Your Data, My Data: Information Disclosure and Competition in Marketplace Platforms

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Abstract

We consider a marketplace platform that serves a seller who is privately informed about the characteristics of its potential buyers. If the seller reveals this information to the platform, the platform can compete with the seller by targeting the same buyers. We find that the seller may conceal information to avoid direct competition with that platform. Vertical separation solves this inefficiency but may motivate the seller to reveal information to deter entry by a competing seller. An information firewall motivates the seller to reveal information, but may result in the platform targeting the wrong buyers.

JEL Classification: L1

Keywords: Information sharing, platform marketplace, vertical relations

1 Introduction

E-commerce platforms play a pivotal role in modern economics, fundamentally reshaping the landscape of retail and business operations. By leveraging technology and data analytics, e-commerce platforms optimize supply chains, personalize shopping experiences, and drive innovation in areas such as mobile commerce and digital payments. It is expected that the total e-commerce market size will grow from \$5.2 trillion in 2021 to about \$8.1 trillion by 2026 (Chevalier 2022). One of the key characteristics of these markets is the dominance of a few major platforms: in the U.S., Amazon continues to lead the e-commerce market with a 39% market share and total sales reaching \$384.6 billion in 2023 (Chevalier 2023). In China,

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in 2022, Alibaba attained a market share of nearly 50% and JD.com ranked second with a market share of 26% (Ma 2023).

The dominance of these major e-commerce platforms, who play a dual role as both marketplace operators and sellers, has given rise to growing concerns about their potential to abuse market power at the expense of third-party sellers. Critics argue that these platforms may exploit their dual role to unfairly favor their own products or services. This can manifest in various ways, one of them – which is the center of this research – is using data from third-party sellers to gain an unfair advantage. Much of the existing literature focuses on how platforms use ex-post data, such as sales or innovation collected from sellers' transactions on the platform, to compete directly with sellers. This paper examines a different channel through which a platform can exploit data: ex-ante data that sellers provide the platform. Sellers may possess valuable information about the characteristics of the product's potential buyers and may share this with the platform to target specific buyers. For example, Amazon's "Sponsored Display" tool allows sellers to specify which buyers the platform should target based on certain characteristics.[1] Sharing this information is valuable for sellers because sellers on such platforms typically have limited advertising budgets and would like to use it as efficiently as possible by targeting only potential buyers. However, disclosing this information ex-ante can result in an "informational spillover," where the platform uses the information to compete with the seller for the same buyers. The risk of competition may discourage sellers from revealing their private information, potentially leading to a market failure.

This paper asks two main research questions. First, under what market conditions does an informational spillover from an independent seller to the platform lead to a market failure? Second, what remedies can be imposed on the platform, and what would be their effect on welfare.

These research questions are important for public policy towards marketplace platforms. Based on the concerns of misuse of third-party sellers' data, both the European Union (EU) and the United States (US) have launched significant antitrust investigations. The European Commission initiated a formal antitrust investigation into Amazon in 2019, examining whether the company's use of sensitive data from independent retailers who sell on its marketplace breaches EU competition rules. The investigation culminated in 2022 with Amazon agreeing to a series of commitments to address these concerns, including restrictions on its use of non-public data. Similarly, in the US, the Federal Trade Commission (FTC) has been

[1] See: https://advertising.amazon.com/library/guides/sponsored-display-guide. This tool allows sellers to "Leverage thousands of pre-built audience segments to help reach new prospective shoppers through awareness and consideration campaigns."

investigating Amazon's business practices since 2019, with a particular focus on how the company handles data from third-party sellers. The House Judiciary Committee's antitrust subcommittee also conducted a 16-month investigation into big tech companies, including Amazon, concluding in 2020 with a report that accused these platforms of abusing their gatekeeper power.

In response to these growing concerns over e-commerce platforms using third-party seller data for anti-competitive practices, legislative efforts have been proposed, two of them are analyzed in this paper: the establishment of an "informational firewall" and a formation of a "structural separation". The concept of an informational firewall mandates that data collected from third-party sellers cannot be used by the platform's own retail division to gain a competitive advantage. The EU has taken a leading role with its Digital Markets Act (DMA), enacted in 2022 and set to be fully applicable by 2024. The DMA explicitly prohibits gatekeepers from using non-public data generated by third party sellers to compete against them. In the US, similar efforts have been proposed, such as the American Innovation and Choice Online Act, which aims to prevent dominant platforms from misusing sellers' data.

In parallel, initiatives to prohibit e-commerce platforms from selling their own products, often referred to as "structural separation" or "vertical separation" have gained traction in recent years. In the US, the most notable proposal is the Ending Platform Monopolies Act, introduced in 2021 as part of a package of antitrust bills. This legislation aims to prevent dominant platforms from leveraging their control across multiple business lines to favor their own products or services. If enacted, it could potentially force companies like Amazon to choose between operating a marketplace and selling their own products on that platform. Similar concepts have been discussed in the EU Union, although the DMA stopped short of mandating full structural separation. India's e-commerce policies have also moved in this direction, with draft rules proposing to ban "related parties and associated enterprises" of e-commerce firms from selling on their platforms.

