Online trade platforms: hosting, selling, or both? *

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Abstract

We illustrate conditions under which a trade platform selling its own products alongside third-party sellers benefits or harms consumers. This benefits consumers by lowering prices in a suite of models: a gatekeeper platform facing a competitive fringe of sellers, when fringe sellers also have their own channels perfectly or imperfectly substitutable to the platform; when the gatekeeper platform with fringe sellers competes against a big seller with market power on a differentiated alternative channel; and when the gatekeeper platform hosts only a big seller with market power. Platform product entry might harm consumers when a big firm sells both on the platform and on its alternative channel. The platform selling its own products harms consumers when consumers have heterogenous tastes for variants of products and the platform can control the access of fringe sellers via its commission and own product price. We also review the recent literature to highlight other channels via which benefits and harm arise from the platform selling its own products in its marketplace.

Keywords: Trade platform, hybrid business model, steering, regulation

JEL Codes: D42, L12, L13, L40, H25

1 Introduction

Digital platforms have become the most profitable firms in the world.[1] Amazon's market capitalization is currently around $1.75 trillion, which is nearly the half of Germany's GDP and three times Belgium's. Such unprecedented amounts (Apple recently neared $2.8 trillion) also characterize the other platforms at the top of the digital economy. Anything this big was likely behaving anti-competitively somewhere, but anti-trust authorities were slow to take up the gauntlet. For their part, academic economists took a while to figure out that the business model of platforms was quite different from extant markets, and that the logic of platform competition can be quite different from traditional markets (Caillaud and Jullien, 2003; Rochet and Tirole, 2003; Wright, 2004; Rochet and Tirole, 2006; Armstrong, 2006). It is only very recently that economists have started to recognize the harm that may have been done by these platforms and tailoring new policies toward them. These led to anti-trust cases against Google, Apple, and Amazon in Europe and in the U.S. ,as well as legislative proposals regulating Big Tech companies: the Digital Markets Act and the Digital Services Act of the European Commission and the five bills in the U.S. (Reuters, June 11, 2021) to curtail perceived new types of abuse of market power.

In this paper we specialize on buyer-seller platforms where the platform charges sellers a commission fee. These fees are particularly prominent in the business model used by digital marketplaces. Our focus will be on one main aspect of this business model, namely the "hybrid model" in which the platform may choose to play a dual role by selling only its own product(s) in some markets and selling only third-party products on which it collects commissions in other markets. Hybrid mode is then under the broad platform umbrella. We also review the literature when the platform sells its product(s) competing against third-party sellers in the same market. The inherent conflict of both competing alongside rivals and collecting commissions from them has been termed acting as both "referee and player" in the market.[2] Examples include Amazon, Apple App Store, Google Play and Zalando (a European fashion platform) (see Hagiu et al. (2021) for more examples).

Various anticompetitive accusations, cases, and proposed legislation have been levied against the hybrid business model, including "steering" (directing consumers towards own products) and using data advantages to innovate into profitable sectors.[3] We discuss some recent work on these

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[1]Seven of the top ten publicly owned companies in terms of market capitalization are digital platforms: Apple, Microsoft, Alphabet, Amazon, Meta (Facebook), Alibaba, Tencent.

[2]US Senator Elizabeth Warren, well known for her position on breaking up American tech, stated about the hybrid platform model, "You can run the platform. That is, you can be the umpire in the baseball game. Or you can be a player. That is, you can run a business or you can have a team in the game. But you don't get to be the umpire and have a team in the game." Huffpost, April 23, 2019.

[3]See the European Commission's Amazon case Press Release, Nov 10, 2020. European Commission (2020) proposes regulations of "gatekeeper" platforms under which they have to stop advantaging their own products or disadvantaging rivals', allow business users access to data generated on the platform, allow interoperability of data

aspects, but our main focus is on the use of the commission rate as a market tool and how it meshes with introduction of own product(s).

One key question is whether the platform ought to be allowed to sell its own product(s) along-side the products it hosts for commissions. The Ending Platform Monopolies Act in the U.S. proposes to prevent dominant or powerful digital platforms from selling their own products (banning hybrid mode). Hagiu et al. (2021)'s and Etro (2021)'s analyses are generally affirmative of the hybrid mode, and their main message is that what is good for the platform is good for consumers too. This finding recalls the "Chicago School" analysis of vertical integration – if the firm wants to do it then it tends to be pro-competitive. However, perhaps these results depend upon the modelling details, and specifically the assumption of perfectly substitutable goods in the market (that can be sold on and off the platform).

Our first suite of models underscores this case of perfect substitutes and indeed substantiates this result. The platform's choice to sell its own product(s) benefits consumers by lowering prices when a monopoly platform hosts competitive fringe sellers. This is true when the platform is "gatekeeper," that is, sellers have no alternative access to consumers.[4] It is also true when sellers have an alternative channel to reach consumers and alternative channels are perfect or imperfect substitutes to the platform channel. This result is also valid when the platform hosting competitive fringe sellers competes against a big seller's direct channel on the Hotelling line or when the platform hosts only a big seller.

On the other hand, platform product entry might harm consumers when a big seller with market power sells on its own channel and also on the platform. In that case, the platform setting a seller fee before the big seller pricing its differentiated products introduces a double markup on the big seller's platform channel price and leaves some rent to the big seller. The platform might prefer to sell its own product to capture more rent, but platform product entry generates more competition in the market as the big seller does not internalize the pricing of the platform channel when it prices only its direct channel. We construct an example where platform entry happens and this harms consumers by raising prices.

We next review and elaborate upon an alternative model by Anderson and Bedre-Defolie (2021) of the market as a venue in which consumers choose among different variants of the good sold by different sellers. Modelling such discrete choice among differentiated products sold by the hosted third-parties and the platform itself brings to light an alternative mechanism by which the hybrid platform business model might distort choices and bring about the opposite conclusion – that the platform should not be allowed to sell its own good. This mechanism is somewhat more subtle,

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and services, allow business users to operate outside the platform. The five bills in the U.S. also propose ex-ante regulations of dominant digital platforms, which prohibit advantaging own products or disadvantaging rivals', ban hybrid business models, prohibit developing new products based on users' data.

[4]The US House Majority Report (2020) notes that this is the case for 37% of Amazon sellers.

but arguably reflects better the salient details of platform markets. In a nutshell, the existence of the platform's product makes it want to drive customers toward its products by raising the fee on the rivals. This is more subtle than the overt steering that is operationalized by transparently recommending own product. For example, on Amazon this can be done by giving Amazon-owned products an "Amazon Choice" label or the "Buy Box." Instead, covert, or "insidious" steering is engineered by raising the fee on the rival products and so to tilt the competitive balance towards the own products. The result is higher prices and less variety, and both work to the detriment of consumers. As we argue, this effect is still present even when the platform cares about participation of consumers in a full two-sided market setting.

The next section provides the benchmark analysis of a gatekeeper platform with a competitive fringe of third-party sellers. Section 3 extends the model to the case where fringe sellers have an alternative channel, considering both the case of perfectly substitutable channels and imperfectly substitutable channels. Section 4.1 studies the case of the platform hosting fringe sellers competing against a big seller's direct channel. Section 4.2 studies the case of where the big seller is active both on the platform and on its alternative channel. Section 4.3 looks at an alternative model where the platform hosts only a big seller (without fringe sellers). Section 5 discusses the case of heterogenous consumer tastes for variety to highlight the opposite predictions with this assumption. Section 6 discusses the findings of the related literature. Section 7 concludes.

2   A gatekeeper platform with competitive fringe of sellers

We consider a single platform enabling trade between a mass of consumers and a competitive fringe of third-party sellers. In the benchmark model the platform is a "gatekeeper," that is, third-party sellers do not have an alternative channel to sell their products. We use general demand to study the case of homogenous products (in this section and in the next section where the alternative channel of the fringe is a perfect substitute to the platform). We use the Hotelling model (assuming covered market) when there is product differentiation (e.g., when the alternative channel is an imperfect substitute to the platform channel).

The platform collects a commission over sales revenue of third-party sellers and does not charge any direct price to consumers for joining. We consider two different tariff structures: a unit fee (t) or an ad-valorem fee (τ). We allow the platform to choose whether to sell its own product alongside third-party products and analyze the consequences of this on consumers.

