

Search platforms: Showrooming and price parity clauses*

Chengsi Wang[†] and Julian Wright[‡]

Abstract

We provide a model in which consumers search for firms directly or through platforms. Platforms lower search costs but charge firms for the transactions they facilitate. Platform fees raise the possibility of showrooming, in which consumers search on a platform but then switch and buy directly to take advantage of lower direct prices. In settings like this, search platforms like Amazon's marketplace and Booking.com have adopted price parity clauses, requiring firms offer their best prices on the platform, arguing this is needed to prevent showrooming. We use our model to evaluate the implications of showrooming and price parity clauses.

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[†]Department of Economics, University of Mannheim, Germany, E-mail: chewang@mail.uni-mannheim.de

[‡]Department of Economics, National University of Singapore, Singapore, E-mail: jwright@nus.edu.sg

1 Introduction

A growing number of intermediaries act as platforms over which firms sell to consumers. Well known examples include third-party marketplaces such as Amazon.com, online travel agencies such as Expedia, and hotel booking services such as Booking.com. Key features of these platforms are that (i) firms set prices on the platforms; (ii) consumers search for firms and complete their purchases through the platforms; and (iii) when consumers complete a purchase through a platform, firms pay a commission fee to the platform. Many booking and reservation systems including global distribution systems and restaurant booking services also share these features, as do some price comparison websites (e.g. for automotive insurance in the U.K.) and insurance brokers. An additional feature of most of the markets in which these platforms operate is that firms can also sell to consumers directly, potentially setting different prices. Consumers can therefore search directly for firms instead of on a platform, or they can search on the platform and then switch to purchase directly. This paper provides a theory that matches these features.

Our interest in modeling these markets stems from recent policy investigations into the use of price parity clauses by platforms. Two types of clauses are relevant. A wide price parity clause requires that the price a firm sets on the platform be no higher than the price the same firm charges for the same good through any other channel, including when it sells directly and when it sells through a rival platform. A narrow price parity clause requires only that the price a firm sets on the platform be no higher than the price the firm sets when it sells directly. These types of restrictions are also known in policy circles as “across platform parity agreements”, “third-party MFNs” and “best-price clauses”.¹

Price parity clauses have been used by platforms in most of the markets we are interested in. For example, Amazon’s General Pricing Rule requires that the item price and total price of an item a seller lists on Amazon.com must be at or below the item price and total price at which the seller offers the item via any other online sales channel. In 2012, German and U.K. authorities investigated Amazon’s rule, and Amazon responded by removing the rule from its marketplace contracts in Europe from 2013, although it has kept the rule in place elsewhere. Similarly, in 2015, after investigations by several European authorities into their use of price

¹These restrictions do not mean a customer is necessarily getting the best price from the firm compared to other customers (i.e. is most favored). Airlines and hotels commonly discriminate across customers based on the customer’s history, when the customer books and other criteria. This is why we prefer not to use the “MFN” terminology.

parity clauses, Booking.com and Expedia, the two largest booking platforms for hotels, made commitments to remove their clauses in Europe preventing hotels from having a lower price on rival platforms but retained their clauses to prevent hotels offering lower prices when selling directly online. However, the French parliament and Italian lower house of parliament have passed laws making both types of price parity illegal, while a German court has upheld a similar ruling with respect to HRS, one of the main booking platforms used there.²

The main defense put forward for price parity clauses is that they are needed to prevent “showrooming”. Consumers might use the platform to search for a suitable firm but then complete their purchase on the firm’s own website if the firm offers a lower price when it sells directly to avoid the platform’s fees. Showrooming, which is a specific form of free-riding, may therefore undermine a platform’s ability to operate. A price parity clause (either narrow or wide) eliminates this possibility of showrooming.

In this paper we develop a theory of search platforms that is used to explore the competition policy implications of showrooming and price parity clauses. Consumers search sequentially for firms directly or through a platform. Search reveals information on a firm’s match value and price. Consumers can complete purchases on the channel they search on, or can switch channels to complete a purchase. The platform lowers search costs and provides convenience benefits to consumers but charges firms for the transactions it facilitates. Among the questions we address are whether showrooming provides a legitimate defense for price parity clauses, and the effect of narrow and/or wide price parity clauses on consumers. We address these questions first for a monopoly platform and then in the context of competing platforms.

We first consider the case without showrooming or any price parity clauses. We show there is an equilibrium in which consumers and firms trade on the platform. Lower search costs on the platform lead to higher expected match values for consumers and more intense price competition among firms. Despite this, equilibrium prices end up higher on the platform. This reflects the high fees the platform charges firms, which get passed through into consumer prices. These fees not only offset the lower margins obtained by firms due to more intensified competition on the platform but also the higher match values consumers expect when they search on the platform and the convenience benefits consumers obtain from completing transactions on the platform.

²See Edelman and Wright (2015) and Hviid (2015) for other examples and further details.

High platform prices give rise to showrooming once switching between channels is allowed. Indeed, we find firms will want to set direct prices below platform prices whenever platform fees exceed consumers' convenience benefits, leading to showrooming. Such showrooming can be good for consumers by restricting the fees set by a monopoly platform. Even if showrooming makes the monopoly platform unviable, we find showrooming does not make consumers worse off.

A price parity clause, which requires firms to offer their best prices when selling through platforms, might appear pro-competitive at first glance. Indeed it ensures the platform is viable by removing the restriction on its fees implied by showrooming by ensuring consumers have no incentive to switch to purchase directly after searching on the platform. However, price parity also removes the restriction on the platform's fees implied by the direct market alternative. Consumers always prefer to search on the platform given prices are never higher, regardless of the fees charged to firms. The platform's fees are only restricted by consumers obtaining non-negative surplus from search. Thus, in the end, price parity allows a platform to fully extract consumers' expected surplus from trade. Despite this, firms are still willing to join the platform since otherwise consumers, who prefer searching on the platform, will not find them.

The effect of price parity clause, depending on its form, can be pro-competitive when platforms compete with each other. Platform competition can act as an alternative constraint on platform fees. This opens up the possibility that consumers are worse off when showrooming makes platforms unviable. However, consumers remain even worse off with wide price parity, which removes the constraint on fees implied by platform competition as well as the constraint implied by showrooming. Allowing competing platforms to retain a price parity clause with respect to direct sales but not with respect to each other (i.e., a narrow price parity clause) ensures the constraint implied by platform competition still applies, while the constraint implied by the possibility of showrooming is eliminated. This is bad for consumers if platforms' viability does not depend on it, but is good for consumers if platforms' viability does depend on it, provided platform competition is sufficiently effective. Thus, while our model predicts wide price parity is always bad for consumers, narrow price parity has ambiguous effects, and can improve consumer surplus provided platform competition is sufficiently effective.

1.1 Related literature

Our paper is closely related to some recent papers that also study price parity clauses. Edelman and Wright (2015) model consumers that can purchase from competing firms directly or through a platform that can add some value to transactions. The platform can impose the equivalent of wide price parity (which they call “price coherence”). They show how wide price parity allows the platform to raise the price of purchasing directly or through other platforms by setting high seller fees, using these higher fees to provide rebates and other benefits to consumers, resulting in an excessive number of consumers joining and using the platform and an over-investment in the provision of platform benefits. The fees in their setting are limited by the benefits consumers enjoy from purchasing through the platform. In our setting, firms are willing to pay much more to join a platform since otherwise consumers searching on the platform won’t find them, resulting in even higher fees and prices in equilibrium. Indeed, with price parity, we find a monopoly platform can fully extract consumers’ expected surplus from trade.

Boik and Corts (2014) and Johnson (2014) also study the effects of wide price parity clauses (which they refer to as MFNs) in the context of competing platforms and show how these clauses can result in higher fees and prices. They adopt a more traditional vertical approach, in which consumers must purchase through one of the platforms, participation of consumers and firms is therefore taken as given, and in which platforms cannot charge fees or provide rebates to consumers. Wide price parity results in firms setting a uniform price across platforms so that each platform’s demand becomes less responsive to its fees, resulting in higher equilibrium fees and prices. This mechanism also holds in our paper whenever there are competing platforms, albeit in a stronger form since demand will be unresponsive to a platform’s fee with wide price parity in our setting until fees reach a point where consumers no longer want to search at all.

A key difference between our theory and these existing works, is that we assume consumers have to search for price and match information, and platforms facilitate this search. Facilitating search is a key feature of many of the platforms (booking websites, marketplaces, and price comparison websites) that have applied price parity clauses. Moreover, we use this search framework to explore the effects of showrooming (i.e. the possibility of firms free-riding on the platform’s search services), which is the usual justification for price parity rules, and distinguish between narrow and wide price parity clauses, which these previous works did not.

In modelling the platform’s role in facilitating search, our article is closer to

the seminal article of Baye and Morgan (2001). They consider an intermediary that operates as a price comparison site. Consumers can either register with the platform (for a fee) and obtain all the registered firms' prices, or they can just buy from their local firm. Their focus is on how price dispersion can arise in such an environment, in which firms sell a homogenous product, rather than the implications of price parity. Extending Baye and Morgan's framework to a setting where firms offer horizontally differentiated products, Galeotti and Moraga-Gonzalez (2009) and Moraga-Gonzalez and Wildenbeest (2011) discuss the implications of prices being the same on the platform as in the direct market. However, in their settings, they note that the single price assumption is innocuous. This reflects that in these papers, consumers cannot search among firms unless they go through the platform and platforms therefore can anyway extract all rents through fixed fees. Our assumptions that consumers can search directly and that platforms can use fees based on completed transactions lead to different results, and arguably better match the markets we are interested in.

Other recent works (e.g. Athey and Ellison, 2011, de Cornière, 2016, Eliaz and Spiegler, 2011, 2016, Hagiu and Jullien, 2011, and Renault, 2014) have developed search models in which platforms such as search engines or shopping malls affect the way in which consumers obtain firms' price and/or match information. These works focus on the case platforms charge either registration fees or per-click fees that do not depend on transactions being completed. Moreover, these models do not allow consumers to buy from firms without going through the intermediary. In this sense, they share the same two key differences with our setting as the price comparison site literature. On the other hand, they explore interesting design choices faced by platforms which we do not consider.

Our model of search builds on the classic works of Anderson and Renault (1999) and Wolinsky (1986), and more recently Bar-Isaac *et al.* (2012). Our article also fits loosely into the burgeoning literature on multi-sided platforms (Armstrong, 2006, Caillaud and Jullien, 2003, and Rochet and Tirole, 2003), although it is closer in spirit to the specific two-sided models of Bedre-Defolie and Calvano (2013), Belleflamme and Peitz (2010), Gomes (2015), Hagiu (2009) and Wright (2012), who model the micro structure of the interactions between consumers and firms.

2 The Model

There is a continuum of consumers (or buyers) denoted B and firms (or sellers) denoted S , of measure 1 in each case. Each firm produces a horizontally differentiated product. We normalize the firms' production cost to zero. In the baseline setting, there is a single platform (M) which facilitates trades between the firms and consumers.

□ **Preference.** Each consumer l has a taste for firm i (i.e. to buy one unit of its product) described by the gross utility (ignoring any search cost) of the form

$$v_l^i - p^i$$

if she buys from i at price p^i . The term v_l^i is a match value between consumer l and firm i . This match value is distributed according to a common distribution function G over $[\underline{v}, \bar{v}]$ for any l and i . It is assumed that all match values v_l^i are realized independently across firms and consumers. We assume G is twice continuously differentiable with a weakly increasing hazard rate and a strictly positive density function g over $[\underline{v}, \bar{v}]$. Increasing hazard implies $1 - G(\cdot)$ is log-concave, which together with other assumptions will imply a firm's optimal pricing problem is characterized by the usual first-order condition.