To examine the issues outlined above, we consider a marketplace platform that connects an independent seller with buyers. The platform has the option to enter the market with its own substitute product, thus competing with the seller, while also charging the seller ad valorem fees. For simplicity, we assume the market consists of two representative buyers: one is referred to as a "potential" buyer, who is interested in purchasing the product, and the other is a "non-buyer," with no interest in the product. Both the platform and the seller have sufficient budgets to target advertisements solely to the potential buyer. In this market, the seller and the platform each hold unique relevant information: the seller knows the characteristics that identify a potential buyer, while the platform knows the characteristics of both buyers but does not know which specific characteristics define the potential buyer.

The seller can request the platform to target its product to the buyer with the potential buyer's unique characteristics, but in doing so, the seller discloses this critical information to the platform. This could lead to a pro-competitive spillover of information, where the platform might use this knowledge to enter the market and compete with the seller for the same buyer.

We find that the seller conceals its information from the platform for intermediate levels of substitution between the seller's and the platform's products. In this range, if the seller were to reveal information, the platform would have competed with the seller on the potential buyer. Anticipating this, the seller prefers to prevent competition by concealing information and the platform randomly advertises the seller's product to one of the buyers and its own product to the second buyer. This outcome is inefficient for two reasons. First, there is no competition over the potential buyer. Second, one of the products is advertised to a buyer who is uninterested in the product and may thus impose a cost on this buyer. When the degree of substitution is high, the seller reveals information, anticipating that doing so would deter the platform from competing with the seller and granting the seller a monopoly position on the potential buyer. Hence, only the first type of inefficiency occurs. When the degree of substitution is low, the seller reveals information and the platform competes with the seller on the potential buyer, and both inefficiencies are alleviated.

We find that the seller chooses to withhold its information from the platform when the level of substitution between the seller's product and the platform's product is moderate. In this situation, if the seller were to disclose the information, the platform would compete directly with the seller for the potential buyer. To avoid this competition, the seller opts to keep its information hidden, resulting in the platform randomly advertising the seller's product to one buyer and its own product to the other. This outcome is inefficient for two reasons: reduced competition level in the market, and advertising an irrelevant product. In this market equilibrium, the seller and the platform do not compete over the potential buyer; second, one product is being advertised to a buyer with no interest in it, an outcome that results in welfare loss.

When substitution is high, the seller reveals the information, knowing that the platform will elect to refrain from entering into competition; thus, securing the seller a monopoly power over the potential buyer. In this case, only the lack of competition creates market inefficiency. Finally, when substitution is low, the seller reveals the information, prompting the platform to compete for the potential buyer, thus resolving both inefficiencies.

To address this market inefficiency, we examine two remedies proposed by policymakers. The first is vertical separation, in which two competing sellers (one with superior information) sell their products through the platform, which is prohibited from competing with them. We find that under vertical separation, the platform is less inclined to foster competition than it is under vertical integration. As a result, vertical separation may encourage the seller with private information to disclose it to the platform in situations where, under vertical integration, the seller would have withheld the information due to the fear of promoting competition. While this effect of vertical separation can enhance welfare, we also find that in certain cases, vertical integration leads to both information sharing and competition, whereas vertical separation leads to information sharing but results in a monopoly outcome. Therefore, vertical separation can either increase or decrease welfare compared to vertical integration, depending on the specific parameters of the market.

The second remedy is the introduction of an informational firewall between the informed seller and the platform. Under this arrangement, if the seller discloses information about the potential buyer's characteristics, the platform is prohibited from using that information to decide whether to enter the market as a seller or to determine to which buyer it should advertise. The benefit of the firewall is that the informed seller consistently shares information, as it no longer risks triggering competition. However, we find that the impact of a firewall on welfare can vary. Specifically, when the level of substitution between the products is low, the seller reveals information regardless of whether a firewall is in place. Yet, in the presence of a firewall, competition for the potential buyer may not always occur, which, in such cases, leads to a reduction in welfare.

To summarize, our findings have significant implications for firms' business strategies in markets where platforms operate both as a marketplace and a seller, and the independent seller holds private information. We highlight how vertical integration, vertical separation, and an informational firewall shape the firms' strategic decisions. From a public policy perspective, these results highlight when remedies like vertical separation and an informational firewall improve or reduce overall welfare.

Our paper is related to a growing literature that studies the implications of vertical integration in marketplaces and platforms, with various papers considering different aspects of the problem. Early literature focused on the decision between operating as a pure reseller—where the platform sells only its own products—and as a pure marketplace that exclusively hosts third-party products (Hagiu and Wright, 2015a; 2015b). More recent work focuses on the anti-competitive effects of vertical integration by platforms and whether marketplaces should be allowed to offer their own products. For example, focusing on the effect of imitation based on ex-post information collected by the platform, Hagiu et al. (2022) find that when the platform is allowed to perfectly imitate the superior seller product at no cost, then under vertical integration, superior sellers stop innovating. Moreover, remedies such as banning imitation or steering are likely to benefit consumers, while enforcing vertical separation harms consumers. Madsen and Vellodi (2021) consider where the platform can commit to an imitation strategy under cost and demand uncertainties. They find that a firewall that prevents insider imitation encourages innovation in markets with significant demand uncertainty, while it reduces innovation in stable, incremental markets. Additionally, vertical separation leads to less innovation than banning insider imitation. We contribute to this literature by studying how ex-ante information that a seller provides a platform can motivate the platform to enter the marketplace and compete with the seller.