We start with some notation and preliminary definitions. There is a single homogenous good with demand $D\left(p\right)$ where p is the lowest price in the market. Where relevant, demand can be satisfied from any of three possible sources: fringe sellers, the platform (product), and the big seller. Each of them has a constant marginal cost. A competitive fringe has unit cost c and the platform

product's unit cost is c_A. Notice that we can equally-well introduce quality differences, for these parlay as synonymous with cost differences and are formally equivalent, so we suppress them.[5] We assume that $D(p)$ is twice differentiable and $\frac{1}{D(p)}$ is convex, or equivalently (-1)-concave.[6] First, the platform decides whether to sell its own product and sets the level of third-party commission (seller fee). Second, the third-party sellers set their price and, whenever relevant, the platform chooses its price. Finally, consumers make purchasing decisions. We invoke a tie-breaking rule for consumers that they all choose the fringe good if its price is the same as the platform good.

2.1 Equilibrium Analysis

If the platform chooses to sell only its own good, it blocks the entry of fringe sellers by setting a sufficiently high commission and becomes a monopolist. Let $p^m(c_A)$ denote the monopoly price:

$$p^m (c_A) = \arg \max_p (p - c_A) D (p). \tag{1}$$

This nets the platform the monopoly profit $\Pi^m (c_A) = (p^m (c_A) - c_A) D (p^m (c_A))$.

If the platform chooses just to sell the fringe product the market price is determined by zero profits for the fringe. With a per unit commission t, this means that the price is $p = c + t$ and so the platform's problem is

$$\max_t (tD (c + t)), \tag{2}$$

which is equivalently the same problem as $\max_p (p - c) D (p)$ and therefore nets the platform the monopoly profit $\Pi^m (c)$. Thus, the platform induces the monopoly price $p^m (c)$ via setting a unit commission $t = p^m (c) - c$ to capture $\Pi^m(c)$.

When the seller fee is an ad-valorem commission τ, the condition for fringe zero profit is $(1 - \tau) p = c$ or $p = \frac{c}{1-\tau}$ so the platform's problem is

$$\max_\tau \left(\tau \frac{c}{1 - \tau} D \left(\frac{c}{1 - \tau} \right) \right), \tag{3}$$

which is the same as $\max_p \frac{p-c}{p} p D (p)$ and is therefore again the monopoly problem and yields $\Pi^m (c)$. It attains this by setting an ad-valorem commission satisfying $p^m(c) = \frac{c}{1-\tau}$ or $\tau = \frac{p^m(c)-c}{p^m(c)}$

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[5]To see this, suppose costs were the same and firms differed only by "quality" according to $D_i (p) = D_j (p + v)$ so that j can price \$$v$ above i and still retain all consumers (breaking ties in j's favor for it could always price minutely below i and get all consumers). The profit and consumer surplus are the same as if products were homogeneous and j had a cost advantage of v. Or indeed, any combination of cost and quality advantage that yields a net advantage of v is equivalent. In the sequel we retain the cost advantage for convenience but the reader is free to prefer a quality advantage interpretation.

[6]The latter implies that the marginal revenue is strictly decreasing when it is positive. It is implied by log-concavity of $D(p)$.

to implement the monopoly outcome. Therefore either commission type enables the platform to extract $\Pi^m(c)$.

The platform's decision is now straightforward. It prefers to host the fringe if and only if $\Pi^m(c) \geq \Pi^m(c_A)$ (where we invoke our tie-breaking rule) or $c \leq c_A$. Note that the platform will never strictly prefer to use a hybrid mode selling its product alongside third-party products *in the same market*. This is because consumers have homogenous tastes for the products. Only if $c = c_A$, the platform gets the same profit from hosting or reselling, or indeed doing both. Given that at equal prices consumers choose the fringe product (the tie-breaking rule), there can never be a hybrid regime in the same market.[7] The platform chooses to sell only fringe products (pure marketplace) in those markets with $c \leq c_A$ and chooses to sell only its own product (pure reseller) in other markets (with $c > c_A$). Hence, the hybrid mode of the platform can arise across different markets under the platform umbrella.

Given our assumption that demand is strictly (-1)-concave, $p^m(c)$ and $p^m(c_A)$ are uniquely determined and increasing in their arguments. Consumer surplus is greatest with the lowest price, so it is largest at the lowest cost. Moreover, so are profits and social surplus. Hence, we obtain our first result.

Proposition 1 *A gatekeeper platform in the presence of competitive fringe sellers prefers to host fringe sellers (pure marketplace mode) if and only if fringe sellers are more efficient than its own product: $c \leq c_A$. The platform prefers to sell only its own product (reseller mode) if and only if $c_A < c$. The platform's choice is optimal for consumers and socially efficient.*

The simple policy take-away is that the platform should not be banned from selling its own good. Whenever it wishes to do so, consumers are better off through lower prices, and the platform's incentives are fully aligned with the socially optimal decision. The gatekeeper platform for a competitive fringe can achieve the same outcome (extracting all monopoly rents from selling) whether it uses a unit seller fee or a percentage seller fee. The same result holds in more elaborate contexts (except where noted below). We therefore use only a unit seller fee in the following unless the results are different with an ad-valorem fee.

3 Alternative channel of fringe firms

We now allow fringe sellers to offer the product on an alternative (say, offline) channel. We change the third stage of the game by allowing the fringe sellers to choose their offline and online prices si-

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[7]Without the tie-breaking rule the platform would be indifferent between selling own product and selling the fringe product if $c = c_A$, so then the hybrid mode would arise in the same market.

multaneously. In the final stage consumers now have the option of buying online from the platform or buying offline.

3.1 Perfect substitute channels

Assume first that the two channels are perfect substitutes to consumers. If the platform has no cost advantage, and in the absence of any consumer preference over delivery method (offline or online), then the platform cannot collect any commission revenue and the fringe supplies the market at price c. So suppose that the platform has a cost advantage: $c_A < c$. If the advantage is sufficiently high, $p^m(c_A) \leq c$, the platform is an unrestricted monopoly seller of its own good with impunity. In this case (and only this case) consumers are better off with the platform good. Otherwise, the platform is constrained by the fringe and can effectively limit price and keep them at bay by charging a price of c (this is basically the asymmetric-cost Bertrand analysis where we invoke the tie-breaking rule in the advantage of the platform product at equal prices since the platform can charge a price slightly below c, winning the market, and make positive profits). Here, potential competition against the fringe effectively "polices" the market, even though the fringe is absent from the market. In terms of social surplus, the platform presence only contributes to welfare through its own profit by dint of its superior efficiency, but there is no consumer benefit.

Proposition 2 *Consider a platform in the presence of competitive fringe sellers which have perfectly substitutable alternative channels. If fringe sellers are more efficient: $c \leq c_A$, the platform cannot make any profits and fringe sellers supply the market at price equal to c. The platform is a pure reseller if and only if $c_A < c$, in which case the market price is $\min\{c, p^m(c_A)\}$ on the online channel and it is c on the offline channel. The platform sells its product whenever it is socially efficient.*

Note here that consumers are only made better off when the platform's product is sufficiently more efficient that its monopoly price is below the fringe cost. The same basic result (no consumer gains) holds even when the platform has a convenience benefit $z > 0$, expressed as a higher willingness to pay from buying online. In this case the platform sets a per unit fee $t = z$ for hosting the fringe and appropriates all the benefits of convenience (as long as costs are not so different that the platform's monopoly price is below fringe costs).

3.2 Imperfect substitute channels

Consider now the case where the offline channel is differentiated from the online channel. Suppose the offline fringe is located at 0 and the online platform is located at 1 on the Hotelling line. As before, the platform either sells its own product only or the fringe product only (due to the products

being homogenous on the platform and our tie-breaking rule) and sets a unit fee t (wlog). Offline fringe sellers set price at their marginal cost c. If the platform decides to sell only the fringe product (pure marketplace), online fringe sellers set their price at their marginal cost: $c + t$. If the platform decides to sell its own product only (pure reseller), it chooses its price p_A.

The utility of choosing the offline fringe product is $u_0 = R - \gamma x - c$, regardless of which mode the platform chooses, where R is the reservation value, γ is the transportation cost and x is the consumer's location on the Hotelling line. We compare the platform's profit under the pure reseller mode with the one under the pure marketplace mode.