□ **Consumer search.** All firms are available for consumers to search even if the platform is absent. For consumers who search directly (not via M), they incur a search cost $s_d > 0$ every time they sample a firm. By sampling firm i , a consumer l learns its price p_d^i and the match value v_l^i . We interpret the search cost as the cost of investigating each firm's offerings, so as to learn p_d^i and v_l^i (e.g. a hotel's location, facilities, feedback, room type and prices for particular dates; or an airline's flight times, connections, aircraft type, cancellation policy and baggage policy). Note this is not the cost of going from one link to another on a website, which is likely to be trivial. Consumers search sequentially with perfect recall.

The utility of a consumer l is given by

$$v_l^i - p_d^i - k s_d$$

if she buys from firm i at price p_d^i at the k th firm she visits. We assume the search cost s_d is sufficiently low that consumers would want to search directly if this were their only choice. (This assumption will be formalized in the next section.) Up to this point the model is standard, following in particular Bar-Isaac *et al.* (2012), but

assuming firms are ex-ante identical.

□ **Platform.** A platform M provides search and transaction services to consumers. If a firm i also sells over the platform, its price on the platform is denoted p_m^i . When consumers search via M instead of directly, we assume search works in the same way³ but their search cost reduces to $s_m < s_d$. Thus, we assume the platform provides a less costly search environment for consumers. Our theory admits the possibility that $s_m = 0$ (so search on the platform allows a consumer to instantly find the best match), although we think $s_m > 0$ is more realistic given that even on a platform, consumers need to spend time investigating each firm's product, which they do sequentially. When consumers complete a transaction on the platform we assume they also obtain a convenience benefit of $b \geq 0$. This captures that the platform may make completing a transaction more convenient (e.g. with respect to payment and entering customer information) and may provide superior after-sale service (e.g. tracking delivery, manage bookings, etc). For instance, large platforms like Amazon, Booking.com and Expedia have created their own consumer Apps to provide such benefits. The assumption allows that there is no such convenience benefit. We assume M incurs a cost $c \geq 0$ for each transaction it mediates.⁴ We assume c is not too high so that the platform is viable when it charges its monopoly fees and consumers cannot switch to buy directly (i.e. without showrooming).

□ **Showrooming.** We are interested in the case that consumers want to search through the platform for a good match and then buy directly, if the direct price is low enough. We call this showrooming. It is possible only if consumers can observe a firm's identity when they search on the platform.⁵ To be as general as possible, we allow consumers to also switch in the other direction, in that they can search directly but having identified a good match, switch to buy on the platform. When consumers switch (in either direction), they can choose to stop and purchase from the firm (or any previous firm they have already searched) or continue to search on the channel they have switched to, or switch back again. We assume that having identified a firm and its match value, there is no cost to the consumer of such switching. In practice, any such cost is likely to be trivial in the case where the

³By sampling firm i on M , a consumer l learns its price p_m^i and the match value v_l^i .

⁴All our existing results with a monopoly platform continue to hold if c is instead interpreted as a fixed cost for the platform to operate. This is because the number of transactions in equilibrium will not depend on c unless c is so high that M is not viable, which is also the only way c would matter if c is interpreted as a fixed cost. With platform competition, we consider the case in which c is a fixed cost in Section 5.1, in which platform competition is imperfect.

⁵Otherwise, switching would involve starting the search over again.

purchases are all online. Costless switching ensures consumers can switch back to buy on the platform in case they find the direct price is higher than expected.⁶

□ **Instruments.** We allow the platform to charge non-negative per-transaction fees f_B for consumers and f_S for firms when they make a transaction through M . All the platforms discussed in the Introduction charge firms fees when they sell through the platform. The fees are either fixed per transaction or are a percentage of the value of the transaction. In our framework, for expositional simplicity, we assume platforms use fixed per transaction fees.⁷ Typically, platforms do not charge consumers anything for their services, which will be consistent with our equilibrium results. We rule out negative fees, but explore the role of costly rewards in Section 5.2. In practice, platforms also do not generally charge users registration fees for joining (i.e. registration fees). This is consistent with our equilibrium analysis if registration fees result in the trivial equilibrium being selected where firms and consumers do not join the platform, since they do not expect others to join. In our model, firms pass through platform fees in equilibrium, so they have no reason to coordinate on joining only for low fees. However, their profit will be strictly lowered by registration fees, so they do have a reason to coordinate on not joining when registration fees are charged. Competition between platforms could also be another reason registration fees are not usually used. We discuss the possible role of registration fees, per-click fees and referral fees in Section 5.3.

□ **Timing and equilibrium concept.** The timing of the game is as follows:

1. The platform decides whether to operate, and if it does, sets fees f_B and f_S to maximize its profits. Firms and consumers observe these fees.
2. Firms decide whether to join M and set prices.
3. Without observing firms' decisions, consumers decide whether to search on M or search directly (possibly switching search channels along the way), and carry out sequential search until they stop search or complete a purchase.

⁶We consider the case with a positive switching cost in an [online appendix](#) which is also available at <http://profile.nus.edu.sg/fass/ecsjdkw/>, where we also discuss an associated selection effect.

⁷In the [online appendix](#), we show the results under percentage fees are qualitatively the same as under fixed per transaction fees, provided firms face production costs. Per-transaction fees differ from the per-click fees charged to advertisers by search engines since per-transaction fees form part of a firm's marginal costs of making an additional sale. Per-transaction fees require that the search engine can monitor sales so the fee can be conditioned on the completion of a sale. Where search engines can do so, per-transaction fees are indeed used (this is known as affiliate marketing or referral fees).

If the existence of a platform that sets its total fees at cost (i.e. $f_B + f_S = c$) is irrelevant to the resulting equilibrium choices of consumers and firms, we assume it does not operate.⁸ We focus on symmetric perfect Bayesian equilibrium where all firms make the same joining decisions and set the same prices. We adopt the usual assumption that consumers hold passive beliefs about the distribution of future prices upon observing any sequence of prices. This is natural since all firms set their prices at the same time. Note there will always be a trivial equilibrium in which consumers do not search through the platform because they expect no firms to join, and firms do not join because they do not expect any consumers to search through the platform. To avoid this trivial equilibrium, in any user subgame (i.e. the subgame starting from stage 2), we select an equilibrium in which all firms join the platform and set the same prices if such a symmetric equilibrium exists.⁹ We also rule out equilibria that only arise because firms do not sell to any consumers directly or do not sell to any consumers through a platform in the equilibrium. That is, in case direct prices (intermediated prices) are not pinned down in the user subgame because there are no consumers expected to buy in the direct market (on the platform), we determine equilibrium prices $p(n)$ when there is an exogenous positive mass n of consumers that *only* search and buy directly (on the platform) and let equilibrium prices p_d in the direct market (p_m on the platform) be the limit of $p(n)$ as n goes to zero. Note assuming this small mass of consumers (not real players of the game) is just a refinement that we impose on selecting equilibrium direct (platform) prices when firms do not expect any consumer (real players of the game) to search directly (or on the platform).

⁸With competing platforms, it will sometimes be necessary for one platform to operate with zero profit in equilibrium.

⁹We can rule out asymmetric equilibria in which only some firms and consumers join M by imposing the mild assumption that consumers are strictly better off by the existence of the platform when its total fees equal its cost c . Suppose only some of the firms join the platform. Given there are a continuum of ex-ante identical firms, the fact only some join will not change their equilibrium pricing strategies in stage 2. For only some consumers to use M , they must be indifferent about using M given they are ex-ante identical. But, in this case, M can profitably lower its fees by an infinitesimal amount to attract all consumers to use M . This deviation would only not be profitable if consumers remain indifferent about using the platform even though the platform charges a total fee equal to c , which the mild assumption rules out. As a result, any equilibrium other than the trivial equilibrium will involve all consumers using M and all firms joining M , since otherwise a firm that does not join obtains zero profit as opposed to the positive profit it obtains by joining.

3 Monopoly platform

In this section, we analyze the model in which there is a single platform. In Section 3.1 we consider a benchmark setting in which consumers cannot switch from the platform to buy directly. Section 3.2 relaxes this assumption by exploring the possibility of showrooming. Section 3.3 considers a price parity clause. Section 4 allows for competing platforms.

3.1 Benchmark case

Initially, we consider the simplest possible setting in which consumers cannot observe a firm's identity when they search on the firm via the platform, thereby ruling out the possibility of consumers switching to buy directly from the firm. Indeed, sometimes platforms deliberately conceal or obscure such information for this reason. This would also be relevant if platforms could track consumers (e.g. using cookies) after they had searched on its platform, and could recover the same fee from firms regardless of whether consumers' eventually purchased on the platform or directly.

We consider an equilibrium in which all firms join M and set the price p_m for consumers who purchase through M and the price p_d for consumers who purchase directly.

Define the reservation value x_d such that

$$\int_{x_d}^{\bar{v}} (v - x_d) dG(v) = s_d, \tag{1}$$

so that the incremental expected benefit from one more search is equal to the search cost. We assume s_d is sufficiently small so that $\int_{\underline{v}}^{\bar{v}} (v - \underline{v}) dG(v) > s_d$. This, together with the fact the left-hand side of (1) is strictly decreasing in x_d and equals zero when $x_d = \bar{v}$ ensures a unique value of (1) exists satisfying $\underline{v} < x_d < \bar{v}$.

It is well understood from Kohn and Shavell (1974) and Weitzman (1979) that the optimal search rule in this environment is stationary and consumers use a cutoff strategy. When searching directly, each consumer employs the following cutoff strategy: (i) she starts searching if and only if $x_d \geq p_d$; (ii) she stops and buys from firm i if she finds a price p_d^i such that $v_i^i - p_d^i \geq x_d - p_d$; and (iii) she continues to search the next firm otherwise. The rule for stopping and buying from firm i says that a consumers' actual gross utility from firm i (i.e. $v_i^i - p_d^i$) must be at least equal to this cuff-off (i.e., $x_d - p_d$). After each search, expecting that firms charge symmetric

prices p_d , a consumer's search ends with probability $1 - G(x_d)$ and continues with probability $G(x_d)$. A consumer's expected search cost is therefore $\frac{s_d}{1-G(x_d)}$. Given that there is a continuum of firms, each consumer will eventually buy a product with value $v \geq x_d$ at price p_d . The expected match value is $\mathbb{E}[v|v \geq x_d]$. The consumer's expected value of initiating a search is therefore

$$\frac{\int_{x_d}^{\bar{v}} v dG(v)}{1 - G(x_d)} - p_d - \frac{s_d}{1 - G(x_d)} = x_d - p_d.$$

The equality is obtained by using (1). Note that x_d is a consumer's gross surplus (including search cost) from searching in the market.

With all firms available on M , the optimal stopping rule for a consumer searching on M is the same but with the reservation value x_m defined by

$$\int_{x_m}^{\bar{v}} (v - x_m) dG(v) = s_m$$

to reflect the lower search costs s_m , and with the prices p_d^i and p_d replaced by p_m^i and p_m respectively, where p_m is the symmetric equilibrium price on M . However, consumers will start search if and only if $x_m \geq p_m + f_B - b$ since f_B is an additional fee they have to pay and b an additional benefit they obtain when they make a purchase through M .

Since $s_m < s_d$ and the left-hand side of (1) is decreasing in x_d , we have $x_m > x_d$. Consumers tend to search more when using M due to the low search cost; i.e. they hold out for a higher match value. We denote this difference in the gross surplus from searching through the platform and directly as

$$\Delta_s = x_m - x_d$$

and call it the *surplus differential* of the platform. It reflects the additional surplus consumers enjoy from being able to search at a lower cost on the platform, ignoring any difference in prices. Note that if

$$c < \Delta_s + b, \tag{2}$$

the platform's costs of mediating transactions is less than the sum of the surplus differential and convenience benefit created by the platform. Thus, (2) is a condition for the efficiency of the platform. If this condition does not hold, the platform is

inefficient and should not operate.