Etro (2023) studies the welfare implications of platforms acting as both resellers and marketplaces, Anderson and Bedre-Defolie (2021, 2022) consider the effects of vertical integration on product variety, and Gautier et al. (2021) study the role of network externalities. Another key anti-competitive concern studied in the literature is self-preferencing—the tendency and incentives of platforms to promote their own products over those of third-party seller's products (Lam and Liu, 2020; Zennyo, 2020; Etro, 2021; Kang and Muir, 2022; Bar-Isaac and Shelegia, 2023). We abstract away from many of the considerations of this literature and focus instead on how vertical integration affects a platform's decision to use ex-ante data provided by sellers to gain an unfair competitive advantage.

In a closely related paper, Hervas-Drane and Shelegia (2022) examine a retailer 's decision to open up a marketplace in order to learn about new product categories. Yet, due to capacity constraint, the retailer must decide in which product categories to act as a reseller, which to act as a pure marketplace, and which to be both. Unlike our paper, their focus is on homogeneous goods and inattentive consumers.

Our analysis focuses on the strategic role of information spillover in platform markets, particularly information held by third-party sellers that can be disclosed and leveraged by the marketplace. The use of information by platforms has recently gained significant attention in the literature. For example, Choi et al. (2019) study how shared data may lead to negative information spillovers, while Markovich and Yehezkel (2024) examine the public benefit aspect of data, where a platform's insights on one user benefit other users on that platform. Our work contributes to this literature by focusing on the role of information spillovers on the seller side.

2 The Model

We study a market comprised of an independent seller, a platform, and a pool of buyers. The platform has access to the pool of possible buyers and can also offer a substitute product that competes with the seller's product. For simplicity, we normalize the production costs to zero.[2]

The seller can only access buyers through the platform and the pool of buyers can only purchase the product on the platform. For simplicity, we represent the pool of buyers using two representative buyers: a "potential" buyer and a "non-buyer". The non-buyer does not want to purchase the products regardless of whether it is sold by an independent seller or the platform, if the platform offers one. In contrast, the potential buyer finds both sellers' products attractive, however would learn and be aware of the products only if the information is presented to them (for example, in the form of advertisement). Suppose that the seller and the platform can advertise only to one buyer. For example, the seller may have a limited advertising budget to target only the mass of potential buyers. Likewise, the platform may not want to overload its possible buyers with advertising. Recall that the existence of two buyers in our model is a simplification of reality; therefore, the assumption of limited advertisement budget is adopted in order to reflect reality in which a firm can advertise its products to its potential buyer and to the entire pool of possible customers.

If the platform chooses to also offer the product and the two products are offered to the potential buyer, the demand functions are $q_1(p_1, p_2; \sigma)$ for the seller's product (hereafter, product 1) and $q_2(p_2, p_1; \sigma)$ for the platform's product (hereafter product 2), where p_i ($i = 1, 2$) is product i's price. Suppose that $q_i(p_i, p_j; \sigma)$ is decreasing in p_i, increasing in p_j and that the demand functions are symmetric such that: $q_i(p, p'; \sigma) = q_j(p', p; \sigma)$ for any p' and p. The parameter $\sigma \in [0, 1]$ measures the level of horizontal substitution between the two products. When $\sigma = 0$, the two products are completely different, such that each firm behaves as a monopoly; i.e., $q_M(p_i) \equiv q_i(p_i, p_j; 0)$. When $\sigma = 1$, the two firms sell identical products such that the potential buyer buys only from the firm that offers the lowest price (i.e., in this case, the model reduces to the standard Bertrand competition with homogeneous products).

When one or both products are advertised to the non-buyer, the non-buyer suffers a disutility, $D > 0$, associated with the attention that the product attracts from the non-buyer who is uninterested in the product to begin with. For example, Brajnik and Gabrielli (2010) document the negative effects of poorly targeted advertising; among which are frustration and negative attitudes toward the platform. Kononova et al. (2020) examined empirically the effect of presenting irrelevant ads to consumers.

As is common in relationships between a platform and a seller, we assume that the platform charges an ad valorem commission from the seller's revenues, r ($0 < r < 1$), that we take as exogenously given.[3]

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[2]We assume that all firms are risk-neutral.

[3]A platform may sell many different products and therefore the market of this specific product does not affect the platform's commission rate. For example, Amazon charges all sellers 15% of the product's selling price on each product sold.

In our model, we distinguish between two types of information: information relating to each specific buyer and information about the characteristics typical to potential buyers. We assume that the the platform possesses data on each buyer's characteristics (such as their age or their geographical location) and the seller has private knowledge about the characteristics of potential buyers—for instance, knowing that the product is particularly appealing to buyers within a certain age range or geographical location. , That is, the seller is aware of the general characteristics that potential buyers might have but lacks direct access to the buyer pool and does not know each buyer's specific characteristics, while the platform knows the latter but cannot identify which specific traits correspond to the potential buyer, leaving the exact buyer unidentified, from the platform's perspective. As a result, when the seller joins the platform, they must decide whether to disclose the information on potential buyer's characteristics to the platform or keep this information confidential. If the seller decides to share this information, the platform commits to advertising the seller's product to the potential buyer. However, an informational spillover may occur: the platform may also use this information to decide whether to compete with the seller by advertising its own competing product to the same buyer. We say that such informational spillover is pro-competitive when revealing the potential buyer's characteristics motivate the platform to compete with the seller on the same buyer, while the informational spillover is anti-competitive when it motivates the platform to avoid competition. All other information is considered to be common knowledge.