In the reseller mode, the utility of buying from the platform is $u_1 = R - \gamma(1 - x) - p_A$. The marginal consumer's location is $\frac{1}{2} + \frac{1}{2\gamma}(p_A - c)$. The platform's problem is $\max_{p_A}(p_A - c_A)(\frac{1}{2} - \frac{1}{2\gamma}(p_A - c))$, and the equilibrium price is $p_A^* = \frac{c_A + c + \gamma}{2}$ and the platform's equilibrium profit is $\Pi^* = \frac{(c + \gamma - c_A)^2}{8\gamma}$. The indifferent consumer's equilibrium location is $\hat{x}^* = \frac{1}{2} + \frac{1}{2\gamma}\left(\frac{c_A - c + \gamma}{2}\right)$ and the utility at that location is $\hat{u}^* = R - \frac{3}{4}\gamma - \frac{1}{4}c_A - \frac{3}{4}c$.

In the pure marketplace mode, the utility of buying from the platform is $u_1 = R - c - t - \gamma(1 - x)$. The platform's problem is $\max_t t D_A(c, t + c)$ where $D_A(p_0, p_1)$ is the platform's demand when the offline price is p_0 and the platform price is p_1. The equilibrium fee is $t^* = \frac{\gamma}{2}$, so the equilibrium location of the marginal consumer and the corresponding utility are $\hat{x}^* = \frac{3}{4}$ and $\hat{u}^* = R - c - \frac{3}{4}\gamma$, respectively. The platform's profit is $\Pi^* = \frac{\gamma}{8}$.

Comparing the platform's profit under pure reseller mode and the one under pure marketplace, we conclude that the platform chooses to be a pure reseller if and only if $\frac{(\gamma + c - c_A)^2}{8\gamma} > \frac{\gamma}{8}$ or equivalently $(c + \gamma - c_A)^2 > \gamma^2$. Hence, we obtain the main result for this case:

Proposition 3 *Consider a platform in the presence of competitive fringe sellers each of which has a differentiated alternative channel (à la Hotelling). The platform is pure marketplace if and only if fringe sellers are more efficient: $c \leq c_A$. The platform is a pure reseller if and only if $c_A < c$.*

The platform's cost advantage lowers the platform's price, making consumers of the platform better off than the pure marketplace case. The platform's market share also increases, making consumer surplus increase further. On the contrary, when $c_A > c$, consumer surplus is greater with the pure marketplace and the platform chooses to be a pure marketplace. Therefore, the platform always chooses the mode with lesser cost, and consumer surplus is fully in tune with that choice. Consumers get the lowest price possible due to the platform's business model choice.

4 A big seller

Suppose now that there is a big seller with market power and the big seller is weakly more efficient than competitive fringe sellers: $c_B \leq c$. We will consider different cases depending on which

channel(s) the big seller offers its product.

4.1   The big seller is active only on an alternative channel

Some brand manufacturers, like Nike, Birkenstock, Rolex, Asics, North Face, Ralph Loren, do not sell on Amazon (see Business Insider, December 15, 2017 and "More brands are leaving Amazon, but the strategy might backfire" CNBC Jan 10, 2020). To capture such cases suppose now the big seller is selling only on an alternative channel competing against the platform with competitive fringe sellers. The big seller locates at 0 and the platform locates at 1. We begin with considering the case when the platform hosts competitive fringe products upon which it can exact a unit commission, t. We suppose that simultaneously the platform chooses the commission and the big seller chooses its outside platform price. This timing aims to capture a case where the big seller does not observe the platform's commission (before setting its price). As before, given the platform's commission, the competitive fringe sellers set price $c+t$ on the platform. The utility of a consumer located at x shopping from the big seller is $u_0 = R - \gamma x - p_0$ where p_0 is the price of the big seller's product, while the utility of shopping from the platform is $u_1 = R - \gamma(1-x) - c - t$. Simultaneously, the big seller and the platform choose the price p_0 and the unit fee t, respectively. The indifferent consumer's location comes out to $\hat{x} = \frac{1}{2} + \frac{c+t-p_0}{2\gamma}$ for $\gamma > 0$; the big seller maximizes its profit $(p_0 - c_B)\hat{x}$ and the platform maximizes its revenue from the fee $t(1 - \hat{x})$. The equilibrium price and the unit fee solve out as $p_0^* = \gamma + \frac{2c_B+c}{3}$ and $t^* = \gamma + \frac{c_B-c}{3}$, as per standard Hotelling analysis. Indeed, both the price that consumers pay for the fringe good on the platform, $c + t$, and the big firm's price are the equilibrium prices firms would set when the platform is a pure reseller of its own good with cost c.

It is readily shown along the earlier lines that the equivalent outcomes prevail with the platform choosing instead a percentage commission, τ. That is, in the pure marketplace case, the same platform profit can be attained with either τ or t, and the platform can get all the profit that it would have if it were itself selling the fringe good as a pure reseller of its own product with $c_A = c$. This is effectively the same result we had in the benchmark analysis of a gatekeeper platform with competitive fringe sellers. Either instrument suffices to get all fringe profit – hence the solution to the platform's problem of whether to introduce its own good is simply do so if $c_A < c$. Thus, the platform's choice of the business mode is aligned with consumers interests.

Proposition 4 *Suppose a platform hosting competitive fringe sellers faces differentiated (à la Hotelling) competition by a big seller on an alternative channel. The platform chooses to sell its own good if and only if its product is more efficient than fringe products, $c_A < c$. When it does so, both on-platform and off-platform prices decrease, consumers are better off, the big seller's profits fall, while those of the platform rise. Total welfare goes up.*

4.2 The platform hosting only the big seller and the big seller also selling on its direct channel

Now suppose that the big seller (B) is active on its own channel and competes against itself on the platform (P) (there is no competitive fringe). As before the direct channel and the platform channel are differentiated on the Hotelling line: the direct channel is at point 0 and the platform channel is at point 1. The price on the platform is p_1 and the price on the direct channel is p_0. The consumer located at x has net utility of $u_0 = R - \gamma x - p_0$ from buying the product on the direct channel and net utility of $u_1 = R - \gamma(1-x) - p_1$ from buying the product on the platform.

If P is a pure marketplace, B is a monopolist selling two differentiated products: the product on the direct channel and the product on the platform. B is then a two-product monopolist facing different marginal costs for its products. For simplicity suppose that P chooses a unit fee t to be collected from sales on the platform and then B chooses its prices, p_0 and p_1. B's marginal cost is c_B for product 0 and its marginal cost is $c_B + t$ for product 1. P can therefore control final prices (imperfectly) by choosing t first: P acts as a Stackelberg leader over B's price choices. P's optimal choice of commission rate t extracts revenue and internalizes the spillover effect in B's pricing. High t induces high p_0 which expands the market base of B's product sold through the platform. In that sense the commission is a practice that facilitates high joint prices. However, P cannot extract all of the profit from the good sold through its platform, and leaves some profit on the table on its channel to B. Using its own product can be one way of capturing some of that.

If P sells its own product, which it can do via a high enough t, P can capture rent from sales of its own product, yet the platform generates more competition between its channel and the seller's direct channel, since B does not internalize substitution between these channels when the platform sells its own product. Hence, P faces a trade-off between extracting more rent via introduction of its own product and generating more competition between the direct channel of the seller and the platform channel. We illustrate below this trade-off more explicitly by describing conditions under which the platform prefers to sell its own product and when this might harm consumers.

We might usually expect that the platform selling its own product would mean that prices would be lower and so consumers would be better off. However we have shown that there can be a particular type of solution for some parameter values for costs at which the sub-game equilibrium prices remain similar to the joint-monopoly solution insofar as they entail a marginal consumer between the two firms being indifferent to buying or not. At this solution, p_1 is lower but p_0 is higher (and their changes just offset each other) and so the market is more balanced. This though entails a loss in total consumer surplus because more consumers are now paying the higher price.

