyers and sellers).

Growing concerns about the market power of some platforms and its effects on consumers, our economy, and society have, in some jurisdictions, led to antitrust actions, a partial rewriting of competition law, and legislative initiatives, perhaps most visible with various regulations at European Union level including the Digital Markets Act and the Digital Services Act. Economic theory has been partly responsive to these developments, e.g. by developing novel theories of harm and efficiency defenses or by focusing on novel business practices (e.g. the imposition of price parity clauses).

price parity clauses are in the interest of consumers (Wang and Wright [2020]). Even in the case of a monopoly platform, price parity can be profitable and, at the same time, increase consumer welfare (see Johansen and Vergé [2017], Mariotto and Verdier [2020], Liu, Niu, and White [2021]; Peitz and Sobolev [2024]).

[38] Fumagalli and Motta (2020) also consider tying between a primary market (where an incumbent firm starts as a monopolist) and a complementary market. The incumbent firm is willing to sacrifice current profits when tying in order to exclude a more efficient rival from the complementary market by depriving it of the critical user size that it needs for success. This leads to a favorable position for the incumbent when a more-efficient rival enters the primary market and allows it to extract part of the rival's efficiency rents. Exclusion crucially relies on the presence of non-negative price constraints.

Bibliography

Ali, S. Nageep, Greg Lewis, and Soshana Vasserman. 2023. Voluntary Disclosure and Personalized Pricing. *Review of Economic Studies* 90: 538–571.

Ambrus, Attila, Emilio Calvano, and Markus Reisinger. 2016. Either or Both Competition: A 'Two-Sided' Theory of Advertising with Overlapping Viewerships. *American Economic Journal: Microeconomics* 8: 189–222.

Ambrus, Attila and Markus Reisinger. 2006. Exclusive vs Overlapping Viewers in Media Markets. Unpublished manuscript.

Amelio, Andrea and Bruno Jullien. 2012. Tying and Freebies in Two-Sided Markets. *International Journal of Industrial Organization* 30: 436–446.

Anderson, Simon P. and Özlem Bedre-Defolie. Forthcoming. Hybrid Platform Model: Monopolistic Competition and a Dominant Firm. *Rand Journal of Economics*.

Anderson, Simon P. and Stephen Coate. 2005. Market Provision of Broadcasting: A Welfare Analysis. *Review of Economic Studies* 72: 947–972.

Anderson, Simon P., Øystein Foros, and Hans-Jarle Kind. 2018. Competition for Advertisers and for Viewers in Media Markets. *Economic Journal* 128: 34–54.

Anderson, Simon P. and Martin Peitz. 2020. Media See-Saws: Winners and Losers in Platform Markets. *Journal of Economic Theory* 186: 104990.

Armstrong, Mark. 2006. Competition in Two-Sided Markets. *Rand Journal of Economics* 37: 668–691.

Armstrong, Mark and Julian Wright. 2007. Two-Sided Markets, Competitive Bottlenecks and Exclusive Contracts. *Economic Theory* 32: 353–380.

Bakos, Yannis and Hanna Halaburda. 2020. Platform Competition with Multihoming on Both Sides: Subsidize or not? *Management Science* 66: 5599–5607.

Belleflamme, Paul and Martin Peitz. 2018a. Platforms and Network Effects. In: Luis C. Corchón and Marco A. Marini (Eds.). *Handbook of Game Theory and Industrial Organization*, Volume II. London: Edward Elgar Publisher.

Belleflamme, Paul and Martin Peitz. 2018b. Inside the Engine Room of Platforms: Reviews, Ratings, and Recommendations. In: Juan-José Ganuza and Gerard Llobet (Eds.). *Economic Analysis of the Digital Revolution*, Volume 4. Funcas Social and Economic Studies. Funcas.

Belleflamme, Paul and Martin Peitz. 2019a. Managing Competition on a Platform. *Journal of Economics and Management Strategy* 28: 5–22.

Belleflamme, Paul and Martin Peitz. 2019b. Platform Competition: Who Benefits from Multihoming? *International Journal of Industrial Organization* 64: 1–26.

Belleflamme, Paul and Martin Peitz. 2019c. Price Disclosure by Two-Sided Platforms. *International Journal of Industrial Organization* 67: 102529.

Belleflamme, Paul and Martin Peitz. 2021. *The Economics of Platforms: Concepts and Strategy*. Cambridge University Press.

Belleflamme, Paul and Martin Peitz. Forthcoming. Network Goods, Price Discrimination, and Two-Sided Platforms. *Journal of Institutional and Theoretical Economics*.