The timing of the game is as follows:

Stage 1: The seller chooses whether to reveal its private information regarding the characteristics of the potential buyer to the platform. If such information is shared, the platform commits to advertise the seller's product to the potential buyer. If the seller does not reveal specific buyer's characteristics, the platform cannot identity of the potential buyer and thus advertises the seller's product to each of the buyers with an equal probability.

Stage 2: The platform chooses whether to advertise its own product to one of the buyers. The platform can choose to *(i)* advertise its product to the same buyer as the one targets with product 1, *(ii)* advertise to the other buyer, or *(iii)* stay out of the market.

Stage 3: The seller observes the platform's decision in stage 2, and the firms set their prices simultaneously.

We complete this section by defining the monopoly and the competitive cases. Under monopoly, when the potential buyer is targeted with only one product, the seller (platform) sets its price to maximize $(1-r)\pi_M(p_1) = (1-r)p_1q_M(p_1)$ ($\pi_M(p_2) = p_2q_M(p_2)$), respectively. Let p_M denote the monopoly price that maximizes $\pi_M(p)$ (i.e., $p_M = \arg\max_p \pi_M(p)$) and let $\pi_M = \pi_M(p_M)$, such that π_M is the maximum payoff of a firm acting as a monopoly.

Under competition, the seller and the platform compete over the same targeted buyer and set prices simultaneously to maximize:

$$\pi_S^C(p_1, p_2; \sigma) = (1-r)p_1q_1(p_1, p_2; \sigma), \tag{1}$$

$$\pi_P^C(p_2, p_1; \sigma) = rp_1q_1(p_1, p_2; \sigma) + p_2q_2(p_2, p_1; \sigma). \tag{2}$$

Let $p_1^C(r,\sigma)$ and $p_2^C(r,\sigma)$ denote the equilibrium prices under competition, and let

$$\pi_S^C(r,\sigma) \equiv \pi_S^C(p_1^C(r,\sigma), p_2^C(r,\sigma); \sigma), \qquad \pi_P^C(r,\sigma) \equiv \pi_P^C(p_2^C(r,\sigma), p_1^C(r,\sigma); \sigma),$$

be the seller's and the platform's competitive equilibrium payoffs, respectively.

When $\sigma = 0$, buyers view the two products to be completely distinct and $p_i^C(r,0) = p_M$. In contrast, when $\sigma = 1$, the two products are perfect substitutes and the model is reduced to Bertrand competition and prices equal the firms' marginal costs, $p_i^C(r,1) = 0$.

We therefore make the following assumptions. Given any $0 < \sigma < 1$:

Assumption 1: prices are strategic complements such that there is a unique solution to $p_1^C(r,\sigma)$ and $p_2^C(r,\sigma)$.
Assumption 2: $p_1^C(r,\sigma)$ and $p_2^C(r,\sigma)$ are continuous and decreasing in σ.
Assumption 3: $\pi_P^C(r,\sigma)$ and $\pi_S^C(r,\sigma)$ are continuous and decreasing in σ.

The assumptions outlined above hold for many explicit demand functions, such as the linear demand function we use as an example throughout this paper. Comparing $p_1^C(r,\sigma)$ and $p_2^C(r,\sigma)$, we have the following results (all proofs are in the Appendix):

Lemma 1. *When the seller and the platform target the same buyer and $0 < \sigma < 1$, the equilibrium prices satisfy $p_M > p_2^C(r,\sigma) > p_1^C(r,\sigma) > 0$. Moreover, all prices are increasing in r.*

To illustrate the results, we complement the general demand function analysis with a linear demand specification. To this end, suppose that when the seller and the platform target the potential buyer, the buyer has the following Quasilinear Quadratic Utility function (See

Shubik and Levitan, 1980):

$$U(q_1, q_2; \sigma) = q_1 - \frac{q_1^2}{2} + q_2 - \frac{q_2^2}{2} - \sigma q_1 q_2. \tag{3}$$

This utility function implies that the potential buyer has preferences for variety: $U(q, q; \sigma) > U(2q, 0; \sigma)$. The potential buyer chooses q_1 and q_2 to maximize $U(q_1, q_2; \sigma) - p_1 q_1 - p_2 q_2$. Thus, the demand for product i is:

$$q_i(p_i, p_j; \sigma) = \frac{1}{1+\sigma} - \frac{p_i}{1-\sigma^2} + \frac{\sigma p_j}{1-\sigma^2}. \tag{4}$$

The demand system above has been widely utilized in the economics, marketing and operations management literature (Foros et al. 2009, Ingene and Parry 2007, Lus and Muriel 2009, Cai et al. 2012, Abhishek et al. 2016, Inderst and Shaffer 2019, Hagiu and Wright 2019). It models partial competition, where $\sigma \in (0, 1)$ reflects the degree of differentiation between the products of the two sellers. When $\sigma = 0$, the utilities derived from the products are independent, meaning each seller operates as a monopoly within its own market. As σ increases, competition between the sellers intensifies. When σ approaches 1, the products become fully substitutable, leading to perfect competition in the market. Intermediate values of σ represent varying levels of product differentiation. This demand specification serves as a good example because it offers two important properties. First, as product differentiation increases (i.e., as the value of σ decreases), the price sensitivity decreases; this property is aligned with the intuition that consumers are less price-sensitive when products are more differentiated. Second, the total potential market size expands as the products are more differentiated; this property is consistent with the idea that more differentiated products can attract a broader customer base. We adopt this demand system for illustrating the results, which generally hold for any demand system satisfying Assumptions 1 - 3.