Our starting point is a situation at which we choose R high enough that B chooses the joint monopoly prices for its product sold through the two channels (for a given commission) and so it
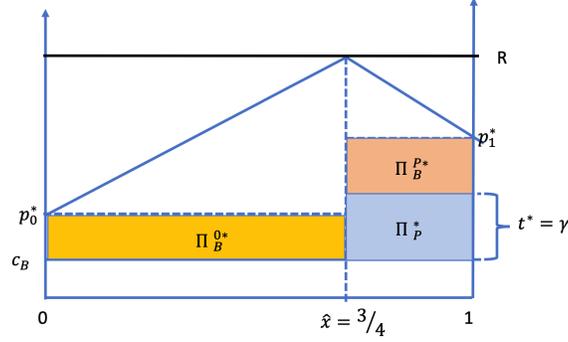
9

Figure 1: The equilibrium when the platform is a pure marketplace

covers the market with the marginal consumer just indifferent between buying and not. This is the case if $\frac{R-c_B}{\gamma} > \frac{3}{2}$ (as we show below). We discuss at the end the case of an uncovered market. The monopolist then captures the entire surplus of the marginal consumer at $\hat{x}$: $p_0 = R - \gamma\hat{x}$ and $p_1 = R - \gamma(1-\hat{x})$. B's problem is to choose $\hat{x}$ to maximize its profit

$$\Pi_B = (R - \gamma\hat{x} - c_B)\hat{x} + (R - \gamma(1-\hat{x}) - c_B - t)(1-\hat{x}).$$

In response to t, B sets $\hat{x}^* = \frac{t+2\gamma}{4\gamma}$. Anticipating the pricing of B, the platform sets t to maximize its fee revenue from B's sales:

$$\Pi_P = t(1-\hat{x}^*) = t(1 - \frac{t+2\gamma}{4\gamma}).$$

The equilibrium fee is $t^* = \gamma$, which results in the equilibrium demand for product 0 of $\hat{x}^* = \frac{3}{4}$, equilibrium prices $p_0^* = R - \frac{3\gamma}{4}$ and $p_1^* = R - \frac{\gamma}{4}$, platform profit $\Pi_P^* = \frac{\gamma}{4}$ and big seller profit $\Pi_B^* = R - c_B - \frac{7\gamma}{8}$.[8] Observe that $p_0^* < p_1^*$ since product 1 pricing involves a double markup because $t^* = \gamma > 0$. As a result, the direct channel of the seller obtains a larger market share than the platform channel sales of the seller: $\hat{x}^* = \frac{3}{4}$.

The solution to the two-product monopolist problem is illustrated in Figure 1 where the plat-

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[8]We now derive the necessary condition for the big seller to want to cover the market at the solution found for a covered market, namely with $\hat{x} = \frac{3}{4}$. If product 0 was priced as a local monopoly, the firm would choose $\hat{x}$ to maximize its profit from only product 0: $\Pi_B = (R - \gamma\hat{x} - c_B)\hat{x}$, and would set $\hat{x}^m = \frac{R-c_B}{2\gamma}$. So the profit-maximizing market length for an unfettered uncovered market is given by $\frac{R-c_B}{2\gamma}$. This exceeds $\frac{3}{4}$ if $\frac{R-c_B}{\gamma} \geq \frac{3}{2}$ so that the firm does not deviate from p_0^* to the local monopoly price. The latter is therefore a necessary condition for the market to be covered. Now consider local monopoly pricing of product 1 where the marginal cost is different: $c_B + t$. The firm would set its market share $\hat{y}$ to maximize its profit from only product 1: $\Pi_B = (R - \gamma\hat{y} - c_B - t)\hat{y}$, so the firm would set $\hat{y}^m = \frac{R-c_B-t}{2\gamma}$. Observe also that at the covered market solution, $t^* = \gamma$, so $\hat{y}^m = \frac{R-c_B-\gamma}{2\gamma}$. The big seller does not deviate from $p_1^* = R - \frac{\gamma}{4}$ to product 1's local monopoly price if $\frac{R-c_B-\gamma}{2\gamma} \geq \frac{1}{4}$. Hence, the market is covered when $\frac{R-c_B}{\gamma} \geq \frac{3}{2}$.
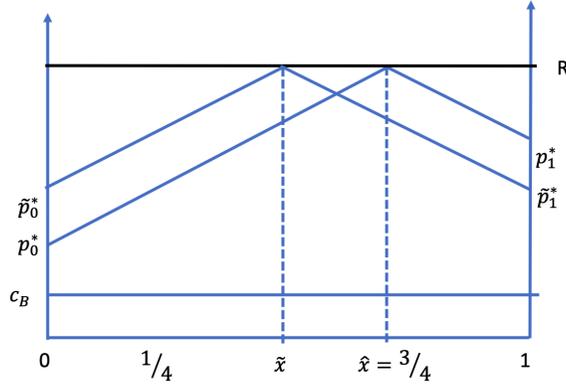
10

Figure 2: A kink equilibrium when the platform sells its product

form's profit is Π_P^* and the big seller's profit is Π_B^{0*} from its direct channel and Π_B^{P*} from the platform channel. So the platform has to leave some rent to the big seller when the platform is a pure marketplace. The platform introduces a double-markup problem in equilibrium by choosing a seller fee $t^* = \gamma > 0$ to capture some rent from the seller even if the double markup inflates the final price and so lowers the total industry profit. This is inefficient for the platform and also bad for consumers due to higher prices than the case if the seller fee was zero, in which case the big seller would choose its two-product monopoly prices with marginal cost of c_B for each product.

If the platform offers its own product, the platform chooses p_1 and sets t high enough to make the big seller unprofitable on the platform. In that case the platform and the big seller compete on the Hotelling line where the firms possibly have asymmetric costs. Suppose that at the new equilibrium the market remains covered (conditions are found below) and the firms extract the entire surplus of the marginal consumer, located at $\frac{1}{4} < \tilde{x} < \frac{3}{4}$, as illustrated in Figure 2. At such an equilibrium the price of product 1 decreases by the same amount that the price of product 0 increases with the platform entry. We consider this case to build an example when platform entry with its own product harms consumers. Note that if the new equilibrium split point is $\tilde{x} > \frac{1}{4}$, platform entry would lower consumer surplus- as can be seen geometrically from Figure 2: the increase in consumer surplus due to a lower p_1 would be less than the decrease in consumer surplus due to a higher p_0.

We now derive the conditions for there to be such an equilibrium when the platform sells its own product (at location 1) against the big seller (at location 0) on its own channel with each firm serving the consumer at some $\tilde{x}$ at her reservation price, R. Necessarily, such an equilibrium involves each firm at a kink in its marginal revenue function. It does not want to raise price and be in a local monopoly region of demand (given the other firm's price), nor does it want to lower price and be in the competitive (traditional Hotelling) region of demand where demand is more *inelastic*

11

because price cuts fight against the rival's product for marginal consumers. Let us deal first with the big seller, from which we can readily transpose the arguments to find the analogous conditions for the platform product. Notice that the firm's conditional profit functions are strictly concave in both local monopoly and competitive regimes: the profit function facing each firm is the lower envelope of the conditional profit functions and entail a kink at the maximum, which is where the regime changes. We next show that full market coverage at such a new equilibrium requires that

$$2\tilde{x} \le \frac{R - c_B}{\gamma} \le 3\tilde{x}. \tag{4}$$

For this case to arise in equilibrium local monopoly of product 1 should not deviate by raising its price above $\tilde{p}_0^*$. Given that the local monopoly profits are $\Pi_B^m = (R - \gamma\tilde{x} - c_B)\tilde{x}$, this happens when the marginal profit of the local monopolist increases at $\tilde{x}$, that is,

$$R - 2\gamma\tilde{x} - c_B \ge 0.$$

This gives us the first part of the condition: $2\tilde{x} \le \frac{R-c_B}{\gamma}$. We also need to determine the condition under which the big seller does not deviate by lowering its price below $\tilde{p}_0^*$. To derive this, write B's "Hotelling" profit as $\Pi_B^H = (p_0 - c_B) x^H$ where $x^H = \frac{p_1 - p_0}{2\gamma} + \frac{1}{2}$, so that

$$\frac{d\Pi_B^H}{dp_0} = x^H - \frac{1}{2\gamma} (p_0 - c_B),$$

which we want to be non-negative at $x^H = \tilde{x}$ where $\tilde{x} = \frac{R-p_0}{\gamma}$, or, equivalently, $p_0 = R - \gamma\tilde{x}$. Hence the desired condition is

$$\tilde{x} - \frac{1}{2\gamma} (R - \gamma\tilde{x} - c_B) \ge 0 \qquad \text{or} \qquad \frac{R - c_B}{\gamma} \le 3\tilde{x}.$$