With all firms available for searching on M , the expected utility (including search cost) that a consumer can get from searching on M is $x_m + b - (p_m + f_B)$. Similarly, if the consumer searches directly, her expected utility is $x_d - p_d$. Then consumers will prefer to search through the platform provided

$$x_m + b - (p_m + f_B) \geq x_d - p_d. \quad (3)$$

We need to derive the equilibrium prices p_d and p_m to determine how much M can charge.

□ **Pricing for direct sales.** Suppose a positive measure n_d of consumers are expected to conduct direct search.¹⁰ Suppose that a firm i deviates and sets its direct-search price to $p_d^i \neq p_d$. The limit version of Wolinsky (1986), and more recently, Bar-Isaac *et al.* (2012) consider exactly this case and our argument follows theirs. The probability that a consumer who visits a random non-deviating firm buys from that firm is $\rho = 1 - G(x_d)$. This probability is exogenous from the deviator's perspective. The expected number of consumers who visit the deviating firm in the first round is n_d . A further $n_d(1 - \rho)$ consumers visit the firm in the second round after an unsuccessful visit to some other firm, a further $n_d(1 - \rho)^2$ visit in the third round, and so on. From (ii) in the optimal stopping rule above, consumers buy from the deviating firm i only if $v^i - p_d^i \geq x_d - p_d$. Therefore, firm i 's expected demand from consumers who search directly is given by

$$\sum_{z=0}^{\infty} n_d(1 - \rho)^z (1 - G(x_d - p_d + p_d^i)) = \frac{n_d}{1 - G(x_d)} (1 - G(x_d - p_d + p_d^i)),$$

and its expected profit from these consumers is given by

$$\pi_d = p_d^i \frac{n_d}{1 - G(x_d)} (1 - G(x_d - p_d + p_d^i)). \quad (4)$$

We assume the search cost s_d is sufficiently low so that

$$x_d > \frac{1 - G(x_d)}{g(x_d)}. \quad (5)$$

This ensures that $x_d > p_d$. Otherwise, consumers would not expect a positive surplus

¹⁰Recall our equilibrium selection rule requires us to consider the case with some positive mass of consumers that search directly in order to pin down the direct price in case no consumers search directly.

from searching in the first place.

The increasing hazard rate property of G ensures the usual first-order condition from differentiating (4) with respect to p_d^i and setting the derivative equal to zero determines the optimal solution. Imposing symmetry on the first order condition, the symmetric equilibrium price for direct sales is

$$p_d(x_d) = \frac{1 - G(x_d)}{g(x_d)}, \quad (6)$$

and the associated expected profit is

$$\pi_d(x_d, n_d) = n_d p_d(x_d) = \frac{n_d(1 - G(x_d))}{g(x_d)}.$$

□ **Pricing for intermediated sales.** Suppose a positive measure n_m of consumers are expected to conduct search on the platform and all firms have joined M . Using the same argument as above, a deviating firm's expected demand when charging p_m^i is given by

$$\frac{n_m}{1 - G(x_m)}(1 - G(x_m - p_m + p_m^i)).$$

Since the firm pays f_S to M for each transaction, its expected profit is given by

$$\pi_m = (p_m^i - f_S) \frac{n_m}{1 - G(x_m)}(1 - G(x_m - p_m + p_m^i)). \quad (7)$$

Solving the first order condition by differentiating (7) with respect to p_m^i and setting equal to zero, and applying symmetry, the equilibrium price for intermediated search is

$$p_m(x_m, f_S) = f_S + \frac{1 - G(x_m)}{g(x_m)}, \quad (8)$$

and the associated expected profit is given by

$$\pi_m(x_m, n_m) = \frac{n_m(1 - G(x_m))}{g(x_m)}. \quad (9)$$

Suppose the platform sets its total fees equal to cost c . Parallel to the assumption in (5) for direct sales, we assume that in this case consumers expect a positive surplus from searching and buying through the platform. Otherwise, there is no way consumers would ever use a platform for search and a platform would not be

viable even if it was the only way consumers could reach firms. This requires

$$x_m + b > c + \frac{1 - G(x_m)}{g(x_m)}. \quad (10)$$

Note that the equilibrium markup firms enjoy in each market is equal to the inverse hazard rate $\frac{1-G(x_k)}{g(x_k)}$ evaluated at the respective reservation value x_k (for $k = m, d$). We denote this difference in the equilibrium markups as

$$\Delta_m = \frac{1 - G(x_d)}{g(x_d)} - \frac{1 - G(x_m)}{g(x_m)}$$

and call it the *markup differential* of the direct market. It reflects the additional margin firms obtain per customer in the direct market compared with through the platform. Note that $\Delta_m \geq 0$ since the surplus differential is positive and G has a weakly increasing hazard rate. (Whenever G has a strictly increasing hazard rate, $\Delta_m > 0$.) Firms thus have higher markups when search costs are higher. It implies firms are collectively worse off when the platform is present, due to the intensification of price competition, even though individually they want to join the platform whenever consumers are searching on the platform. Without any platform fee, Δ_m can also be interpreted as the lower prices that consumers would enjoy on the platform compared to the direct market.

□ **Platform pricing.** The platform can only make a positive profit if consumers choose to use the platform. Consumers compare the expected surplus from using each channel. The platform can influence consumers' expected surplus through its fees f_B and f_S . Provided consumers expect all firms to join M , they are better off using the platform to search if (3) holds. Whether (3) holds depends on the prices firms charge through each channel. Substituting (6) and (8) into (3), consumers will use the platform to search if and only if

$$f_B + f_S \leq \Delta_s + \Delta_m + b. \quad (11)$$

Consumers benefit from the platform due to lower search costs (the surplus differential), intensified competition (the markup differential), and transaction convenience. Equation (11) says that in order to attract consumers, platform fees cannot exceed the sum of the three benefits the platform provides for consumers. The platform's profit in this case is

$$\Pi = f_B + f_S - c.$$

Since M 's profit only depends on the total fee $f_B + f_S$, M is indifferent between setting fees only to consumers, only to firms, or fees to both, provided the total of the two fees is the same.¹¹ We therefore normalize $f_B = 0$, reflecting that consumer fees are seldom charged.¹² Then maximizing f_S subject to (11), M 's optimal fee makes the constraint bind. The following proposition summarizes the equilibrium derived above.

Proposition 1. (Benchmark equilibrium)

Stage 1: M operates, and sets the fees $f_B^ = 0$ and*

$$f_S^* = \Delta_s + \Delta_m + b. \quad (12)$$

Stage 2: Firms' on-platform prices are given by (8) and direct prices are given by (6).

Since the consumers' equilibrium search strategy was characterized earlier, in Proposition 1 we just characterize the equilibrium with respect to the platform's and firms' strategies.¹³ The resulting equilibrium price on the platform is obtained by substituting (12) into (8), implying

$$p_m(x_m) = \Delta_s + \frac{1 - G(x_d)}{g(x_d)} + b. \quad (13)$$

The equilibrium outcome involves all consumers searching and purchasing on M . The platform's profit is $\Pi^* = \Delta_s + \Delta_m + b - c$. Since $\Delta_s > 0$, $\Delta_m \geq 0$ and $b \geq 0$, we know $f_S^* > 0$ and the platform generates positive revenues. Our assumption on c is that M is viable in this case, which requires $c \leq \Delta_s + \Delta_m + b$.

We know without any platform fee, prices would be lower on the platform due to lower search costs making firms price more competitively on the platform. Collectively firms would prefer an equilibrium where all trade happens directly. However, each individual firm strictly prefers to join the platform given consumers are expected to search on the platform. The platform can take advantage of this by increasing its fee so that prices on the platform are equal to direct prices. This is

¹¹This result is consistent with the more general neutrality result of Gans and King (2003).

¹²In practice, there may be higher transaction costs associated with charging consumers compared to charging firms.

¹³Given our equilibrium selection rule, all firms join the platform whenever it operates. Since firms always join any platforms that operate in the equilibria we characterize, for brevity we do not state this result in our propositions.

the markup differential term in (12). But this is not the end of the story. With equal prices, consumers would still strictly prefer to search on the platform since, at equal prices, lower search costs and convenience benefits mean the expected surplus of going through the platform remains higher than searching directly. This is the surplus differential term and convenience benefit term in (12). The platform will increase fees until the higher prices on the platform just offset the sum of surplus differential and transaction convenience, and consumers are indifferent between searching on the platform and searching directly.

3.2 Showrooming

Suppose now consumers obtain a firm's identity when they search the firm on the platform. This will enable them to switch to buying directly having found a good match through the platform, potentially at a lower price. For instance, the equilibrium in the previous section in which prices are higher on the platform than off the platform by the amount $\Delta_s + b$ would be undone by a showrooming problem. Facing the equilibrium prices (6) and (13), consumers would search on M and then switch to purchase directly. As a result, M would obtain no profit, and would want to lower the fee f_S it charges firms provided it can still recover its cost c .

The possibility of switching is potentially more complicated, however, since a firm may want to raise its price on the platform and/or lower its direct price to induce consumers to switch, given the firm can avoid paying the fee f_S on any consumer who purchases directly. In this section, we take into account this possibility.

We first characterize consumers' optimal search strategy. Consumers always prefer searching on M to searching directly as $x_m > x_d$ and switching incurs no cost. But consumers will search on M only if they expect non-negative net surplus, i.e.,

$$x_m - \min\{p_m + f_B - b, p_d\} \geq 0. \quad (14)$$

If $p_m + f_B - b > p_d$, consumers will switch and make their purchase directly. If instead $p_m + f_B - b \leq p_d$ consumers who search on M expect to make their purchase on M . In the standard sequential search model, a consumer at any decision node is comparing the value of immediate stopping and the value of continuing to search. The value of stopping in the current setting is the highest value between purchasing immediately on M and switching to purchase in the direct search market, which is therefore given by

$$v^i - \min\{p_m^i + f_B - b, p_d^i\}.$$

The value of continuing to search on the platform is given in (14). Using the standard argument, consumers' optimal stopping strategy is therefore:

- if $v^i - \min\{p_m^i + f_B - b, p_d^i\} < x_m - \min\{p_m + f_B - b, p_d\}$, continue to search on M .
- if $v^i - \min\{p_m^i + f_B - b, p_d^i\} \geq x_m - \min\{p_m + f_B - b, p_d\}$,
 - stop and buy on M immediately if $p_m^i + f_B - b \leq p_d^i$.
 - stop and switch to purchase from direct search market if $p_m^i + f_B - b > p_d^i$.

With consumers' optimal strategy specified above, we can now specify the equilibrium when showrooming is possible. The equilibrium outcome involves all consumers searching and purchasing through M whenever M operates. (The proof is in the Appendix, along with other proofs not contained in the text.)

Proposition 2. (Showrooming equilibrium)

Stage 1: (i) Suppose $c \leq b$. M operates, and sets the fees $f_B^ = 0$ and $f_S^* = b$.*

(ii) Suppose $c > b$. M will not operate.

Stage 2: If $f_B + f_S \leq b$, firms' prices are given by (6) and (8); if instead $f_B + f_S > b$, firms' prices are given by $p_d = \frac{1-G(x_m)}{g(x_m)}$ and (8). If M does not operate, firms' prices are given by (6).

Proposition 2 characterizes the equilibrium when showrooming is possible. Without the possibility of switching, we know from Proposition 1 that the platform sets the fees $f_B^* = 0$ and $f_S^* = \Delta_s + \Delta_m + b$. With the possibility of switching, M 's fees and profits are constrained by showrooming. With the fees in the benchmark equilibrium, a firm can do better inducing consumers to switch to buy directly. In the equilibrium that would result, all consumers would search on M but switch to purchase directly with direct prices determined as if firms competed on M but without facing any fees. To rule this switching equilibrium out, M has to lower its fees to b . In this case, the total fees that firms and consumers jointly pay is no more than the convenience benefits of using the platform and therefore firms cannot profitably induce consumers to switch. Without any switching in equilibrium, the firms' prices are determined in the same way as before (i.e. without any showrooming). With lower platform fees, prices on the platform will be lower. Consumers will always use the platform to search and complete transactions provided the platform remains feasible.