Figure 1 illustrates p_M, $p_1^C(r, \sigma)$ and $p_2^C(r, \sigma)$ as a function of σ, based on our linear demand specification. For any $0 < \sigma < 1$, the platform charges a higher price than the seller. Intuitively, the platform internalizes the share of the revenues it expects to receive from the independent seller, and thus as r increases, the platform chooses to soften competition by increasing the price it charges. Notice also that as in Assumption 2, both prices decrease with σ and approach 0 as σ approaches 1.

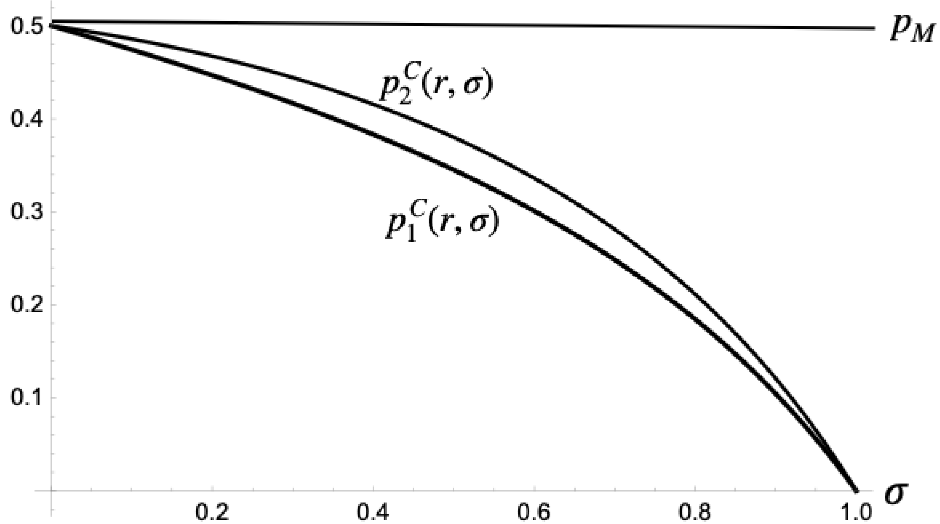

Figure 1: p_M, $p_1^C(r,\sigma)$ and $p_2^C(r,\sigma)$ as a function of σ ($r = 0.5$)

3 Competition between the Platform and the Seller

Below, we analyze the base model introduced in Section 2. We solve the game backward, starting with the price setting decision in stage 3. In our model, three market configurations may arise: (1) each buyer receives an ad to one product. In this case, the potential buyer receives an ad to one of the products and the non-buyer receives an ad to the other product; (2) seller's 1 product is advertised to one of the buyers and the platform chooses to stay out of the market. It is possible to show that such market configuration will be played only if the platform knows that seller 1's product is targeted at the potential buyer; (3) the platform targets one of the buyers with both products.

Starting with the first configuration, in this case, there is no competition between the platform and the seller. Therefore, if the platform targets the potential buyer, the seller and the platform earn 0 and π_M, respectively, where π_M is the monopoly profits as defined in Section 2 . Otherwise, the seller and the platform earn $(1-r)\pi_M$ and $r\pi_M$, respectively. Under the second market configuration, the potential buyer is targeted with the seller's product, and the seller earns $(1-r)\pi_M$. The platform, here, stays out of the market and receives only the commission $r\pi_M$.

In the third market configuration, the seller and the platform compete over one of the buyers and simultaneously set prices, $p_1^C(r,\sigma)$ and $p_2^C(r,\sigma)$ respectively, and earn $\pi_P^C(r,\sigma)$ and $\pi_S^C(r,\sigma)$, as defined in Section 2, if both target the potential buyer. If both target the non-buyer, both firms earn zero profits.

Turning to stage 2, where the platform chooses whether to be active in the market, and if so whether to have its product targeted at the same buyer as the seller's product. Suppose first that the seller revealed its private information, in which case the platform advertises product 1 to the potential buyer. Since the platform knows that the other buyer is the non-buyer who would bear a cost if targeted with either product, the platform needs to essentially choose whether to directly compete with the seller on the potential buyer (pro-competitive informational spillover) or to stay out (anti-competitive information spillover). The following lemma outlines the conditions under which the platform chooses to avoid competition.

Lemma 2. *If the seller reveals its private information, the platform avoids competing with the seller on the same buyer if the two products are close substitutes. That is, there is a threshold, $\widetilde{\sigma}(r)$, such that the platform stays out of the market ($\pi_P^C(r,\sigma) < r\pi_M$) if and only if $\sigma > \widetilde{\sigma}(r)$, where $\widetilde{\sigma}(0) = 1$ and $0 < \widetilde{\sigma}(1) < 1$.*

According to Lemma 2, when the seller reveals its private information, the platform's decision whether to compete with the seller over the potential buyer depends on the level of product substitution and the platform's commission rate. Specifically, if product substitution is high, the platform chooses not to compete with the seller, even though it knows the buyer's identity. Here, informational spillover between the seller and the platform is anti-competitive. As products become more differentiated, the platform, which becomes informed about the identity of the potential buyer, benefits from competing on the potential-buyer, and generating revenues from both channels: its direct sales and commission from the seller. In this case, informational spillover is pro-competitive.