We can just transcribe to get the conditions for firm P by switching c_A in for c_B and writing the relevant market length as the distance from the right endpoint, i.e., $\tilde{y} = 1 - \tilde{x}$. Thus the conditions for firm P are

$$2\tilde{y} \le \frac{R - c_A}{\gamma} \le 3\tilde{y}. \tag{5}$$

Figure 3 illustrates the parameter space where the platform selling its own product lowers consumer surplus. The upper diagram illustrates the region with values of $\frac{R-c_B}{\gamma}$ when this happens (blue dashed region). Above the red line the market is covered when B is hosted by P ($\frac{R-c_B}{\gamma} \ge \frac{3}{2}$). B has no incentive to deviate from the kink equilibrium at $\tilde{x}$ (with the platform product) when $2\tilde{x} \le \frac{R-c_B}{\gamma} \le 3\tilde{x}$, see (4). This is the area between the two increasing lines until the point $\tilde{x} = \frac{3}{4}$, where the kink equilibrium with the platform product meets the kink equilibrium for the
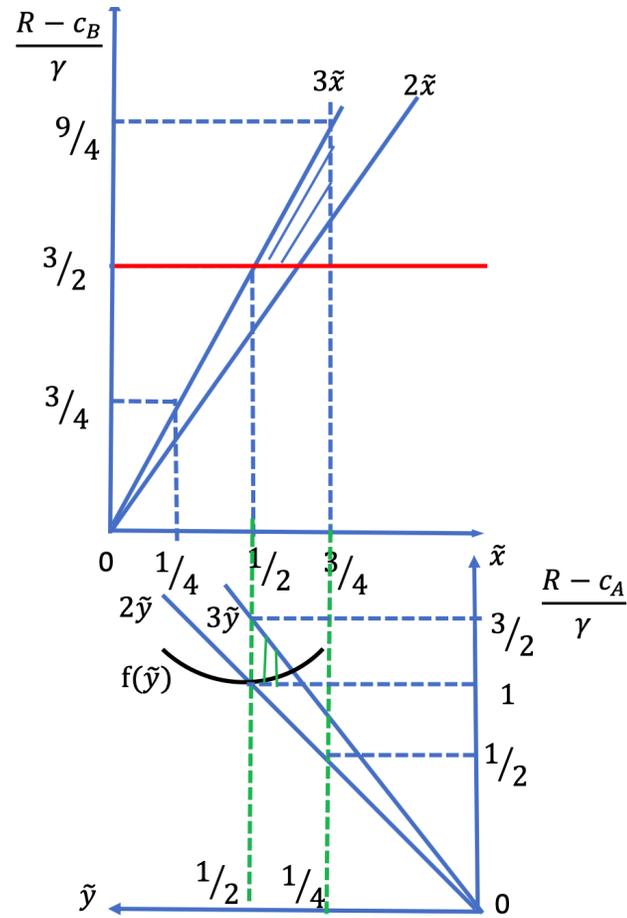
Figure 3: The parameter space when the platform selling its product lowers consumer surplus at the kink equilibrium.

two-product monopolist seller. The corresponding values of this region for $\tilde{y}$ are between $\left[\frac{1}{2}, \frac{1}{4}\right]$ as illustrated in the lower diagram of Figure 3. This illustrates the region with values of $\frac{R-c_A}{\gamma}$ when the platform does not have an incentive to deviate from the kink equilibrium at $\tilde{y}$ (green dashed region) corresponding to (5). Finally, we need to check whether the platform wants to introduce its product in this region. This is the case above the black curve in Figure 3. We now derive this curve.

We are interested in situations where P prefers its own product, given the equilibrium type above exists. P's profit at such an equilibrium is $\tilde{y}\left(R - \gamma\tilde{y} - c_A\right)$, i.e. its consumer base times the mark-up given that the consumer at distance $\tilde{y}$ from 1 is indifferent between buying and not. This profit needs to be at least as attractive as profit $\left(\frac{\gamma}{4}\right)$ under the double-marginalization regime at which the platform just earns commission revenue. Inserting the relevant values implies profitable own-product if

$$\frac{R - c_A}{\gamma} \geq f(\tilde{y}) \equiv \frac{1}{4\tilde{y}} + \tilde{y}.$$

Hence, the platform's entry with its own product harms consumers in the blue dashed values of $\frac{R-c_B}{\gamma}$ and in the green dashed values of $\frac{R-c_A}{\gamma}$. For example, we can derive the region of parameters that lead to $\tilde{x} = \frac{1}{2}$ when the platform introduces its own product and this lowers consumer surplus. Looking for the conditions (and Figure 3), this happens when $\frac{R-c_B}{\gamma} = \frac{3}{2}$ while $\frac{R-c_A}{\gamma} \in \left[1, \frac{3}{2}\right]$. These conditions imply that P's product need not necessarily be more inefficient than B's (costs could be the same) in order for a situation to arise in which consumers are worse off when P (weakly) prefers its own product to hosting B.

Proposition 5 *Consider a platform which hosts a big seller which also sells through its own substitute alternative channel on the Hotelling line. Then there exist parameter values (as shown in Figure 3) such that consumers are worse off when the platform prefers to sell its own product.*

This example, although difficult to construct, indicates that it is not always true that platform incentives to host its own product are in the public interest once we consider more ornate strategic environments. When the big seller has market power and the platform hosts only the big seller, the seller can coordinate its pricing on the platform and on its direct channel, so internalize substitution between the channels, which would lead to less competitive outcome given costs. The platform via its choice of the seller fee adds an additional markup on the seller's pricing of its product on the platform. However, the platform wants to use a positive seller fee for rent extraction. Hence, the equilibrium outcome of two-product monopolist seller facing a double markup on one of its products would lead to an inefficient outcome for the firms as well as for consumers. The platform has an imperfect tool to extract rent of the big seller. Selling own product could be used as an alternative tool to extract more rent. However, when the platform sells its own product, it prevents

the big seller from internalizing competition between the platform channel and the big seller's direct channel. As a result of this trade-off, as we showed in our example, the platform might prefer to sell its product which can be less efficient than the big seller product and this harms consumers.

Now consider the case where the market is uncovered. The two products will then be priced as local monopolies, where pricing of B product on the the platform would involve a double markup due to the seller fee. If the platform sells its product, the double markup will be eliminated and so the price of the platform product will decrease. But the platform product could be less efficient and so this might imply a higher price of the product 1 than the big seller selling it with a double markup. We now show that when the platform prefers to sell its own product in this uncovered market, consumers are better off.

The uncovered market is the situation where the reservation price R is low enough – the presence of the big seller's channel is irrelevant because there is no interference between the two channels. Indeed, because demand is linear for the monopoly problem, we can make the point by normalizing without loss of generality to a linear demand with price and quantity intercepts both 1 ($p = 1 - q$) and also set the big seller's marginal cost $c_B = 0$. We shall show that the platform's price choice whenever it prefers to sell its own product is below the level when it hosts the big seller.

It is readily verified that the hosting solution to this classic double-marginalization problem entails setting $t = 1/2$, so that B sets the final price equal to $3/4$ and output is $1/4$. The platform then earns profit $1/8$. If instead the platform were to sell its own product, produced at marginal cost c_A, it would set price to $\frac{1+c_A}{2}$ with output $\frac{1-c_A}{2}$ and earn profit $\left(\frac{1-c_A}{2}\right)^2$. The platform prefers to sell its own product if $\left(\frac{1-c_A}{2}\right)^2 \geq \frac{1}{8}$, which implies $c_A \leq 1 - \frac{1}{\sqrt{2}}$. The associated price must be lower than the price under the double marginalization outcome as long as $\frac{1+c_A}{2} \leq \frac{1}{8}$, which is necessarily true. Therefore consumers are better off (prices are lower) whenever the platform prefers its own product.

4.3 The platform hosting only the big seller, no direct channel

We now look at a gatekeeper platform hosting a big seller: we close down the competitive fringe and suppose that the big seller can only reach consumers via the platform. We look at this version to make several key takeaways. We suppose that the platform chooses the commission and then the seller chooses the price. The big seller has market power, so that this vertical structure introduces double marginalization and our aim is to make some points about that. First, double marginalization is inefficient for joint surplus maximization, so there is now a difference between per unit and percentage commissions. Percentage commissions deliver more profit to the platform.

15

This is because any given output that can be attained under a unit fee can also be attained under a percentage fee, but with more revenue. We illustrate below this result, which is firstly provided by Johnson (2017) building on the findings of taxation literature Suits and Musgrave (1953) and Anderson et al. (2001).