The next proposition follows directly by comparing the equilibrium outcome implied by Proposition 2 with that implied by Proposition 1.

Proposition 3. (The effect of showrooming)

(i) Low platform costs: *Suppose $c \leq b$. The possibility of showrooming makes M lower its fees. This decreases consumer prices, increases consumer surplus, leaves firms' profits unchanged, decreases M 's profit, and leaves welfare unchanged.*

(ii) High platform costs: *Suppose $c > b$. The possibility of showrooming makes M unviable. This decreases consumer prices, leaves consumer surplus unchanged, increases firms' profits, decreases M 's profit, and increases welfare if $c > \Delta_s + b$ and decreases welfare if $c < \Delta_s + b$.*

Proposition 3 shows that showrooming can help constrain M 's ability to set high fees and so benefit consumers. This explains why a platform may hide the identity of firms or impose price parity clauses to rule out showrooming. Indeed, provided M remains viable, showrooming is good for consumers. It does not lead to any efficiency loss. The lower are the convenience benefits of using M , the more constrained are M 's fees, and so the better the outcome for consumers. This is the case covered by (i) in Proposition 3.

If the convenience benefits of using M are sufficiently low, showrooming makes M unviable, which arises in case (ii) in Proposition 3. Although prices will be lower without M , consumer surplus remains unaffected given the lower prices in the direct market are offset by higher search costs and the loss of convenience benefits. Whether welfare is higher or lower when M cannot operate due to showrooming depends on whether its costs are higher or lower than the surplus differential and convenience benefits it generates.

3.3 Price parity

One way a platform can eliminate showrooming and the constraint it implies for the platform's fees is to use a price parity clause, thereby requiring the price firms charge on the platform be no higher than the price they set for the direct channel. We consider such price parity in this section.¹⁴

If a firm joins M and thereby accepts price parity, its direct price will be at least as high as its price on the platform. This means provided $f_B \leq b$, M can rule out

¹⁴With a single platform, there is no difference between a wide price parity clause and a narrow price parity clause, and we therefore just refer to "price parity" in this section.

the possibility of showrooming arising. However, price parity allows M to do even better, raising its fee beyond the level it sets without showrooming.

We first characterize the platform's and firms' pricing equilibrium with price parity.

Proposition 4. (Price parity equilibrium)

Stage 1: M operates, and sets the fees $f_B^ = 0$ and*

$$f_S^* = x_m - \frac{1 - G(x_m)}{g(x_m)} + b. \quad (15)$$

Stage 2: Suppose $f_S \leq f_S^$. If $f_B \leq b$, firms' prices on M are given by (8) and the firms' direct prices are given by the maximum of (6) and (8); if instead $f_B > b$, firms set a single price $p_c = \frac{1 - G(x_m)}{g(x_m)}$. If $f_S > f_S^*$, firms do not join M and their direct prices are given by (6).*

Facing the same or lower price but lower search costs, consumers will all search on M . This is true no matter how high M sets f_S provided consumers still obtain non-negative surplus from search. Provided $f_B \leq b$, consumers will not switch. For higher f_B consumers will always switch and buy directly. This would lead firms to price as if they competed on M but without facing any fees. Clearly, M would never want to set f_B so high. In equilibrium, firms will all participate since if they do not, they will not attract any business given all consumers are searching on M . The optimal fees charged by M imply firms will set their prices (both through the platform and directly) equal to $x_m + b$, so consumers expect zero surplus from search in equilibrium and are just willing to search. Given (10), the platform makes a positive profit at these fees. The net surplus consumers expect to obtain from the good itself after taking into account their search costs is fully extracted by M through its very high seller fee, and through firms' equilibrium markup on this fee. Despite this, consumers do not want to search directly, since this would imply a negative surplus given in equilibrium prices are set equally high regardless of which channel they come through but search costs are higher when they search directly and they would lose the convenience benefit of buying through M .

The implications of price parity are given in the following proposition, which follows directly by comparing the equilibrium outcome implied by Proposition 4 with that implied by Proposition 2.¹⁵

¹⁵In case switching is not possible so that the relevant comparison is between Proposition 4 and

Proposition 5. (The effect of price parity)

(i) Low platform costs: *Suppose $c \leq b$. If price parity is imposed, M sets higher fees. Consumer prices increase, consumer surplus decreases, firms' profit is unchanged, M 's profit increases, and welfare is unchanged.*

(ii) High platform costs: *Suppose $c > b$. If price parity is imposed, M becomes viable. Consumer prices increase, consumer surplus decreases, firms' profit decreases, M 's profit increases, and welfare is lower if in addition $c > \Delta_s + b$ (higher if in addition $c < \Delta_s + b$).*

As can be seen from Proposition 5, price parity leads to higher platform fees, higher consumer prices, and higher platform profits. This is because price parity removes any price advantage to consumers of buying directly when platform fees are high. This ensures consumers prefer to search on M even when fees and prices are very high. An individual firm cannot do better by abandoning M since consumers are expected to search on M to take advantage of the lower search costs. The only thing limiting M 's fees is that consumers should expect non-negative surplus from searching. The resulting very high fees go beyond the normal monopoly fees set in the benchmark case without price parity, extracting consumers' expected surplus from the good itself. These results imply banning price parity is always good for consumers.

Showrooming has been posited as the main reason why platforms need price parity. Proposition 5 says just because showrooming is a possibility, there is no reason to presume price parity improves consumer surplus or efficiency. Without competition between platforms, Proposition 5 shows price parity always lowers consumer surplus. The only case where price parity improves welfare is when $b < c < \Delta_s + b$. This scenario can arise if showrooming implies M has to set very low fees to prevent switching and it cannot cover its costs despite its costs still being low enough to make it efficiency enhancing. Price parity would allow M to avoid showrooming in this case, and thus become viable, although consumers would still be worse off as a result.

Proposition 1, the results for case (i) of Proposition 5 apply. This implies that in the absence of any showrooming possibility, a platform still benefits from imposing price parity, at the expense of consumers.

4 Competing platforms

In this section, we consider competition between two platforms, M^L and M^H . Both platforms have the same costs and provide the same search service, so the cost per transaction remains c and the search cost remains s_m . However, platform M^H is assumed to be more efficient because it offers a higher convenience benefit of completing transactions than M^L . Even when firms sell on both platforms at the same prices, consumers may prefer to complete transactions on one platform over another since it gives them higher convenience benefits (e.g. it may have a more popular App). Specifically, we assume M^j offers convenience benefit b_j with $b_H \geq b_L$. Note this includes the case that the convenience benefits are equal across both platforms, although in this case we continue to assume consumers use M^H in case both platforms have the same fees and firms join both platforms. The inequality in (10) is assumed to hold with b replaced by b_L since otherwise M^L would be irrelevant. The model of platform competition is therefore equivalent to classical asymmetric Bertrand competition.¹⁶

We denote the fees charged by M^j to consumers as f_B^j and to firms as f_S^j . Consumers can continue to search on either platform or directly. To avoid the trivial equilibrium without intermediation and equilibria in which competition does not arise because all consumers and firms coordinate on a single platform, we select an equilibrium in the user subgame in which all firms join both platforms whenever both platforms operate and such an equilibrium exists. (In case only a single platform operates, we use the same equilibrium selection rules of Section 2.) We continue to focus only on symmetric equilibria, in which all firms charge the same price within the same channel. Finally, we replace our assumption on c from Section 2 that $c \leq \Delta_s + \Delta_m + b$ with $c \leq \Delta_s + \Delta_m + b_H$. This ensures that the more efficient platform M^H can remain viable if it is a monopolist, consistent with our assumption in Section 2.

4.1 Benchmark case

We start by considering the benchmark case in which consumers cannot switch between channels. This arises if the firms' identities remain concealed on the platforms. Consumers' search behavior in stage 3 remains the same as before. Since the platforms have identical search technologies and firms are available on both

¹⁶Section 5.1 considers a setting in which the platforms are horizontally differentiated in their convenience benefits, rather than vertically differentiated as assumed in this section.

platforms, what matters is the platforms' total fees net of the corresponding convenience benefits. We call these *total net fees*. Consumers will choose to search on the platform which sets lower total net fees in stage 2. If the platforms' total net fees are the same, consumers are assumed to search on the higher-benefit platform in equilibrium, since otherwise that platform could always undercut the other by an arbitrarily small amount and attract all consumers. The following characterization of the platforms' and firms' equilibrium pricing strategies follows from the usual analysis of asymmetric Bertrand competition.

Proposition 6. (Competing platforms equilibrium)

- Stage 1:* (i) Suppose $c \leq \Delta_s + \Delta_m + b_L$. Both platforms operate. M^L sets the fees $f_B^{L*} = 0$ and $f_S^{L*} = c$, and M^H sets the fees $f_B^{H*} = 0$ and $f_S^{H*} = c + b_H - b_L$.
(ii) Suppose $c > \Delta_s + \Delta_m + b_L$. Only M^H operates. M^H sets the fees $f_B^{H*} = 0$ and $f_S^{H*} = \Delta_s + \Delta_m + b_H$.
- Stage 2:* Firms' direct prices are given by (6). Firms' prices on M^j , if it operates, are given by (8) where f_S is replaced by f_S^j .

In the equilibrium in Proposition 6, all consumers will search and purchase on M^H . In case operating costs are too high so M^L cannot cover its costs even if it charges its monopoly fees (i.e. $c \geq \Delta_s + \Delta_m + b_L$), M^L will be irrelevant and M^H will behave the same as a monopoly platform offering the convenience benefit b_H . Therefore, Proposition 1 still applies in this case. When costs are not so high as to make M^L irrelevant (i.e. $c < \Delta_s + \Delta_m + b_L$), platform competition disciplines the fees that M^H can set. This is the main effect of introducing competition between platforms. Competition results in M^H setting its platform fees equal to $c + b_H - b_L$, which results in lower prices and higher consumer surplus than without platform competition. If $c + b_H - b_L$ is low enough, the price on the platform will be lower than the direct price. The welfare effects of having platforms remains the same—that is, whether c is higher or lower than $\Delta_s + b_H$.

4.2 Showrooming

Suppose that having searched a firm on a particular platform, consumers can switch and buy from the firm directly or through the other platform. The following proposition characterizes the platforms' and firms' equilibrium pricing strategies.

Proposition 7. (Competing platforms and showrooming equilibrium)

Stage 1: (i) Suppose $c \leq b_L$. Both platforms operate. M^L sets the fees $f_B^{L} = 0$ and $f_S^{L*} = c$, and M^H sets the fees $f_B^{H*} = 0$ and $f_S^{H*} = c + b_H - b_L$.*

(ii) Suppose $b_L < c \leq b_H$. Only M^H operates. M^H sets the fees $f_B^{H} = 0$ and $f_S^{H*} = b_H$.*

(iii) Suppose $c > b_H$. Neither platform operates.

Stage 2: Firms' direct prices are given by (6) if (a) M^L operates and sets $f_B^L + f_S^L \leq b_L$, (b) M^H operates and sets $f_B^H + f_S^H \leq b_H$ or (c) neither platform operates; otherwise they are given by $p_d = \frac{1-G(x_m)}{g(x_m)}$. Firms' prices on M^j , if it operates, are given by (8) where f_S is replaced by f_S^j .

When c is too high, neither platform will operate since setting fees to recover a platform's costs would lead firms to induce consumers to switch to buy directly. If costs are lower but still higher than b_L , M^L does not constrain the fees set by M^H , and the analysis just corresponds to the case of a monopoly platform with showrooming, as given in Proposition 2. When c is low enough, then M^L constrains the fees that M^H can set below that implied by the showrooming constraint.