Suppose now that the seller does not reveal its private information, and the platform does not know which buyer is the potential buyer. In this case, the platform targets the potential buyer with the seller's product with probability 0.5. If the platform chooses to avoid competition and advertise to the other buyer, the platform earns: $\frac{1}{2}\pi_M + \frac{1}{2}r\pi_M$ – with probability $\frac{1}{2}$ the platform advertises its own product to the potential buyer and with probability $\frac{1}{2}$ it advertises the seller's product to the potential buyer. If the platform chooses to have both products targeted at the same buyer, with probability $\frac{1}{2}$, both products are advertised to the potential buyer and the platform earns $\frac{1}{2}\pi_P^C(r,\sigma)$. Comparing the two options, we obtain the following result:

Lemma 3. *When the seller does not reveal its private information, the platform always avoids competition and advertises the seller's product to one of the buyers and its own product to the other buyer. That is,*

$$\frac{1}{2}\pi_M + \frac{1}{2}r\pi_M > \frac{1}{2}\pi_P^C(r,\sigma).$$

That is, acting monopolistically in two separate markets is more profitable than competing over the same buyer, specifically when there is only a probability of $\frac{1}{2}$ that this specific buyer is indeed the potential buyer. Another way to understand this result is to see that that value of $\pi_P^C(r,\sigma)$ when $\sigma = 0$ is $\pi_P^C(r,0) = \pi_M(r,0) + r\pi_M(r,0) = \pi_M + r\pi_M$; furthermore, $\pi_P^C(r,0)$ is decreasing in σ, based on Assumption 3, and thus, when not informed, the platform is always better off avoiding competition.

Finally, we consider the first stage of the game–the seller's decision whether to reveal its private information. The analysis above identified two interesting regions. Suppose first that $\sigma > \widetilde{\sigma}(r)$. In this region, the seller knows that if it reveals its information, the informational spillover is anti-competitive: the platform will avoid competition. Hence, under this region, the seller always reveals its information-.

Suppose now that $\sigma < \widetilde{\sigma}(r)$. In this case, the seller faces a trade-off. If it reveals its information, the informational spillover is pro-competitive: the platform will compete with it on the potential buyer, and the seller earns $\pi_S^C(r,\sigma)$. If the seller does not reveal its information, the platform avoids competition, but the seller's ad would be assigned to the potential buyer with probability of $\frac{1}{2}$, resulting in the seller earning a profit of $\frac{1}{2}\pi_M(1-r)$. Hence, the seller chooses to reveal its private information if and only if $\pi_S^C(r,\sigma) > \frac{1}{2}\pi_M(1-r)$. The following lemma summarizes the result:

Lemma 4. *If the seller expects that sharing its information would result in the platform competing with it directly, the seller conceals its information only if products are close substitutes. That is, there is a threshold, $\widehat{\sigma}(r)$, such that the seller conceals information ($\pi_S^C(r,\sigma) < \frac{1}{2}\pi_M(1-r)$) if $\sigma > \widehat{\sigma}(r)$. Moreover, $0 < \widehat{\sigma}(0) < 1$, $\widehat{\sigma}(r)$ is increasing with r, and $\widehat{\sigma}(1) > \widetilde{\sigma}(1)$.*

The intuition is simple. When the two products are close substitutes, competition has a large negative effect on profits. . Thus, knowing that it would face competition from the platform, the seller chooses not to reveal its information, even though this lowers its probability of targeting the potential buyer.

The commission rate r also has important implications to the seller's choice. Recall that as r increases, the platform has stronger incentives to soften competition because it internalizes the revenues from the seller's sale. As a result, the higher the fee the platform charges, the smaller the region for which it is profitable for the seller to conceal its information.

Combining Lemmas 2 - 4, we are ready to characterize the equilibrium:

Proposition 1. ***(Seller conceals information when substitution is intermediate)*** *The seller conceals its private information when substitution between the seller and the platform is intermediate. That is:*

(i) *For $\sigma > \widetilde{\sigma}(r)$, the seller <u>reveals</u> the characteristics of the target buyer and the platform <u>does not enter</u> the market.*

(ii) *For* $\sigma \in [\widehat{\sigma}(r), \widetilde{\sigma}(r)]$, *the seller* <u>*conceals*</u> *information and the platform enters but* <u>*avoids competition*</u>.

(iii) *For* $\sigma < \min\{\widehat{\sigma}(r), \widetilde{\sigma}(r)\}$, *the seller* <u>*reveals*</u> *the characteristics of the target buyer and the platform* <u>*targets*</u> *this buyer.*

(iv) *When* r *approaches* 0, $\widehat{\sigma}(r) < \widetilde{\sigma}(r)$ *and when* r *approaches* 1, $\widehat{\sigma}(r) > \widetilde{\sigma}(r)$.

Figure 2 illustrates the results of Proposition 1 for the case of the linear demand function.