Second, the profit-maximizing percentage fee yields a strictly lower consumer price if the price elasticity of demand is decreasing, $\left(\frac{pD'(p)}{D(p)}\right)' \leq 0$, which is the Marshall's Second Law of Demand (Bishop, 1968; Gaudin and White, 2014; Llobet and Padilla, 2016; Johnson, 2017). This is because a percentage tax delivers the upstream firm a more elastic demand and the firm takes advantage of this by expanding output, which has the benefit to it of reducing the commission it pays per unit which is clearly fixed under a unit fee. Consumers are better off and percentage commissions are welfare superior. Notice that this suggests that percentage taxes are also superior in a two-sided market setting when consumer participation is important.

We next show that for general inverse demand $p(Q)$, a percentage commission on sales of the big seller, τ, yields greater profit than a per unit commission t.

For a given unit commission t, the big seller's problem is

$$\max_{Q} \left(p(Q) - c_B - t\right) Q,$$

whereas the percentage commission case entails

$$\max_{Q} \left((1 - \tau) p(Q) - c_B\right) Q \qquad \text{or} \qquad \max_{Q} (1 - \tau) \left(p(Q) - \frac{c_B}{1 - \tau}\right) Q,$$

and so the output level of a given unit commission t (and hence the price) can be attained by τ^e satisfying

$$c_B + t = \frac{c_B}{1 - \tau^e} \qquad \text{or} \qquad \tau^e = \frac{t}{c_B + t}.$$

The platform's revenues under the two scenarios are tQ and τpQ. So we want to show that any revenue generated under a per unit commission t can be beaten by a percentage one: $t^* Q \leq \tau^* pQ$. It suffices to show that for any t, there is a τ^e giving the same Q, which is done above, and then that the Q-equivalent revenues are larger with the percentage commission τ^e. So we want to show $tQ \leq \tau^e pQ$ or $t \leq \tau^e p$. Given $\tau^e = \frac{t}{c_B + t}$ as shown above, we need to show that $t \leq \frac{t}{c_B + t} p$, that is, $c_B + t \leq p$. This must be true because the big seller's price should exceed its cost per unit.

Now consider the platform's choices between a pure reseller mode selling only its own product and pure marketplace mode hosting only the big seller. If the platform chooses just to sell its own good, it is a monopolist charging $p^m(c_A)$ and gets $\Pi^m(c_A)$. If the platform were a gate-

keeper for the big seller and set a percentage commission τ, the market price is $p^m \left(\frac{c_B}{1-\tau} \right) = \arg \max_p \left(p - \frac{c_B}{1-\tau} \right) D(p)$. So given that $\tau > 0$, for $c_B \geq c_A$ the consumer surplus and profit are strictly lower than when the platform sells its own good, and this is also true for c_A not too high above c_B. In such cases, therefore, closing down the platform's ability to sell its own product reduces consumer surplus and the platform's incentives are aligned with consumer benefits. Even when it is the case that platform profits are higher with the double marginalization arrangement, it does no good to ban the platform from selling its own good because it does not want to do so anyway.

5   Heterogenous tastes for variety

In the previous sections using a suite of models we illustrate that allowing the platform to decide whether to sell its own products benefit consumers, which is in line with the main findings in Hagiu et al. (2021) and Etro (2021) (see next section for a detailed review of these papers). It turns out that this result depends on a key modelling assumption of the previous models: consumers have homogenous tastes for products.

Anderson and Bedre-Defolie (2021) (hereafter ABD) obtain the opposite result that hybrid mode harms consumers by adding consumers' differential tastes for products as well as allowing the platform to control entry of differentiated third-party sellers. Thus, in a given market, both the platform products and third-party products can have some positive sales. By setting commissions the hybrid platform can affect the number of sellers participating on the platform and hence the amount of competition and pricing in its markets. This captures the trade-off of a hybrid platform between charging low commissions to encourage seller entry to the market and charging higher commissions to shift demand towards its own products in the market. So, the hybrid platform can carve out a bigger market share for its own product by setting a higher commission to reduce the competition (compared to a pure marketplace). This is what we call "insidious steering" in ABD. But this might be costly for the platform by reducing consumer participation and volume of trade on the platform, since consumers value variety and dislike high prices. ABD show that insidious steering is profitable for the hybrid platform and becomes more profitable if the platform's own products get better (higher quality or lower cost). As a result, the platform's presence with its own products reduces choices and raises their prices in the market, and so hurts consumers.

The key economic mechanism behind these results is the following. In general consumers benefit from more choice and lower prices on the platform. They also benefit from better platform products. If the quality of the platform product improves, then more people will buy it and it becomes more profitable. This means two things. First, the platform wants more of the market footprint for itself by raising rivals' costs. Second, it wants to rebalance its portfolio to get a

similar high return from its commissions on sellers. Both of these mean it wants to set a higher commission (compared to a pure marketplace). Higher commissions on sellers lead to higher prices and fewer sellers. Thus, better platform products crowd out some smaller sellers and induce the platform to set higher commissions raising prices and reducing choices. As a result, a better platform product is actually harmful to consumers.

ABD's description of the marketplace reflects the following characteristics of e-commerce markets: in a given market consumers choose one product from a list of different options. Consumers have heterogenous tastes for these products. To capture the long-tail of products on e-commerce platforms, they consider a large number of third-party products, and also a large number of outside alternatives for consumers. When the platform chooses to be hybrid, the platform also has its own product range competing against third-party products, which can have different qualities and costs than the platform products. The platform and third-party sellers are quite different. First, the platform typically sells a range of products in any market segment. So it has substantial market power in each segment, whereas small sellers do not. Second, sheer size, reputation, market presence and dominant position of the platform in the market gives it significant advantages. After all, it is the one setting the commission rate and it will do so by taking into account how the commission affects sellers' response in choosing to sell on the platform and pricing their product. Third, sellers rely on the "gatekeeper" platform as the only access to consumers. There is fluid entry of sellers to the platform and positive network effects between consumers and sellers: more consumers visit the platform when there are more choice and prices are lower, and more sellers enter the platform, when there are more consumers.

Insidious steering is different from blatant steering, that is, prioritizing own products in the rankings or recommendations, like Amazon choice or Buy Box, and it is implicit: it happens via charging higher seller commissions.[9] It is therefore harder to detect insidious steering than blatant steering. So, a behavioral ban on blatant steering will not be effective in preventing insidious steering. ABD show that banning the hybrid mode (as proposed in the U.S. bills) benefits consumers if and only if the platform becomes pure marketplace after the ban. The ban harms consumers if the platform becomes a pure reseller (shutting down its marketplace). This happens if the platform's products are of very high quality or low cost.

Insidious steering is similar to the vertically integrated firm raising rivals' costs by raising the price of the essential input. In the case of a gatekeeper platform, the essential input for sellers is the access to consumers since they have no alternative channels. Different from previous theories of vertical foreclosure (Rey and Tirole, 2007), the vertically integrated firm (platform) collects

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[9]Within the hybrid regime, they also find that the platform wants to do blatant steering in the sense of raising the perceived value of its products at the expense of lowering the perceived value of third-party products if the platform's products are sufficiently of high quality or low cost.

a percentage commission from downstream rivals and controls their entry via its choices of the commission and own product prices. ABD show that the divestiture of the platform from its reseller unit can be an alternative remedy.

Taxation can be an alternative instrument to a structural ban on hybrid mode. In 2019, the French government introduced the Digital Services Tax on marketplace revenues of Amazon (Forbes, August 19, 2019). Amazon reacted to the tax by raising its third-party commissions by the same amount on Amazon.fr. Indeed, ABD show that taxing the hybrid platform's commission revenues from third-party sellers raises commissions and harms consumers by increasing prices and reducing choice. So the French tax will harm consumers. They instead propose taxing the platform's own product revenues to correct distortions arising from hybrid business mode. Taxing the platform's reseller revenues reduces the platform's incentives to promote/protect own product and improves allocation.

6   Related Literature

The literature on buyer-seller platforms is scarce but has been developing fast in the last couple of years. Galeotti and Moraga-González (2009) model a "gatekeeper" platform charging access fees to both consumers and sellers for interacting. Consumers make a discrete choice among differentiated products on the platform. There is a fixed number of products (sellers) and a uniform taste distribution for products. In equilibrium, all buyers and sellers join the platform which extracts all the market surplus. They conclude that the platform does not introduce a distortion over the markup generated by differentiated sellers. This is true also in the presence of an alternative channel even if the platform has to leave some rents to consumers in that case. They do not consider the platform's hybrid mode choice since this was not an issue at the time.