The next proposition follows by comparing the equilibrium outcome implied by Proposition 7 with that implied by Proposition 6. Since the comparisons are not immediate, we have included the proof in the Appendix.

Proposition 8. (The effect of showrooming when there are competing platforms)

(i) Low platform cost: *Suppose $c \leq b_L$. The possibility of showrooming is irrelevant.*

(ii) Moderate platform cost: *Suppose $b_L < c \leq b_H$. The possibility of showrooming decreases consumer prices, increases consumer surplus, leaves firms' profits unchanged, decreases the profit of M^H , and leaves welfare unchanged.*

(iii) High platform cost: *Suppose $c > b_H$. The possibility of showrooming causes M^H to no longer operate. This increases the profit of firms and decreases the profit of M^H . Showrooming decreases consumer surplus if $c \leq \Delta_s + \Delta_m + b_L$. Showrooming decreases prices and leaves consumer surplus unchanged if $c > \Delta_s + \Delta_m + b_L$. It increases welfare if $c > \Delta_s + b_H$ and decreases welfare if $c < \Delta_s + b_H$.*

Showrooming has similar effects in this setting with competing platforms as it did in the case with a single platform. This can be seen by comparing Proposition 8 with Proposition 3. Provided platform costs are no more than the convenience benefits created by the high-benefit platform, the results are qualitatively the same

as the monopoly case. Showrooming lowers fees and therefore consumer prices, which is good for consumers and bad for M^H . Competition potentially reduces the magnitude of this effect, given competition may already constrain fees without showrooming (i.e. in the case $c < \Delta_s + \Delta_m + b_L$). When platform costs are high, neither platform will operate if showrooming is possible. To the extent platform competition does not constrain the fees without showrooming, showrooming has the same effects as in the monopoly case, lowering consumer prices and raising consumer surplus. However, if platform competition constrains fees without showrooming, then when showrooming causes M^H to stop operating, it can cause prices to be higher and consumer surplus to decrease. This possibility is the only qualitatively different result compared to the monopoly case and provides one scenario whereby eliminating showrooming is actually good for consumers. However, it remains to be determined if doing so using price parity clauses benefits consumers.

4.3 Price parity

In this section, we consider the possibility platforms can use price parity clauses in stage 1 as part of their contract with firms. We initially consider wide price parity, which requires that the price a firm sets on a platform be no higher than the price the same firm charges for the same good through any other channel, including when it sells directly and when it sells through a rival platform. We then consider narrow price parity in which the restriction is imposed only with respect to the direct sales channel.

4.3.1 Wide price parity

We characterize an equilibrium in which both platforms use a wide price parity clause. Since firms that join a platform cannot set lower prices through other channels, this eliminates the possibility of showrooming in equilibrium given M^L and M^H can always set their fee to consumers below b_L and b_H respectively. Facing the same (or lower) prices and lower search costs, consumers will all search on the platform offering the lowest $f_B^j - b_j$ in stage 2. If this expression is equal across the two platforms, we assume consumers search on the more efficient platform.

We first characterize the platforms' and firms' pricing in an equilibrium in which both platforms operate and use a wide price parity clause.¹⁷

¹⁷For brevity, in Propositions 9 and 10 we do not characterize all the different user subgames in which one or both platforms do not operate, do not use a price parity clause, set $f_B^L > b_L$ or

Proposition 9. (Competing platforms and wide price parity equilibrium)

Stage 1: Platforms operate and use a wide price parity clause, setting the fees $f_B^{L} = f_B^{H*} = 0$ and*

$$f_S^{j*} = x_m - \frac{1 - G(x_m)}{g(x_m)} + b_j, j = L, H. \quad (16)$$

Stage 2: Let M^j be the platform with the lowest $f_B^j - b_j$ (if there is a tie, set $M^j = M^H$). Firms' prices on M^j are given by (8), where f_S is replaced by f_S^j ; firms' prices on platform $M^i \neq M^j$, are given by the maximum of (8) evaluated at $f_S = f_S^i$ and (8) evaluated at $f_S = f_S^j$; firms' direct prices are given by the maximum of (8) evaluated at $f_S = f_S^j$ and (6).

Given all consumers are searching on M^H , firms all join M^H in equilibrium. They obtain their standard profit (9). Firms are indifferent about joining M^L and given our equilibrium selection criteria, we assume they do. Consumers prefer to search and buy on M^H given $b_H \geq b_L$ and equilibrium prices are the same regardless of how they search. The fees set by M^H imply that the common price is $p_c = x_m + b_H$ and ensure that consumers expect zero surplus from search in equilibrium, so they cannot do better by not searching. The outcome is essentially the same as the case with a single platform imposing price parity (see Proposition 4). As we show in the proof of the proposition, M^H strictly prefers to use a wide price parity clause and M^L prefers to do so in a weak sense.

How does the use of a wide price parity clause affect outcomes? The qualitative effects are the same as with a single platform. Specifically, Proposition 5 continues to hold, except b is replaced by b_H . Price parity continues to benefit M^H and lower consumer surplus in all cases. The only difference with the earlier results is that the increase in prices due to wide price parity can be larger when platforms compete. This reflects that competition can help lower fees without wide price parity but has no effect on fees with wide price parity.

Competition with M^L is ineffective when M^H uses a wide price parity clause. To understand why this is the case, consider what would happen if M^L lowered f_S^L below $f_S^H - (b_H - b_L)$. Previously, this lower fee would be passed through into lower prices on M^L , and this would cause consumers to search on M^L instead, thereby disciplining the fees M^H can charge. Wide price parity shuts down this competitive mechanism since firms cannot lower their price on M^L below the price they charge

$f_B^H > b_H$, or set fees to firms above those in (16) in stage 1. These are considered in the respective proofs.

on M^H . In the face of a lower f_S^L , an alternative for firms is to abandon M^H and take advantage of lower fees from M^L . Whether this works depends on how equilibria are selected. We have assumed that firms will continue to join both platforms whenever that is an equilibrium in the user subgame. It is an equilibrium here since individual consumers prefer to search through M^H and given they do, individual firms would be worse off if they abandoned M^H since they would no longer attract any consumers.¹⁸

4.3.2 Narrow price parity

Recently, under pressure from competition authorities, the two largest hotel booking platforms in Europe have removed price parity clauses with respect to competing platforms but have kept a price parity clause with respect to hotels selling directly online. This would seem to give the best of both worlds, since competition between platforms can constrain fees, while price parity with respect to direct online sales can prevent showrooming from undermining the ability of platforms to cover their costs. The following proposition describes the equilibrium that arises when platforms are not allowed to use wide price parity clauses, and platforms use a narrow price parity clause instead. We continue to assume consumers can identify firms and switch channels if they want to.

Proposition 10. (Competing platforms and narrow price parity equilibrium)

Stage 1: Platforms operate and use a narrow price parity clause. M^L sets the fees

$$f_B^{L*} = 0 \text{ and } f_S^{L*} = c, \text{ and } M^H \text{ sets the fees } f_B^{H*} = 0 \text{ and } f_S^{H*} = c + b_H - b_L.$$

Stage 2: Firms' prices on M^j are given by (8) where f_S is replaced by f_S^j . Firms' direct price is the maximum of the price on M^L , the price on M^H , and the price in (6).

Narrow price parity effectively rules out the possibility consumers switch to buy directly (i.e. showrooming) or that they would prefer to search and buy directly in the first place. This implies platforms fees are always pinned down by platform competition, in the same way as in part (i) of Proposition 6.

The implications of allowing narrow price parity can be found by directly comparing the outcomes in Proposition 10 with Proposition 7.

¹⁸Even if such a firm could still sell to half of consumers because $b_H = b_L$ and consumers split equally between the two platforms in equilibrium, a firm may not be willing to give up on the other half of consumers so as to enjoy a lower fee from M^L . This possibility, in which the equilibrium fees in Proposition 9 still apply, is shown in Section 5.1 for the case with horizontally differentiated platforms.

Proposition 11. (Implication of narrow price parity)

- (i) Low platform cost: *Suppose $c \leq b_L$. Narrow price parity is irrelevant.*
- (ii) Moderate platform cost: *Suppose $b_L < c \leq b_H$. Imposition of narrow price parity increases consumer prices, decreases consumer surplus, leaves firms' profits unchanged, increases the profit of M^H , leaves welfare unchanged.*
- (iii) High platform cost: *Suppose $c > b_H$. Imposition of narrow price parity results in platforms becoming viable. It increases the profit of M^H and decreases firms' profit. Consumer prices decrease iff $c < \Delta_m + b_L - b_H$, consumer surplus increases iff $c < \Delta_s + \Delta_m + b_L$, and welfare increases iff $c < \Delta_s + b_H$.*

The three different cases in Proposition 11 reflect the different constraints acting on platform fees in the absence of price parity clauses. If platform costs are low relative to the convenience benefits created by platforms, both platforms will operate and compete regardless of whether price parity is imposed. Thus, platform competition constrains their fees, and narrow price parity which just eliminates any constraint from direct sales, is irrelevant. In this case, narrow price parity does not help platforms and nor does it harm consumers. With moderate platform costs, in the absence of any price parity clauses, the binding constraint is the possibility of consumers searching on M^H and switching to buy directly, since the less efficient platform provides a weaker constraint on the dominant platform's fees. In this case, narrow price parity removes the constraint implied by showrooming but leaves the weaker constraint implied by competition from the less efficient platform. This implies higher fees ($b_H + c - b_L$ instead of b_H , where $b_L < c \leq b_H$), and as a result higher prices and lower consumer surplus. With high platform costs, in the absence of any price parity clauses, neither platform is viable given the possibility of consumers switching to buying directly. As a result, prices are determined in the direct search market. Narrow price parity removes this showrooming constraint, making platforms viable with fees constrained by platform competition. This results in lower prices, higher consumer surplus and welfare provided platform competition is sufficiently strong that fees are constrained to sufficiently low levels.

In summary, a narrow price parity clause removes the constraints arising from the direct channel (showrooming and the comparison with direct prices), so fees are only constrained by platform competition. This can be good or bad for consumers. It is bad if the platform remains viable without narrow price parity, or even if it does not, competition from the less efficient platform does not constrain platform fees sufficiently so consumers are better off without platforms and their high fees.

However, compared to the outcome under a wide price parity clause, narrow price parity always leads to lower prices, higher consumer surplus and lower platform profits.

5 Extensions

In this section, we briefly discuss four extensions. The full details and formal proofs for the results in this section are contained in the [online appendix](#).

5.1 Horizontally differentiated platforms

In our platform competition model of Section 4, consumers all viewed M^H as offering superior convenience benefits compared to M^L . We can instead consider the case that the two platforms are symmetric but horizontally differentiated in their convenience benefits. This generates a setting in which both platforms can make positive profits in equilibrium, which also allows us to accommodate the possibility that platforms face a positive fixed cost of entering and operating.

Specifically, consider the following model. There are two platforms M^1 and M^2 which each face a fixed cost of entering and operating c , and decide sequentially whether to enter and operate. Active platforms then set fees simultaneously, and the rest of the game unfolds as before. The marginal cost of each intermediated transaction is set to zero. To model differentiation between platforms, we assume that before deciding which platform to search on, each consumer obtains an individual-specific random shock a , which is drawn from a common distribution $F(a)$ on $[0, b]$. Half of the consumers obtain convenience benefit b from buying on M^1 and $b - a$ from buying on M^2 . The other half of the consumers obtain convenience benefit b from buying on M^2 and $b - a$ from buying on M^1 . Since $a \in [0, b]$, consumers always obtain non-negative convenience benefits when completing purchases on a platform. This specification allows platforms to be differentiated across consumers in a way that does not distort consumers' choice between their preferred platform and buying directly.