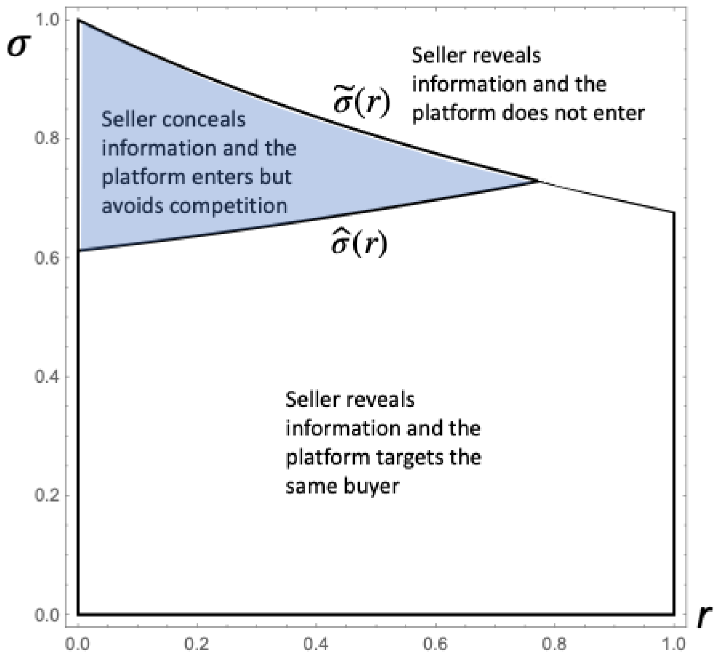

Figure 2: Equilibrium outcome for the case of the linear demand function.

As illustrated in Figure 2, the threshold functions $\widehat{\sigma}(r)$ and $\widetilde{\sigma}(r)$ divide the parameter space of σ and r into three distinct regions. When $\sigma > \widetilde{\sigma}(r)$, the products are close substitutes, leading the platform to avoid competing with the seller, even when it knows the identity of the potential buyer. Foreseeing that informational spillover is anti-competitive, the seller opts to disclose its private information, as this ensures that its advertisement will target the potential buyer, allowing the seller to operate as a monopoly.

When $\sigma \in [\widehat{\sigma}(r), \widetilde{\sigma}(r)]$, the level of competition is moderate. In this scenario, if the platform knows the identity of the potential buyer, it chooses to compete directly with the seller, which significantly harms the seller. The seller, anticipating the pro-competitive informational spillover, opts to withhold its private information, understanding that this decision will lead the platform to avoid direct competition. Thus, competition is avoided because the seller chooses to have its ad placed on the potential buyer with only a probability of $\frac{1}{2}$.

Finally, when $\sigma < \min\{\widehat{\sigma}(r), \widetilde{\sigma}(r)\}$, the products are sufficiently differentiated, reducing the impact of competition. Consequently, in this region, the seller also reveals the identity of the potential buyer, despite the pro-competitive informational spillover in which the platform directly competing with it. That is, the seller chooses to reveal information in two regions–when $\sigma > \widetilde{\sigma}(r)$ and when $\sigma < \min\{\widehat{\sigma}(r), \widetilde{\sigma}(r)\}$–but for different reasons. In the first case, intense competition drives the platform to stay out of the market, leaving the seller as a monopoly. In the second case, the level of competition is low, so even when facing competition from the platform, the seller is not overly concerned about the negative consequences of competition and reveals information to ensure its ad targets the potential buyer.

The equilibrium described in Proposition 1 carries also important implications for social welfare. In our model, among the three potential market outcomes described in Proposition 1, social welfare is the highest when both the the seller and the platform target the potential buyer, as this results in the buyer purchasing both products, and competition driving prices down. Therefore, when $\sigma < \min\{\widehat{\sigma}(r), \widetilde{\sigma}(r)\}$, social welfare is indeed the highest. In all other cases, social welfare is sub-optimal due to two sources of inefficiency. First, the lack of competition between the two products, resulting in higher prices and less variety than the desirable outcome. Second, there is a social cost, $D > 0$, when the platform advertises to the non-buyer. When $\sigma > \widetilde{\sigma}(r)$, the first source of inefficiency is observed, as only the seller operates in the market and charges a monopoly price from the target buyer. When $\sigma \in [\widehat{\sigma}(r), \widetilde{\sigma}(r)]$, although both the platform and the seller are active in the market, each serves a different buyer and charges a monopoly price for its product. Hence, in this region, the market is characterized by both sources of inefficiency: there is no competition over the target buyer and the non-target buyer incurs disutility from being exposed to irrelevant product. We summarize the discussion regarding social welfare using the following Corollary.

Corollary 1. ***(Welfare implications)*** *Social welfare is the highest when the following two conditions are satisfied: 1) the seller and the platform compete over the target buyer; 2) the platform does not advertise to the non-buyer. Hence:*

(*i*) *When $\sigma < \min\{\widehat{\sigma}(r), \widetilde{\sigma}(r)\}$, the market is welfare enhancing.*

(*ii*) *When $\sigma \in [\widehat{\sigma}(r), \widetilde{\sigma}(r)]$, social welfare is sub-optimal because of lack in competition over the target buyer and the platform advertises to the non-buyer.*

(*iii*) *When $\sigma > \widetilde{\sigma}(r)$, social welfare is sub-optimal because of lack in competition over the target buyer.*

4 Potential Remedies

Given the presence of market inefficiencies, below we consider two alternative policies–vertical separation and the implementation of a firewall–and analyze their effectiveness in mitigating these inefficiencies. Under vertical separation, the regulator prohibits the platform from selling its own products. This enforces a division between the platform's role as a marketplace and its ability to sell competing goods. To maintain the availability of two products, we assume that the competing product is managed by a different, independent seller. In the case of a firewall, the regulator allows the platform to sell its own products, but with an informational barrier. This firewall separates the platform's marketplace operations from its selling activities, ensuring that any information the platform receives from the seller cannot be used to decide which buyer to target with its own product.