Hybrid trade platforms might look similar to a retailer selling private labels, implications of which have already been studied in the literature (Mills, 1995; Berges-Sennou et al., 2004; Meza and Sudhir, 2010; Tiboldo et al., 2021). Hybrid platforms however are different from retail stores due to several fundamental differences in their business model. First, hybrid platforms do not own third-party products, so do not pay for their purchasing costs and do not directly control their prices. Hagiu and Wright (2015b) provide a detailed discussion of significant differences between a retailer and a marketplace. Second, hybrid platforms use the agency model instead of the wholesale model - they tax transactions of third-party sellers and let sellers determine their product prices. Johnson (2017) higlights two key differences in the economics of these two business models: 1. the type of contract is ad-valorem in agency and unit fee in wholesale, 2. who owns the bargaining power (the intermediary makes the offer in agency, whereas the supplier makes the offer in wholesale). Johnson (2017) shows that the intermediary is better off and the supplier is worse off

with the agency model compared to the wholesale model. These differences imply that hybrid platforms do not directly control or internalize the downstream margin of third-party products, but instead get a commission over third-party sales. Recently, in a vertical differentiation framework Shopova (2021) analyzes the differences between the wholesale and agency models when the intermediary chooses to enter into its marketplace with a private label and chooses also the quality of its product. She shows that the introduction of the platform product reduces the unit seller fee, but the platform's product is priced above a standalone monopolist's product and also higher than the private label price if the intermediary acted as a retailer using the wholesale model.

Early literature on hybrid platforms raise the question of in which markets it makes sense for the platform to sell its own product(s) (pure reseller mode) and in which markets the platform is better off hosting third-party products (pure marketplace mode). Hagiu and Wright (2015a) study important factors that determine the key trade-offs involved when choosing one mode over the other in a given market: asymmetric information between the platform and third-party sellers on demand, efficiency of the platform vs third-party sellers, spillovers across products (like complementarities), long-tail vs short-tail products.

Hagiu et al. (2021) analyze the implications of the hybrid business mode (or dual mode) on third-party sellers' actions, consumers and total welfare. They conclude that the dual mode benefits consumers. In their model there are three product types, homogeneous up to quality/cost shifts: a superior product, a platform product, and a competitive fringe product. There is an exogenous fraction of consumers that prefer to buy from sellers' direct channels, which are homogenous to the platform channel up to a quality/cost shift, and sellers can set differential prices inside and outside the platform. "Direct consumers" are necessary to make hybrid mode profitable in equilibrium: The superior seller sometimes prefer to exploit its direct consumers rather than lowering its direct price to compete against the platform product. Thus, direct consumers prevent head-to-head competition between on-platform and off-platform purchases. Before visiting the platform consumers know the presence of fringe sellers (and their direct channel), but they learn the presence of the superior seller only after visiting the platform.

In dual mode of Hagiu et al. (2021), consumers buy either the platform product or the superior seller product on the platform. In the former case, the superior seller constrains the price of the platform product in asymmetric Bertrand equilibrium. In the latter case, the platform product intensifies competition by constraining the superior seller's inside price (and the platform product is not purchased). This in turn lowers prices and increases transaction volume on the platform despite the fact that the platform sets a higher commission on third-party sellers when it has the dual mode. Due to the competition intensifying effect, the platform prefers the dual mode over pure marketplace mode. However, the platform's profits might be lower in the dual mode than reseller mode (selling only own products) due to the platform facing competition of third-party

sellers in the dual mode. Hence, the platform adopts the dual mode only in those markets with intermediate or low levels of the platform's cost/quality advantage and becomes pure reseller in those markets where its cost/quality advantage is sufficiently high. The ban on dual mode harms consumers. If the ban makes the platform switch to a reseller mode, consumers have fewer choices both inside and outside of the platform (as they are not aware of the superior product). If the ban makes the platform switch to pure marketplace, consumers face higher prices since the superior seller charges higher prices in the absence of the platform's product. However, the total welfare might be higher under pure marketplace when the superior seller invests less in innovation in the dual mode.

Hagiu et al. (2021) also consider potential steering and imitation of innovation by the platform. When the platform is allowed to steer consumers toward its own product, the superior seller product is not visible to consumers, so dual mode becomes the most profitable for the platform. When the platform is allowed to perfectly imitate the superior seller product at no cost, there is no innovation by the superior seller in dual mode. Even in those cases, a ban on dual mode harms consumers. Banning product imitation would instead be a better policy. Such a ban enables the platform to credibly commit not to imitate the superior seller's innovation and so increases innovation. This also benefits the platform. Banning steering benefits consumers unless the ban leads the platform to switch to pure reseller. They conclude that behavioral remedies, like banning imitation and banning steering, are likely to benefit consumers, whereas a blanket ban on hybrid mode harms consumers.

In the same vein Etro (2021) shows that private and social incentives for a platform to resell its product or host third-party sellers coincide for specific demand functions (for which consumer surplus is proportional to profit). He also finds that the platform entry might be too much or too little compared to the socially efficient level for more general demand specifications (depending on the monotonicity of the fraction of demand elasticity and subutility elasticity). He considers an environment with competitive fringe sellers entering into independent product markets, with homogenous product in each market (up to a demand/cost shift): the platform product has lower unit costs and the third-party products have a higher demand. The platform charges a unit commission on third-party sales. Each independent market aims to capture Amazon Standard Identification Number, or ASIN, level competition on Amazon, where the platform decides which product to feature in each ASIN: Own product (a private label or a branded product sold by Amazon as a reseller (first party)) or a third-party product. Hence, whenever the platform introduces its product, it replaces a third-party seller in the market. Thus, in a given market the platform makes a mutually exclusive choice between pure reseller and pure marketplace, and is never hybrid. The platform sells those products where its cost advantage is not offset by the demand advantage of third parties. These results fully accord with ours and Hagiu et al. (2021). When third-party sellers have market

power, there is too little entry of the platform product (from consumer welfare point of view) due to double markup problem.

Hervas-Drane and Shelegia (2021) analyze the implications of the platform learning from successful third-party sellers to muscle in on lucrative product market categories. They consider independent product markets that differ in their value, with inelastic demand and one independent seller in each market. Different from previous papers, in Hervas-Drane and Shelegia (2021) the platform has an exogenous number of categories it can enter as a retailer (its capacity). It only knows about the existence and value of a fraction of categories until informed by an independent seller's entry. The marketplace arises from the capacity constraint the firm faces in its reseller channel and information acquisition on some products' existence by hosting them. They find that banning hybrid mode may harm consumers since the hybrid mode limits the price of a monopolist seller and leads to lower prices for "attentive" consumers, who buy the cheapest product. This is similar to the competition intensifying effect of hybrid mode in Hagiu et al. (2021), although one important difference arises in the counterfactual scenario, that is, without the platform's product (pure marketplace mode): in Hervas-Drane and Shelegia (2021) the monopoly price prevails, whereas in Hagiu et al. (2021) competitive fringe sellers constrain the pricing of the superior seller with market power. Thus, in Hervas-Drane and Shelegia (2021) the hybrid mode turns the market structure from a monopoly extracting entire surplus to asymmetric Bertrand in that market. Moreover, the platform assigns the "Buy Box" to one product (its own product or the third-party product) in the hybrid mode and the winner of this assignment guarantees the demand by inattentive consumers (of an exogenous measure) if its price is not above the value. Entry in the most profitable categories drives a subgame equilibrium in which the platform gives itself the "Buy Box" and sells at the category reservation price to (exogenous) inattentive buyers who pay no attention to the cheaper third-party seller. The platform sets the commission rate to induce third parties to enter unknown markets and either earn commission on them or else enter too and earn both commission and own-product profit.[10] They assume third-party sellers (entrants) set their price before the platform: the consequent limit pricing induces the platform product to just take the inattentive consumers rather than undercutting and taking all.

Madsen and Vellodi (2021) studies the implications of a hybrid platform imitating the innovation of a third-party seller ("insider imitation") where the platform can commit to an imitation strategy (data usage policy), facing uncertainty on the cost of the innovation and demand uncertainty before innovation takes place, which is resolved once the product is introduced. Once the entrepreneur innovates and introduces her product on the marketplace, she generates a stream of profits over an infinite, continuous time horizon. Imitation strategy is a mapping from the de-

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[10]They assume that the platform cannot change the commission after entry of third parties (tells it market strength), since otherwise the platform would monopolize the market, but then third-parties would not enter.

mand state to the time at which the platform introduces an imitation product. They find that a ban on insider imitation stimulates innovation in product markets where the demand has a significant *(*upside potential), that is, a significant chance of having very low demand and a very low chance of having very high demand. On the other hand, the ban reduces innovation in "incremental" product markets where the demand has very little *(*upside potential). They also find that divestiture of the platform's private label from its marketplace always lowers innovation and results in less innovation than the insider imitation ban.