With this model of platform competition, the competitive fees without showrooming or price parity considerations equal $\frac{1}{F'(0)}$, while showrooming constrains platform fees to $\min\{b, \frac{1}{F'(0)}\}$. When both platforms remain viable even with showrooming, narrow price parity weakly increases fees and prices, by removing the constraints implied by the direct market. On the other hand, if the platforms' viability

depends on removing the constraint from showrooming, then provided platform competition is effective in the absence of showrooming, narrow price parity is beneficial for consumers. These findings replicate the qualitative results of Section 4.3.2.

Next consider the implications of wide price parity. We show that under reasonable conditions, provided b is not too large, an equilibrium similar to that in Section 4.3.1 still applies, in which platforms fully extract consumer surplus. However, for higher b , we find this zero surplus market-sharing equilibrium no longer exists as the platform fees are so high that each platform has an incentive to set a lower fee that can attract firms to join it exclusively. This works because each firm will prefer to drop the rival platform even if it expects other firms not to do so, knowing it can still sell to the deviating platform's consumers but optimizing its price to these consumers given it faces a much lower fee and is not subject to the rival platform's wide price parity clause. In this case, we characterize an equilibrium in which platforms leave consumers positive surplus despite the use of wide price parity clauses. However, provided b is not too large, the resulting lower equilibrium fee level is still higher than that arising when wide price parity is absent, in which showrooming constrains fees to at or below b . This implies that, provided price parity is not needed for the viability of platforms, wide price parity increases price and thus harms consumers. On the other hand, when platform viability depends on removing the constraint from showrooming and b is sufficiently high, the effect of wide price parity on consumer surplus is ambiguous, reflecting that under wide price parity fees are also constrained by the ability of each platform to undercut the other in order to attract firms exclusively. Even in this case, plausible parameter restrictions suggest wide price parity clauses reduce consumer surplus.

5.2 Endogenous convenience benefits

We now return to our benchmark model and suppose instead the convenience benefit offered by platform j is endogenous. Suppose prior to its other decisions, M^j can spend k (a fixed cost) to increase convenience benefits to $b_j + b(k)$ per transaction. This allows us to explore the effect of price parity clauses on investment. Assume $b(k)$ is continuous and strictly increasing in k for $k \geq 0$, and that there exists a unique $\bar{k} > 0$ such that $b(\bar{k}) = \bar{k}$. Assume $b(k) > k$ for $k < \bar{k}$ and $b(k) < k$ for $k > \bar{k}$. This captures the possibility that a platform can offer rewards and benefits where the cost of these exceeds their benefit. Define the efficient investment k^e which maximizes $b(k) - k$. Assume $b_H - b_L \leq b(\bar{k}) - b(k^e)$, which implies the ex-ante

asymmetry between platforms is not too big. Where there are competing platforms, we assume M^H can choose k first, followed by M^L , before the rest of the game unfolds. This is to avoid coordination failures where they both invest in these fixed costs but only one platform intermediates transactions.

The first thing to note is that in the case of a monopoly platform, M will always set k efficiently, so convenience benefits become $b + b(k^e)$. This reflects that M can recover $b(k)$ in the fees it charges, even with showrooming, and so wants to set it efficiently. The same result is also true with platform competition provided a wide price parity clause does not apply (i.e., efficient investment also emerges with showrooming or with a narrow price parity clause). In these cases, M^H will invest efficiently, and there is no incentive for M^L to invest anything.

The only case where endogenous convenience benefits matter is when wide price parity restricts competition between platforms. In that case, at the proposed equilibrium in Proposition 9, the less efficient platform M^L could undercut M^H by providing sufficiently high convenience benefits (e.g. rewards and other benefits), thereby making all consumers prefer to search and purchase on its platform given firms join both, and allowing it to charge firms the monopoly fees given wide price parity. In equilibrium, M^H will invest in providing convenience benefits to the point that M^L can no longer afford to attract consumers in this way. This implies M^H will invest k to solve

$$\begin{aligned} & \max_k \left\{ x_m - \frac{1 - G(x_m)}{g(x_m)} + b_H + b(k) - c - k \right\} \\ & \text{subject to } b(k) + b_H \geq b(k^*) + b_L \\ & \text{and } k^* = x_m - \frac{1 - G(x_m)}{g(x_m)} + b_L + b(k^*) - c. \end{aligned}$$

This will result in M^H taking the whole market, and M^L not investing to increase its convenience benefits. Since $x_m - \frac{1 - G(x_m)}{g(x_m)} + b_L > c$, we have $k^* > \bar{k}$ and from the assumption that $b_H - b_L \leq b(\bar{k}) - b(k^e)$, we can show that M^H must set $k > k^e$ to ensure $b(k) + b_H \geq b(k^*) + b_L$. This is a new inefficiency caused by a wide price parity clause reflecting that M^H ends up investing in offering inefficient levels of rewards and benefits to attract consumers exclusively. Moreover, M^H 's fees, and so firms' prices, increase to offset the higher convenience benefits, so consumer surplus in the new equilibrium is the same as in Proposition 9. Thus, consumers continue to do just as badly under wide price parity as before, but now there is excessive investment.

5.3 Alternative contracting tools

We have assumed that platforms only use per-transaction fees. This is based on the fact that the platforms we are studying (those where price parity clauses have been used) rely on fees that only arise when transactions are completed. Given per-transaction fees get passed through into firms' prices in equilibrium, firms still make positive profits when selling over the platform, reflecting that search costs are not zero. This raises the question of why platforms do not charge registration fees to extract some of this profit, and what are the consequences for our analysis if they did?¹⁹

In the case of a monopoly platform, the platform could do better by also charging a registration fee to extract the firms' equilibrium profit provided all firms still join. This would shift profit from firms to M , but would not change our main results.²⁰ This assumes firms continue to believe all consumers and firms will use the platform (i.e. they coordinate on the equilibrium in which they use the platform). This seems less likely when M uses registration fees, because registration fees lower firms' profits from joining (zero in the case registration fees are used to extract all their profit). In realistic situations in which firms are heterogeneous and platforms do not know firms' expected profits, registration fees would cause some firms to no longer join. This is captured in our equilibrium analysis by the more extreme assumption that positive registration fees would cause consumers and firms to coordinate on the trivial equilibrium in which M does not intermediate any transactions. In the case of competing platforms, this coordination on the platform that does not charge registration fees is quite natural.

Conversely, we note that some platforms that do not impose price parity clauses do rely on registration fees. Consider shopping malls. They typically cannot monitor transactions and so registration fees (monthly rentals) become necessary. But given the use of monthly rentals, retailers have no incentive to try to set lower prices outside the mall, which means the mall has no need for price parity clauses.

An alternative to charging a registration fee is to charge a per-click fee, a fee a firm incurs each time a consumer clicks on its "page" on the platform to view its details. This leads to a similar outcome to the use of a registration fee in our

¹⁹Amazon charges a small monthly fee for professional sellers but this comes with offsetting benefits, and seems to be used more as a way to screen out small individual sellers that are not active.

²⁰Per-transaction fees would still be set in exactly the same way since these were set to maximize M 's profit without affecting the firms' profit that can be extracted, given that firms pass them through into their prices in equilibrium.

setting, when used as an additional instrument to extract the equilibrium profit left with firms. While in theory this resolves the firms’ concerns about making a loss if consumer demand turns out to be less than expected, it remains the case that per-click fees will lower firms’ equilibrium profits from joining and so provide a reason for them to coordinate on an equilibrium in which they do not join a platform that charges such fees.

Suppose the possibility of showrooming constrains per-transaction fees to a level that does not allow a platform to recover its costs. This raises the possibility of using registration fees or per-click fees to cover costs, and keeping per-transaction fees sufficiently low to rule out showrooming. If this is not possible (or profitable) for the reasons noted above, another possibility is to use a referral fee. For digital services, if consumers can be tracked after they view a firm on the platform until they complete a transaction on the firm’s site, then platforms may be able to charge referral fees in addition to per-transaction fees, so as to rule out showrooming. The use of cookies and random monitoring by platforms may make this feasible. In this case, narrow price parity and a referral fee are alternative instruments to rule out showrooming, with only one of them being needed. Thus, referral fees lead to the same equilibrium outcome as a narrow price parity clause. Wide price parity continues to work as analyzed and the rest of our analysis continues to apply except that we would need to compare the outcome under wide price parity with the outcome under the benchmark setting without showrooming. Banning wide price parity therefore continues to benefit consumers while banning narrow price parity will have no effect.

5.4 Loyal consumers

In our benchmark setting, we have assumed consumers are homogeneous prior to search. As a result, all consumers either search on the platform or none do. In this section, we allow for consumer heterogeneity by considering what happens when some consumers do not value searching on the platform because they already know which firm they want to buy from. Consider the case of a monopoly platform and suppose a fraction $1 - n_m$ of consumers only value the product offered by a particular firm. These “loyal” consumers are assumed to be equally distributed across the firms and can costlessly observe the match value and price of their local firm. The consumers are otherwise the same, drawing a match value v_i^j from the same distribution G still. Firms cannot directly distinguish these loyal consumers

from regular consumers. Initially, we will also assume loyal consumers only buy directly.

Without any price parity clauses or showrooming possibility, firms set their direct prices at the monopoly level, implying $p_d = p^*$ where $p^* = \arg \max_p p(1 - G(p))$. Since this direct price is weakly higher than the direct price that arises in the benchmark model, M is able to weakly increase its total fees to $\Delta_s + b + \left(p^* - \frac{1 - G(x_m)}{g(x_m)}\right)$ without causing the remaining n_m consumers to search directly. The introduction of loyal consumers therefore weakly increases platform fees in the absence of showrooming or price parity.²¹

Allowing for showrooming, the existence of some loyal consumers implies that firms are less willing to lower their prices below those in (6) in order to attract consumers who are searching on M to switch and buy directly. That is, $f_B + f_S > b$ is no longer sufficient for firm i to want to reduce its price to induce consumers to switch. This is because firms that lower their direct price to attract consumers to switch from buying through M have to now accept a lower profit from the loyal consumers who will buy directly anyway. Therefore, M can set higher fees and still remain viable in the face of showrooming if some consumers are loyal. Indeed, even if M provides no convenience benefit, it can still sustain positive fees in the face of showrooming due to a firm's opportunity cost of lowering its direct price implied by loyal consumers. However, the possibility of showrooming still helps to constrain fees and prices compared to the case without showrooming.

With a price parity clause imposed, the platform can again shut down the constraint implied by showrooming. It will increase its fees, knowing that since a firm's direct price cannot be lower than its price on M , the n_m consumers will have no incentive to search directly or switch to purchase directly after searching on M . In the resulting equilibrium, the price on M and the direct price will be the same, and will exceed the monopoly price for loyal consumers p^* . This implies a new source of deadweight loss from price parity—that there will be less sales to loyal consumers.

Under price parity, the introduction of loyal consumers can result in either higher or lower platform fees. On the one hand, firms will no longer pass through the full increase in fees in their prices in order to avoid setting a price too much above the monopoly price for loyal consumers p^* . The platform can take advantage of this to increase its fees and obtain higher profit. On the other hand, fees may have to be kept lower than in the homogenous case given firms can always opt out of the platform and still obtain the monopoly profit on their loyal consumers. Thus, the

²¹In case the hazard rate is strictly increasing rather than constant, the increase becomes strict.

introduction of loyal consumers has an ambiguous impact on the fees and prices that result under a price parity clause. Nevertheless, a price parity clause still unambiguously increases the total fee and the total amount of money consumers pay (i.e. the price and the buyer fee), as it did in the homogenous setting.