Belleflamme, Paul and Eric Toulemonde. 2009. Negative Intra-Group Externalities in Two-Sided Markets. *International Economic Review* 50: 245-272.

Boik, Andre and Kenneth S. Corts. 2016. The Effects of Platform Most-Favored-Nation Clauses on Competition and Entry. *Journal of Law and Economics* 59: 105–134.

Bourreau, Marc and Jan Krämer. 2023. Interoperability in Digital Markets: Boon or Bane for Market Contestability? Unpublished manuscript.

Caillaud, Bernard, and Bruno Jullien. 2003. Chicken & Egg: Competition among Intermediation Service Providers. *Rand Journal of Economics* 34: 309-328.

Carroni, Elias, Leonardo Madio, and Shiva Shekhar. 2024. Superstar Exclusivity in Two-Sided Markets. *Management Science* 70: 991-1011.

Casner, Ben. 2020. Seller Curation in Platforms. *International Journal of Industrial Organization* 72: 102659.

Chen, Yongmin and Chuan He. 2011. Paid Placement: Advertising and Search on the Internet. *Economic Journal* 121(556): 309–328.

Chen, Zhijun, Chongwoo Choe, Jiajia Cong, and Noriaki Matsushima. 2022. Data-Driven Mergers and Personalization. RAND Journal of Economics 53: 3–31.

Chen, Zhijun and Patrick Rey. 2023. A Theory of Conglomerate Mergers. Unpublished manuscript.

Choi, Jay Pil and Doh-Shin Jeon. 2021. A Leverage Theory of Tying in Two-Sided Markets with Non-Negative Price Constraints. *American Economic Journal: Microeconomics* 13: 283–337.

Choi, Jay Pil and Doh-Shin Jeon. 2023. Platform Design Biases in Ad-Funded Two-Sided Markets. *Rand Journal of Economics* 54: 240–267.

Choi, Jay Pil, Doh-Shin Jeon, and Michael D. Whinston. 2024. Tying with Network Effects. TSE Working Paper 1524.

Condorelli, Daniele and Jorge Padilla. 2020. Harnessing Platform Envelopment in the Digital World. *Journal of Competition Law & Economics* 16: 143–187.

Condorelli, Daniele and Jorge Padilla. 2024. Data-Driven Envelopment with Privacy-Policy Tying. *Economic Journal* 134: 515–537.

de Cornière, Alexandre. 2016. Search Advertising. *American Economic Journal: Microeconomics* 8: 156–188.

de Cornière, Alexandre, Andrea Mantovani and Shiva Shekhar. Forthcoming. Third-Degree Price Discrimination in Two-Sided Markets. *Management Science*.

de Cornière, Alexandre and Greg Taylor. Forthcoming. Data-Driven Mergers. *Management Science*.

Dinerstein, Michael, Liran Einav, Jonathan Levin, and Neel Sundaresan. 2018. Consumer Price Search and Platform Design in Internet Commerce. *American Economic Review* 108: 1820–1859.

Doganoglu, Toker and Julian Wright. 2006. Multihoming and Compatibility. *International Journal of Industrial Organization* 24: 45–67.

Doganoglu, Toker and Julian Wright. 2010. Exclusive Dealing with Network Effects. *International Journal of Industrial Organization* 28: 145–154.

Edelman, Benjamin and Julian Wright. 2015. Price Coherence and Excessive Intermediation. *Quarterly Journal of Economics* 130: 1283–1328.

Eisenmann, Thomas, Geoffrey Parker, and Marshall Van Alstyne. 2011. Platform Envelopment. *Strategic Management Journal* 32: 1270–1285.

Eliaz, Kfir and Rani Spiegler. 2011. A Simple Model of Search Engine Pricing. *Economic Journal* 121(556): F329–F339.

Etro, Federico. 2021a. Product Selection in Online Marketplaces. *Journal of Economics and Management Strategy* 30: 1-25.

Etro, Federico. 2021b. Device-Funded vs Ad-Funded Platforms. *International Journal of Industrial Organization* 75: 102711.

Etro, Federico. 2023. Platform Competition with Free Entry of Sellers. *International Journal of Industrial Organization* 89: 102903.

Etro, Federico. Forthcoming. E-Commerce Platforms and Self-Preferencing. *Journal of Economic Surveys*. https://doi.org/10.1111/joes.12594

European Commission. 2024. Commission Notice on the Definition of the Relevant Market for the Purposes of Union Competition Law. C/2024/1645.