Very recently Kang and Muir studies the implication of hybrid mode on the vertical contracting problem of the platform facing competitive fringe sellers (producers) where producers have private information on their unit cost. They show that when the platform is gatekeeper, so fringe sellers do not have an alternative channel to access to consumers, the hybrid mode lowers the downstream price by reducing the double markup problem in the vertical channel and so benefits consumers.[11] However, when the producer has access to competing downstream channels, the platform finds it optimal to dampen competition against alternative channels by engaging in exclusive dealing with the producer or acquiring the alternative channels and shutting them off (so called "killer acquisition"). These practices harm consumers.

To sum up, similar to the first strand of models presented in this paper, in Hagiu et al. (2021), Etro (2021), Hervas-Drane and Shelegia (2021) and Kang and Muir, consumers have homogenous tastes for products on the platform. All of these papers conclude that allowing the platform to sell its own products is good for consumers since this lowers prices. Due to homogenous tastes for products, the platform is never actively hybrid in a given market, that is, either the platform product or the third-party product is sold in a given market. On the other hand, the platform can be hybrid across different segments of consumers, like in Hervas-Drane and Shelegia (2021), where an exogenous fraction of consumers are inattentive and so buy the good that is presented in the Buy Box, and the other fraction (attentive consumers) buy the cheapest product. The platform can also be hybrid across different markets, that is, selling only its product(s) in some markets and selling only third-party products in other markets.

The reasons of why the platform's presence is good in the current paper are different from the previous papers: the platform prefers to sell its own product only if it is more efficient than the third-party sellers. This is true even if the outside channels of fringe sellers is differentiated (with heterogenous consumer tastes) or there is a big seller with market power on an outside differentiated channel. In the latter case, whenever the platform sells its own product, it constrains the pricing of the big seller outside the platform and so benefits consumers further compared to the

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[11]In her framework double markup problem arises due to asymmetric information, whereas in the current paper with full information and competitive fringe sellers there is no double markup problem, as fringe sellers' margin is zero in equilibrium.

case where the platform is gatekeeper (without an alternative channel of sellers).

As shown by Anderson and Bedre-Defolie (2021) (and discussed in the previous section) introducing consumers' heterogenous tastes for differentiated products in a given market changes previous predictions drastically: when the platform introduces its product(s), it finds it optimal to raise its commission on third-party sellers to shift demand to its own product(s). This in turn reduces consumers' choices and raises their prices, and ultimately harms consumers.

Similar to Anderson and Bedre-Defolie (2021), Zennyo (2020) captures consumers' heterogenous tastes for differentiated products in a discrete choice demand model (logit) and allows for free entry of third-party sellers. Differing from previous literature, Zennyo (2020) provides a novel mechanism for a hybrid platform to bias product search towards its own good and reaches significantly different results than Anderson and Bedre-Defolie (2021). First, in fair encroachment mode (where the platform sells its own product and where the search engine is fair between the first- and third-party products), the equilibrium commission is the same as that of pure intermediary mode. This difference arises from different type of seller fees used in these papers: Zennyo (2020) considers per unit commissions, whereas Anderson and Bedre-Defolie (2021) considers percentage commissions. Second, in Zennyo (2020) the number of sellers entering (variety) does not affect consumer surplus due to consumers randomly sampling in his simultaneous search setup. Thus, there is no variety effect of platform entry (encroachment) on equilibrium commission, prices and consumer welfare (in the fair search results case), even if there are fewer sellers entering the platform. Third, in biased encroachment mode (where the platform sells its own product and biases search results in favor of its first-party product), the platform charges a lower commission than fair encroachment and pure intermediary modes. Welfare rises when there is a biased search (meaning the platform product is always considered) because in the hybrid mode commissions are lower to attract more consumers to the platform and to the larger base of its own product.

Very recently, in the framework of Anderson and Bedre-Defolie (2021), Etro et al. (2021) analyzes alternative demand systems based on a representative consumer and shows that with constant elasticity demand (CES), the platform's commission is independent of its business mode and so the hybrid mode is neutral to the prices. This result is an implication of a property documented in Anderson and de Palma: a unit tax in logit demand is equivalent to an ad-valorem tax in CES demand. Hence, logit demand with a unit commission on sellers (Zennyo, 2020) generates the same neutrality of hybrid mode for the commission level as the CES demand with a percentage commission on sellers (Etro et al., 2021). Etro et al. (2021) also documents that for more general representative consumer demand systems satisfying the independence of irrelevant alternatives (IIA) property, the hybrid mode might raise (or lower) the seller commission and so harm (or benefit) consumers.

Finally, there is a fast growing empirical literature that studies the implications of self-preferencing and hybrid mode using data from Amazon. Lee and Musolff (2021) show that self-preferencing via

recommendation algorithms on Amazon benefits consumers in the short-run, but might be harmful in the long-run by reducing variety (third-party seller entry) on the platform. Lam (2021) finds that self-preferencing via rankings and Buy Box allocation on Amazon harms third-party sellers, but benefit consumers. Using counterfactual simulations he also predicts that banning hybrid mode is detrimental to consumers, whereas divestiture of the reseller unit from the marketplace unit benefits consumers. Gutierrez Gallardo (2021) estimates demand and supply, and using counter-factual simulations he finds that a ban on hybrid mode harms consumers if the platform turns into a pure marketplace and stops Prime Services, but such a ban might be beneficial if the platform keeps Prime Services via expanding in Fulfillment by Amazon. In line with previous theoretical findings, his analysis predicts that the ban will be harmful to consumers by reducing third-party product variety if the platform turns into a pure reseller after the ban.

7 Conclusion

We provide a suite of models and also study recent theoretical models in the literature of online trade platforms (e-commerce marketplaces) enabling interactions between buyers and sellers. Our ultimate aim is to enlighten the policy question of whether and when a dominant platform selling its own products in its marketplace along with third-party seller products (hybrid mode) could harm consumers. We mainly focus on how the hybrid mode choice affects the optimal commission the platform sets on third-party sellers. In the literature review we also discuss the implications of the hybrid mode choice on other dimensions affecting consumer surplus: innovation, product rankings and recommendations.

We derive the following main findings. First, when consumers have homogenous tastes for products, allowing the platform to sell its own products in its marketplace benefits consumers by reducing prices: the platform prefers to sell only its own products in those markets where it has lower cost (higher quality) than third-party sellers and sell only third-party products otherwise. The platform product entry can also limit market power of a big seller on the platform and also outside the platform (on a differentiated alternative channel of the seller). Hence, the platform's choice of entering into its marketplace with its own product(s) benefits consumers in those markets where we have homogenous tastes for products: markets with very little product differentiation, like ASIN level competition on Amazon, or when consumers have similar tastes for different products, that is, products could be objectively ranked.

Second, the hybrid platform might engage in practices like steering consumers toward its own product, imitating third-party sellers' product (innovation), mitigating competition against third-party sellers' alternative channels, for example, via exclusive dealing provisions. These practices mostly harm consumers, even if consumers benefit from the platform's hybrid mode choice. Thus,

behavioral regulations banning these practices or eliminating incentives to engage in these practices (like Chinese walls between the reseller channel of the platform and the marketplace activities) might be effective in eliminating consumer harm from such practices.

On the other hand, when consumers have heterogeous tastes for products, in the hybrid mode the platform sells its own products competing against third-party products in the same market. This generates a conflict of interest for the platform: raising rivals' costs by increasing commissions on third-party sellers and increasing the volume of trade by lowering commissions on third-party sellers. This in turn implies that the hybrid mode harms consumers by leading to higher commissions on third-party sellers (higher prices and fewer choices) than pure marketplace mode, that is, *insidious steering*. A ban on blatant steering will not be effective to eliminate distortions from insidious steering. A structural ban on hybrid mode might have unintended consequences, for example, if the platform switches itself into a reseller (shutting down marketplace). However, alternative interventions like taxing the hybrid platform's revenues from its reseller channel or divesting the platform's reseller unit from the marketplace unit can eliminate distortions arising from the hybrid mode of the platform by reducing or eliminating incentives to do insidious steering.

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