How do our earlier findings with platform competition change as a result of the introduction of some loyal consumers? Wide price parity continues to shut down the constraint implied by platform competition. The existence of loyal consumers adds an additional welfare loss from wide price parity as some loyal consumers stop buying due to the higher price in the direct market, but otherwise the results are unchanged. For narrow price parity, the different cases in Proposition 11 and the logic behind them continue to apply, but the cutoff values of c that define the different cases change due to the existence of loyal consumers. In general, it is ambiguous whether the existence of loyal consumers increases or decreases the range of c over which narrow price parity is bad for consumers (and the range over which it is good). There are two main effects. One is that with loyal consumers, firms are less likely to lower prices to induce consumers to switch to buy directly, so platforms remain viable for higher c even without narrow price parity. This narrows the region over which narrow price parity is good for consumers. On the other hand, when platforms are not viable without narrow price parity because their costs are too high, the resulting direct price will now reflect both loyal and searching consumers. This makes it unclear whether the upper end of c for which narrow price parity is good for consumers increases or decreases as a result of loyal consumers.

An interesting twist to the above analysis arises if loyal consumers can also buy from their preferred firm over a platform. Even assuming they do not enjoy any convenience benefit from buying through the platform, this possibility of buying on the platform can mean narrow price parity leads to the same outcome as under wide price parity. Suppose a wide price parity clause is removed and replaced by a narrow price parity clause. M^2 , which previously did not attract any transactions, is willing to reduce its fee f_S^2 (potentially down to c) to attract transactions. Despite this, no firm may be willing to lower its price on M^2 . If firm i lowers its price on M^2 , it will attract consumers on M^1 to switch to buying through M^2 , saving the difference in fees $f_S^1 - f_S^2$ on each transaction. However, it will also attract loyal consumers to buy through M^2 , incurring the new fee f_S^2 on each transaction. If there are sufficiently many loyal consumers and f_S^2 is high enough, firm i will be worse off in this case. Indeed, if c is high enough, firm i will not want to reduce its price on M^2 even if M^2 's fee is reduced to its cost c . If this is the case, M^2 does not have any incentive

to reduce fees and therefore replacing wide price parity by narrow price parity does not affect the allocation and prices in the market.

6 Policy implications and conclusion

This paper has shown that platforms that lower search costs for consumers can raise prices, which happens because of the fees they charge to firms. This naturally gives rise to the possibility of showrooming, given firms would like to avoid paying these fees by selling to consumers directly at lower prices. We found showrooming helps constrain platform fees and is generally good for consumers provided the platform remains viable. Thus, showrooming is not necessarily a legitimate justification for the use of price parity clauses by platforms, although it can be.

Based on our analysis, price parity clauses have several anticompetitive effects. Firstly, narrow or wide price parity clauses suppress price competition between a platform and firms that sell directly. Without a price parity clause, the prices that firms set when selling directly constrain the fees that a monopoly platform can charge these firms. If a monopoly platform sets high fees, firms will have an incentive to set low direct prices to induce consumers to switch and buy directly, thereby avoiding these fees. The elimination of this constraint together with the constraint implied by consumers choosing whether to search directly or through the platform causes the fees charged to firms (and consumer prices) to increase under price parity. Note this should not be thought of as a type of price-fixing agreement between the firms and the platform. Firms are never made better off due to price parity clauses. Rather, a price parity clause should properly be viewed as a vertical restraint that the platform imposes to suppress disintermediation, and therefore the constraint that direct search puts on its fees.

A wide price parity clause that applies across all channels also distorts price competition between competing platforms. It eliminates the incentive competing platforms would otherwise have to lower their fees to firms, as lower fees by one platform cannot be passed on to consumers by way of lower prices. Platforms may compete away their excess profits by offering costly rewards and other consumer benefits in an attempt to attract consumers exclusively to their platform. However, we show such expenditures are inefficient and represent a distortion in the nature of price competition that otherwise would operate in the absence of wide price parity. For instance, wide price parity can prevent entry by a platform that invests efficiently in consumer-side benefits and charges lower fees to firms. Since firms cannot pass on

these lower fees into lower prices, consumers will have no reason to switch to such a platform. And without consumers switching, firms will not be willing to abandon the platform using a wide price parity clause.

Banning price parity clauses will remove these competition distortions and our theory predicts it will benefit consumers under many circumstances. We show the benefit to consumers of banning a wide price parity clause continues to arise even if platforms become unviable due to a showrooming problem. In this case, consumers benefit from the lower prices that would arise without wide price parity and high fees, which more than offsets the higher search costs and loss of convenience benefits consumers face from only being able to buy directly.

Rather than banning price parity clauses altogether, banning wide price parity but still allowing narrow price parity is an alternative that has received considerable attention recently. We show price parity applied only with respect to direct sales can lead to desirable outcomes if competition between platforms is sufficiently effective and if showrooming would otherwise lead platforms to be unviable. By allowing platforms to use narrow price parity, platforms can rule out such showrooming, while their fees can still be competed down through platform competition. However, our modeling suggests some caution needs to be applied to this conclusion. Narrow price parity may not lead to more competitive outcomes than wide price parity when there are sufficient loyal consumers. Moreover, platforms may be able to use other less restrictive contracting instruments to avoid showrooming in case price parity clauses are removed. How effective platform competition actually is in practice in these markets is an empirical question, as is whether price parity clauses are really needed to ensure platforms are viable. Amazon has remained viable in Europe despite removing its price parity rule in 2013. It remains to be seen what are the effects of the recent removal of wide price parity clauses by hotel booking platforms across Europe, and the removal of narrow price parity clauses as well in selected European countries.

One reason why the removal of price parity clauses may not affect the viability of platforms is that a platform can still steer consumers away from firms that do not offer their best prices on the platform (e.g. by making the firm less prominent on the platform) as a way of implicitly enforcing price parity. This could be done in a seemingly innocuous way by ranking firms based on the revenue they generate or on conversion rates. This would ensure firms that induce consumers to switch to buy directly with discounted direct prices will appear lower in the search order, which may be enough to stop firms discounting in this way. Thus, price parity may

remain a relevant concern even when formal price parity clauses are removed. This suggests an important direction for future research—to model how search platforms’ ranking mechanism can direct consumers to firms that do not charge lower prices on other channels, and to use such a framework to see whether the implications of such mechanisms are similar to the price parity rules we have studied.

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Appendix: Proof of Propositions

Proof of Proposition 2. We first establish the equilibrium pricing rules in stage 2. There are two user subgames we need to distinguish.

■ The user subgame following $f_B + f_S \leq b$: First, note, $f_B + f_S \leq b$ implies $f_B - b + f_S + \frac{1-G(x_m)}{g(x_m)} \leq \frac{1-G(x_d)}{g(x_d)}$ as $\frac{1-G(x_m)}{g(x_m)} \leq \frac{1-G(x_d)}{g(x_d)}$. This implies $p_m + f_B - b \leq p_d$ given the proposed equilibrium pricing strategies. That is, in the proposed equilibrium, consumers will make purchases on M rather than switching.

Consider a unilateral deviation by firm i designed to induce switching. (Note any deviation that does not induce switching can be ruled out for the same reason as in the benchmark case). This deviation requires $p_m^i + f_B - b > p_d^i$. This is always possible as firm i can manipulate p_m^i and p_d^i simultaneously. In this case, consumers who want to buy from i will switch to buy from firm i directly. Consumers who visit firm i through M ($1/(1-G(x_m))$ of them) will choose to continue to search through M if they do not buy from firm i . Only consumers with $v^i - p_d^i \geq x_m - (p_m + f_B - b)$ will buy from firm i . Therefore, firm i 's maximization problem is given by

$$\max_{p_d^i} p_d^i \left[\frac{1 - G(x_m - (p_m + f_B - b) + p_d^i)}{1 - G(x_m)} \right]. \quad (17)$$

Then note

$$\begin{aligned}
& \max_{p_d^i} p_d^i \left[\frac{1 - G(x_m - (p_m + f_B - b) + p_d^i)}{1 - G(x_m)} \right] \\
&= \max_{p_d^i} p_d^i \left[\frac{1 - G(x_m - (f_B - b + f_S + \frac{1-G(x_m)}{g(x_m)}) + p_d^i)}{1 - G(x_m)} \right] \\
&\leq \max_{p_d^i} p_d^i \left[\frac{1 - G(x_m - \frac{1-G(x_m)}{g(x_m)} + p_d^i)}{1 - G(x_m)} \right] \\
&= \frac{1 - G(x_m)}{g(x_m)}.
\end{aligned}$$

The first equality follows from the definition of p_m in the equilibrium pricing strategy. The first inequality follows from our assumption that $f_B + f_S \leq b$. The second equality follows since $p_d^i = \frac{1-G(x_m)}{g(x_m)}$ is the argument maximizing the expression. Since $\frac{1-G(x_m)}{g(x_m)}$ is firm i 's profit in the proposed equilibrium, the inequality above shows that firm i cannot make a profitable deviation from the proposed equilibrium when $f_B + f_S \leq b$. Note that if $f_B + f_S > b$ then the inequality is reversed, and there is a profitable deviation that induces consumers to switch.

■ The user subgame following $f_B + f_S > b$: First, note, $f_B + f_S > b$ implies $f_B - b + f_S + \frac{1-G(x_m)}{g(x_m)} > \frac{1-G(x_m)}{g(x_m)}$. This implies $p_m + f_B - b > p_d$ given the proposed equilibrium pricing strategies. That is, in the proposed equilibrium, consumers will always switch to buy directly after searching on M .

Consider a unilateral deviation by firm i . If firm i deviates such that $p_d^i < p_m^i + f_B - b$, firm i 's sales are still all through direct purchases. In this case, firm i cannot be better off by choosing a price different from $p_d^i = \frac{1-G(x_m)}{g(x_m)}$, given all other firms are choosing this direct price. This is because when all other firms are charging $p_d = \frac{1-G(x_m)}{g(x_m)}$ and $p_d < p_m + f_B - b$, consumers expect to use the platform as a showroom and make purchases directly. If the deviation is such that $p_d^i < p_m^i + f_B - b$ and firm i expects consumers to buy from it directly, a consumer who visits firm i will buy from firm i directly only if $v^i - p_d^i \geq x_m - p_d$. Firm i chooses p_d^i to maximize

$$p_d^i \left[\frac{1 - G(x_m - \frac{1-G(x_m)}{g(x_m)} - p_d^i)}{1 - G(x_m)} \right].$$

So firm i 's best response is indeed exactly $p_d^i = \frac{1-G(x_m)}{g(x_m)}$.

Now consider a unilateral deviation by firm i such that $p_d^i \geq p_m^i + f_B - b$ so as

to induce consumers not to switch. Consumers buy from firm i through M only if $v_i - (p_m^i + f_B - b) \geq x_m - p_d$. Firm i 's maximization is

$$\begin{aligned}
& \max_{p_m^i} (p_m^i - f_S) \left[\frac{1 - G(x_m - p_d + p_m^i + f_B - b)}{1 - G(x_m)} \right] \\
&= \max_{p_m^i} (p_m^i - f_S) \left[\frac{1 - G(x_m - \frac{1-G(x_m)}{g(x_m)} + p_m^i + f_B - b)}{1 - G(x_m)} \right] \\
&< \max_{p_m^i} (p_m^i - f_S) \left[\frac{1 - G(x_m - \frac{1-G(x_m)}{g(x_m)} + p_m^i - f_S)}{1 - G(x_m)} \right] \\
&= \frac{1 - G(x_m)}{g(x_m)}.
\end{aligned}$$

The first equality follows from the definition of p_d in the equilibrium pricing strategy. The first inequality follows from our assumption that $f_B + f_S > b$. The second equality follows since $p_m^i = \frac{1-G(x_m)}{g(x_m)}$ is the argument maximizing the expression. Since $\frac{1-G(x_m)}{g(x_m)}$ is firm i 's profit in the proposed equilibrium, the inequality above shows that firm i cannot make a profitable deviation from the proposed equilibrium when $f_B + f_S > b$.