Farrell, Joseph and Timothy Simcoe. 2012. Four Paths to Compatibility. In: Martin Peitz and Joel Waldfogel (Eds.). *Oxford Handbook of the Digital Economy*. Oxford University Press.

Fumagalli, Chiara and Massimo Motta. 2020. Tying in Evolving Industries when Future Entry Cannot be Deterred. *International Journal of Industrial Organization* 73: 102567.

Gambato, Jacopo and Martin Peitz. 2023. Platform-Enabled Information Disclosure. CRC TR 224 Discussion Paper 468.

Gomes, Renato and Alessandro Pavan. 2016. Many-to-Many Matching and Price Discrimination. *Theoretical Economics* 11: 1005–1052.

Hagiu, Andrei. 2009. Two-sided Platforms: Product Variety and Pricing Structures. *Journal of Economics and Management Strategy* 18: 1011–1043.

Hagiu, Andrei and Hanna Halaburda. 2014. Information and Two-Sided Platform Profits. *International Journal Industrial Organization* 34: 25–35.

Hagiu, Andrei and Bruno Jullien. 2011. Why do Intermediaries Divert Search? *Rand Journal of Economics* 42: 337-362.

Hagiu, Andrei and Robin S. Lee. 2011. Exclusivity and Control. *Journal of Economics and Management Strategy* 20: 679-708.

Hagiu, Andrei and Daniel Spulber. 2013. First-Party Content and Coordination in Two-Sided Markets. *Management Science* 59: 933–949.

Hagiu, Andrei, Tat-How Teh, and Julian Wright. 2022. Should Platforms Be Allowed to Sell on Their Own Marketplaces? *Rand Journal of Economics* 53: 297–327.

Hagiu, Andrei and Julian Wright. 2015. Multi-Sided Platforms. International Journal of Industrial Organization 43: 162–174.

Hagiu, Andrei and Julian Wright. 2023. Data-Enabled Learning, Network Effects and Competitive Advantage. *Rand Journal of Economics* 54: 638–667.

Hagiu, Andrei and Julian Wright. 2024. Marketplace Leakage. *Management Science* 70: 1529–1553.

Hagiu, Andrei and Julian Wright. Forthcoming. Optimal Discoverability on Platforms. *Management Science*

Hart, Oliver and Jean Tirole. 1990. Vertical Integration and Market Foreclosure. *Brookings Papers on Economic Activity: Microeconomics*: 205–286.

Heidhues, Paul, Mats Köster, and Botond Kőszegi. 2024. A Theory of Digital Ecosystems. Unpublished manuscript.

Hua, Xinyu and Kathryn Spier. 2023. Holding Platforms Liable. Unpublished manuscript.

Jeon, Doh-Shin, Byung-Cheol Kim, and Domenico Menicucci. 2022. Second-Degree Price Discrimination by a Two-Sided Monopoly Platform. *American Economic Journal: Microeconomics* 14: 322–69.

Jeon, Doh-Shin, Yassine Lefouili, and Leonardo Madio. 2021. Platform Liability and Innovation. Unpublished manuscript.

Jeon, Doh-Shin and Patrick Rey. 2021. Platform Competition, Ad Valorem Commissions and App Development. Unpublished manuscript, Toulouse School of Economics.

Jiang, Baojun, Kinshuk Jerath, and Kannan Srinivasan. 2011. Firm Strategies in the “Mid Tail” of Platform-based Retailing. *Marketing Science* 30: 757–775.

Johansen, Bjørn Olav and Thibaud Vergé. 2017. Platform Price Parity Clauses with Direct Sales. Working Paper in Economics 01/17, University of Bergen.

Johnen, Johannes and Robert Somogyi. Forthcoming. Deceptive Features on Platforms. *Economic Journal*.

Johnson, Justin. 2017. The Agency Model and MFN Clauses. *Review of Economic Studies* 84: 1151–1185.

Johnson, Justin, Andrew Rhodes and Matthijs Wildenbeest. 2023. Platform Design when Sellers use Pricing Algorithms. *Econometrica* 91: 1841–1879.

Jullien, Bruno. 2011. Competition in Multi-Sided Markets: Divide and Conquer. American Economic Journal: Microeconomics 3: 186–220.

Jullien, Bruno and Alessandro Pavan. 2019. Information Management and Pricing in Platform Markets. *Review of Economic Studies* 86: 1666–1703.

Jullien, Bruno, Alessandro Pavan, and Marc Rysman. 2022. Two-Sided Markets, Pricing, and Network Effects. In: Ho, Kate, Ali Hortaçsu, and Alessandro Lizzeri (eds.). *Handbook of Industrial Organization*. Vol. 4. Elsevier.

Karle, Heiko and Martin Peitz. 2017. De-targeting: Advertising an Assortment of Products to Loss-Averse Consumers. *European Economic Review* 95: 103–124.

Karle, Heiko, Martin Peitz, and Markus Reisinger. 2020. Segmentation versus Agglomeration: Competition between Platforms with Competitive Sellers. *Journal of Political Economy* 128: 2329–2374.

Kittaka, Yuta, Susumu Sato, and Yusuke Zennyo. 2023. Self-Preferencing by Platforms: A Literature Review. *Japan and the World Economy* 66: 101191.

Liu, Chang, Fengshi Niu, and Alexander White. 2021. Optional Intermediaries and Pricing Restraints. Unpublished manuscript.

Madio, Leonardo and Martin Quinn. 2023. Content Moderation and Advertising in Social Media Platforms Unpublished manuscript.

Madsen, Erik and Nikhil Vellodi. Forthcoming. Insider Imitation. *Journal of Political Economy*.

Mariotto, Carlotta and Marianne Verdier. 2020. Platform–Merchant Competition for Sales Services. *Journal of Economics & Management Strategy* 29: 834–853.

Nocke, Volker, Martin Peitz, and Konrad Stahl. 2007. Platform Ownership. *Journal of the European Economic Association* 5: 1130–1160.

Peitz, Martin. 2022. The Prohibition of Self-Preferencing in the DMA. CERRE issue paper. November 2022. https://cerre.eu/wp-content/uploads/2022/11/DMA_SelfPreferencing.pdf

Peitz, Martin. Forthcoming. Governance and Regulation of Platforms. In: Claude Menard and Mary M. Shirley (eds.). Handbook of New Institutional Economics. 2nd ed. Springer.

Peitz, Martin and Susumu Sato 2023. Asymmetric Platform Oligopoly. CRC TR 224 Discussion Paper 428.

Peitz, Martin and Anton Sobolev. 2024. Product Recommendations and Price Parity Clauses. Unpublished manuscript.

Rochet, Jean-Charles and Jean Tirole. 2003. Platform Competition in Two-Sided Markets. *Journal of the European Economic Association* 1: 990–1029.

Rochet, Jean-Charles and Jean Tirole. 2006. Two-Sided Markets: A Progress Report. *Rand Journal of Economics* 37: 645–667.

Tan, Hongru and Julian Wright. 2018. A Price Theory of Multi-Sided Platforms: Comment. *American Economic Review* 108: 2758-2760.

Tan, Hongru and Julian Wright. 2021. Pricing Distortions in Multi-Sided Platforms. *International Journal of Industrial Organization* 79: 102732.

Tan, Guofu and Junjie Zhou. 2021. The Effects of Competition and Entry in Multi-Sided Markets. *Review of Economic Studies* 88: 1002–1030.

Teh, Tat-How. 2022. Platform Governance. *American Economic Journal: Microeconomics* 14: 213–254.

Teh, Tat-How, Chunchun Liu, Julian Wright and Junjie Zhou. 2023. Multihoming and Oligopolistic Platform Competition. *American Economic Journal: Microeconomics* 15: 68–113.

Teh, Tat-How and Julian Wright. 2024. Competitive Bottlenecks and Platform Spillovers. Unpublished manuscript.

Valenzuela-Stookey, Quitzé. 2024. Platform-Mediated Competition. Unpublished manuscript.

Wang, Chengsi and Julian Wright. 2020. Search Platforms: Showrooming and Price Parity Clauses. *Rand Journal of Economics* 51: 32–58.

Wang, Chengsi and Julian Wright. 2023. Platform Investment and Price Parity Clauses. *Journal of Industrial Economics* 71: 538–569.

Weeds, Helen. 2016. TV Wars: Exclusive Content and Platform Competition on Pay TV. *Economic Journal* 594: 1600–1633.

Wen, Wen and Feng Zhu. 2019. Threat of Platform-Owner Entry and Complementor Responses: Evidence from the Mobile App Market. *Strategic Management Journal* 40: 1336–1367.

Weyl, E. Glen. 2010. A Price Theory of Multi-Sided Platforms. *American Economic Review* 100: 1642–1672.

Zhu, Feng and Qihong Liu. 2018. Competing with Complementors: An Empirical Look at Amazon.com. *Strategic Management Journal* 39: 2618–2642.