■ M 's strategy in stage 1: Given the firms' pricing equilibrium in stage 2 (and consumers' corresponding optimal search behavior as described in the text), we can now work out M 's optimal fees. In stage 1, the platform therefore chooses f_B and f_S to maximize $f_B + f_S - c$ subject to $f_B + f_S \leq b$ (since otherwise all consumers will switch to buying directly) and also subject to consumers choosing to search on M in the first place. The latter condition requires $x_m + b - p_m - f_B \geq 0$ or $f_B + f_S \leq x_m + b - \frac{1-G(x_m)}{g(x_m)}$. Normalizing $f_B^* = 0$ without loss of generality, the two constraints imply $f_S^* = \min \left\{ b, x_m + b - \frac{1-G(x_m)}{g(x_m)} \right\} = b$ as $x_m - \frac{1-G(x_m)}{g(x_m)} > x_d - \frac{1-G(x_d)}{g(x_d)} > 0$ from (5). Thus, if $c \leq b$, then M sets $f_S^* = b$. Otherwise, if M sets $f_S = c$ it will attract no transactions and M will not operate. \square

Proof of Proposition 4. We first establish the equilibrium pricing rules in stage 2. There are two user subgames we need to distinguish.

■ The user subgame following $f_B \leq b$: Provided $f_B \leq b$, consumers will never want to switch to buying directly. Given consumers search only through M , prices on M are determined by (8) following the same argument as in the benchmark case. Direct price have to be at least as high as these. A firm's associated expected profit is given by the normal equilibrium profit in (9) but with $n_m = 1$. A firm cannot

do better by not joining since then it will get zero profit given all consumers are searching on M . Because of the price parity clause, firm i is also unable to deviate by raising p_m^i and lowering p_d^i to induce consumers to switch.

■ The user subgame following $f_B > b$: Facing a common price and $f_B > b$, consumers will all want to search through M and switch to buying directly. The firms' pricing equilibrium is then determined by the same analysis as in case (ii) in Proposition 2 when $f_B + f_S > b$, such that all consumers search on M but purchase directly. An individual firm i cannot make strictly more profit by increasing p_d^i , or decreasing p_m^i , or doing both simultaneously given all other firms charge p_c on both channels. A firm's associated expected profit is given by the normal equilibrium profit in (9) but with $n_m = 1$. A firm cannot do better by not joining since then it will get zero profit given all consumers are searching on M .

■ M 's strategy in stage 1: If $f_B > b$, M obtains no profit. It will therefore want to set $f_B \leq b$ and intermediate all transactions. Consumers will prefer to search through M in the first place provided $f_B \leq \Delta_s + b$. In addition, consumers must expect a non-negative surplus from searching and buying on M , which requires

$$x_m + b - (p_c + f_B) \geq 0. \quad (18)$$

Substituting (8) into (18), we have that

$$f_B + f_S \leq x_m + b - \frac{1 - G(x_m)}{g(x_m)}. \quad (19)$$

As before, only the total fee matters and we can normalize $f_B^* = 0$ which ensures the required constraint on f_B holds. Then the platform maximizes its profit by setting f_S to make (19) hold with equality which gives (15). \square

Proof of Proposition 6. Given a firm can always set high prices, it will always be willing to join any platform that operates. Given consumers cannot switch, the firms' pricing problem on each platform and in the direct market is identical to that in Proposition 1. Firm i therefore charges the equilibrium price

$$p_m = f_S^j + \frac{1 - G(x_m)}{g(x_m)}$$

on M^j if M^j operates.

Now consider the platforms' stage 1 decisions. Consumers will search on the platform with the lowest total net fee $f_B^j + f_S^j - b_j$ provided this does not exceed

$\Delta_s + \Delta_m$. Since only total fees matter, the buyer fee f_B^j can be normalized to zero for $j = L, H$. Asymmetric Bertrand competition implies M^L will choose the lowest possible f_S^L subject to $f_S^L \geq c$. M^H will set f_S^H so consumers are indifferent between the two platforms given indifferent consumers will search on M^H . This implies $f_S^H = f_S^L + b_H - b_L$.

We only need to consider two cases.

■ Assume $c \leq \Delta_s + \Delta_m + b_L$: The above conditions imply the platforms set $f_B^{L*} = f_S^{L*} = 0$, $f_S^{L*} = c$ and $f_S^{H*} = c + b_H - b_L$ with consumers searching and buying on M^H since $f_B^{H*} + f_S^{H*} = c + b_H - b_L \leq \Delta_s + \Delta_m + b_H$.

■ Assume $c > \Delta_s + \Delta_m + b_L$: These conditions imply M^L would set $f_B^{L*} = 0$ and $f_S^{L*} = c > \Delta_s + \Delta_m + b_L$ if it operated. As a result, consumers always prefer to search directly rather than search on M^L , and therefore M^L is irrelevant to the equilibrium outcome in the user subgame. M^L will not operate. M^H 's optimal fees are determined by Proposition 1 where b is replaced by b_H , which proves case (ii) in Proposition 6. \square

Proof of Proposition 7. Consider the user subgame first. Note consumers will not switch from one platform to another given both platforms have the same search costs. If one platform has lower total net fees than the other, consumers will prefer to search on that platform in the first place and firms will have no incentive to induce consumers to switch to the platform with higher net fees. The only question is whether firms want to induce consumers to switch to buying directly. They will only do so if the platform with the lowest total net fees has total fees that exceed the corresponding convenience benefits (i.e. so total net fees are positive). The logic is the same as in the proof of Proposition 2, as is the resulting direct price equilibrium.

Now consider the platforms' stage 1 decisions. Since only total fees matter, the buyer fee f_B^j ($j = L, H$) can be normalized to zero. Since consumers search on the platform with the lowest total fees net of convenience benefits, asymmetric Bertrand competition implies M^L will choose the lowest possible f_S^L subject to $f_S^L \geq c$.

We only need to consider two cases.

■ Assume $c \leq b_L$: Then $f_B^{L*} = f_B^{H*} = 0$, $f_S^{L*} = c$ and $f_S^{H*} = c + b_H - b_L$ with consumers searching and buying on M^H since $f_B^{H*} + f_S^{H*} = c + b_H - b_L \leq b_H$.

■ Assume $c > b_L$: These conditions imply M^L would set $f_B^{L*} = 0$ and $f_S^{L*} = c > b_L$ if it operated. As a result, consumers would never complete transactions on M^L , which is dominated by M^H . M^L is irrelevant to the equilibrium outcome in the user subgame and will not operate. M^H 's optimal fees are determined by Proposition 2 where b is replaced by b_H , which proves case (ii) in Proposition 7. \square

Proof of Proposition 8. Consider case (i). If $c \leq b_L$, then consumers buy through M^H , with $f_B^{L*} = 0$ and $f_S^{H*} = c + b_H - b_L$ in both Proposition 6 (without showrooming) and 7 (with showrooming). Thus, showrooming does not affect the equilibrium outcome.

Consider case (ii). If $b_L < c \leq b_H$, then we can either be in case (i) or (ii) of Proposition 6. In case (i) of Proposition 6, consumers buy through M^H , with $f_B^{L*} = 0$ and $f_S^{H*} = c + b_H - b_L$. In Proposition 7, consumers buy through M^H , with $f_B^{L*} = 0$ and $f_S^{H*} = b_H$. Since $c > b_L$, fees are higher without showrooming. In case (ii) of Proposition 6, consumers buy through M^H , with $f_B^{L*} = 0$ and $f_S^{H*} = \Delta_s + \Delta_m + b_H$. Since $\Delta_s + \Delta_m > 0$, fees are again higher without showrooming. Thus, showrooming lowers prices and raises consumer surplus.

Consider case (iii). If $c > b_H$, then we can again either be in case (i) or (ii) of Proposition 6. Consider case (i) of Proposition 6 first. Then the price is $c + b_H - b_L + \frac{1-G(x_m)}{g(x_m)}$ without showrooming and $\frac{1-G(x_d)}{g(x_d)}$ with showrooming. The change in price is $\Delta_m - c - (b_H - b_L)$, which can be positive or negative. Consumer surplus is $x_m - \left(c + b_H - b_L + \frac{1-G(x_m)}{g(x_m)} \right) + b_H = x_m - c + b_L - \frac{1-G(x_m)}{g(x_m)}$ without showrooming and $x_d - \frac{1-G(x_d)}{g(x_d)}$ with showrooming. The change in consumer surplus is $c - (\Delta_s + \Delta_m + b_L)$. Since $c \leq \Delta_s + \Delta_m + b_L$ in case (i) of Proposition 6, showrooming lowers consumer surplus. Consider case (ii) of Proposition 6. The price is $\Delta_s + \Delta_m + b_H + \frac{1-G(x_m)}{g(x_m)} = \Delta_s + b_H + \frac{1-G(x_d)}{g(x_d)}$ without showrooming and $\frac{1-G(x_d)}{g(x_d)}$ with showrooming. Since $\Delta_s + b_H > 0$, showrooming lowers prices. Consumer surplus is $x_m - \left(\Delta_s + b_H + \frac{1-G(x_d)}{g(x_d)} \right) + b_H = x_d - \frac{1-G(x_d)}{g(x_d)}$ without showrooming and $x_d - \frac{1-G(x_d)}{g(x_d)}$ with showrooming. Showrooming does not change consumer surplus. \square

Proof of Proposition 9. The proof follows the same logic as the proof of Proposition 4. We just have to show that it is an equilibrium for both platforms to operate, to use the wide price parity clause, to set $f_B^j \leq b^j$, and to set $f_S^j \leq f_S^{j*}$. Note in equilibrium, M^H makes a positive profit and M^L makes a zero profit.

If one platform does not operate, then that platform will make zero profit and the analysis of the user subgame is identical to the monopoly case. If M^H deviates and drops the price parity clause but tries to maintain such high fees, firms will want to set direct prices according to (6), and knowing this, consumers would only search directly. Thus, M^H cannot maintain such high fees if it does not impose price parity, and so prefers to maintain it. M^L cannot attract any transactions by removing its price parity clause, given firms still have to offer their best prices on M^H and consumers prefer to purchase on M^H . If both platforms operate, but the

platform with the lowest $f_B^j - b_j$ sets $f_B^j > b_j$, firms will set a single price $p_c = \frac{1-G(x_m)}{g(x_m)}$ but then consumers will all search on that platform but switch to buy directly. This will give the deviating platform zero profit. If a platform sets $f_S^j > f_S^{j*}$, consumers would get negative surplus from searching on the platform even if firms joined it. The outcome is equivalent to the platform not operating. \square

Proof of Proposition 10. It is clear that M^L 's presence when it sets $f_B^L = 0$ and $f_S^L = c$ still affects the equilibrium in the user subgame. This is because such fees restrict the fees charged by M^H given that narrow price parity eliminates other constraints on M^H that arise from the direct market. Therefore, M^L operates. Platforms engage in asymmetric Bertrand competition as in Proposition 6. If buyer fees are set at zero, the resulting seller fees are $f_S^L = c$ and $f_S^H = c + b_H - b_L$. Then to show the proposed strategies constitute an equilibrium, we need to show that both platforms prefer to keep the narrow price parity clause and set $f_B^j \leq b_j$ for $j = 1, 2$.

Suppose M^H deviates by removing its price parity clause but still maintains the same total fees (or increases them). The total fee is at least $c + b_H - b_L$ which is higher than b_H if $c > b_L$. As a result, firms can profitably deviate to set price equal to (6) and consumers will switch after searching M^H . In other words, if $c > b_L$, M^H cannot attract any transactions if it maintains (or increases its) total fees if it removes its price parity clause. M^H is indifferent about using its price parity clause if $c < b_L$, and we assume it does so. That M^L cannot benefit by dropping its price parity clause and both platforms prefer $f_B^j \leq b_j$ follows directly from the proof of Proposition 9. \square