4.1 Vertical separation

Under vertical separation, we assume the presence of two independent sellers: Seller 1, who is has private information on the potential buyer's characteristics, and Seller 2, who lacks this information. As before, if Seller 1 chooses to share its information with the platform, the platform must target the potential buyer with Seller 1's ad. Since Seller 2 has no knowledge of the potential buyer's characteristics, it is up to the platform to decide which buyer will receive Seller 2's ad.

The timing of this modified game is as follows: First, Seller 2 decides whether to join the platform and will do so only if it expects to gain positive profits. Then, Seller 1 decides whether to disclose the potential buyer's characteristics to the platform. Next, based on the information provided by Seller 1, the platform allocates the ads of both sellers to the two buyers. Finally, the sellers simultaneously set their prices.

We start our analysis from the last stage - price setting by the sellers, assuming that Seller 2 operates in the market. Due to the nature of the commission based contract between the sellers and the platform, if the platform allocates both sellers to the same buyer, the equilibrium prices are unaffected by the commission rate r. Hence, we can denote the competitive prices as $p_1^C(\sigma) \equiv p_1^C(0,\sigma)$ and $p_2^C(\sigma) \equiv p_2^C(0,\sigma)$, where $p_i^C(0,\sigma)$, $i = 1,2$ are the equilibrium prices that are the solution to equations (3) and (4), evaluated at $r = 0$. Comparing prices under vertical integration with prices under vertical separation, we obtain the following result:

Lemma 5. *Under vertical separation, when both sellers compete on the same buyer, price competition is more intense than under vertical integration. That is, for all* $r > 0$ *and*

$0 < \sigma < 1$, *$p_1^C(\sigma) < p_1^C(r, \sigma)$ and $p_2^C(\sigma) < p_2^C(r, \sigma)$.*

Recall from Lemma 1 that when the platform competes with Seller 1, it benefits from the financial success of this seller through the commission channel. As a result, the platform tends to soften the competition by setting a higher price. In contrast, when an independent seller competes against Seller 1, this seller does not benefit from a similar revenue stream, and therefore sets a lower price than the platform does. Given the strategic complementarity in price competition, Seller 1 responds by also setting a lower price than $p_1^C(r, \sigma)$. We further define $\widehat{\sigma} \equiv \widehat{\sigma}(0)$, and we note that $\widehat{\sigma} < \widehat{\sigma}(r)$ for any $r \in (0, 1]$. This value of $\widehat{\sigma}$ will prove to be useful as we turn to examine the platform's decision regarding the allocation of the two ads among the two buyers.

Lemma 6. *Under vertical separation, when Seller 2 joins the platform:*

(i) if Seller 1 reveals its information, the platform advertises both sellers' products to the potential buyer if $\sigma \leq \widehat{\sigma}$. If $\sigma > \widehat{\sigma}$, the platform avoids competition at allocates Seller 2's ad to the non-buyer.

(ii) if Seller 1 conceals its information, the platform avoids competition and allocates each seller's ad to a different buyer.

As in the case of vertical integration, when the platform receives information, it will avoid encouraging competition between the sellers if the level of substitution between the products exceeds a certain threshold, $\widehat{\sigma}$. Values above this threshold represent products that are closely substitutable such that competition diminishes the payoffs for both sellers, which in turn reduces the platform's earnings from commission. When the level of substitution between the products is low (specifically, below $\widehat{\sigma}$), the platform benefits from exposing the potential buyer to both products. In this case, the platform leverages the information revealed by Seller 1 to introduce competition which in turn results in larger quantity and higher revenues–thereby, increasing its own profitability. The threshold value of substitution above which the platform avoids competition is lower under vertical separation than under vertical integration: $\widehat{\sigma} < \widehat{\sigma}(r)$. That is, under vertical separation, the platform avoids competition for a wider parameter region than under vertical integration. This is due to two reasons: First, recall that under vertical separation competition is more intense than under vertical integration. Second, under vertical separation the platform cannot collect all the revenues of Seller 2, hence it is less profitable for the platform to allow Seller 2 to compete with Seller 1. As we show below, this feature will play a crucial role in the comparison between vertical integration and separation.

Next, we analyze Seller 1's choice whether to reveal information, given that Seller 2 joined the platform.

Lemma 7. *If, given information revelation, there is competition over the potential buyer, then seller* 1 *will choose not to reveal information iff* $\sigma > \widehat{\sigma}$.

Lemma 7 highlights the impact of competition when the two sellers are independent, as opposed to the case of vertical integration (see Section 3). Under vertical integration, the competition between the platform and Seller 1 is less intense compared to vertical separation as the platform internalizes some of the negative effects competition has on Seller 1's profits. As a result, relative to vertical separation, under vertical integration, Seller 1 will opt to reveal information even when products are closer substitutes. That is, under vertical separation, Seller 1 reveals information when $\sigma < \widehat{\sigma} \leq \widehat{\sigma}(r)$. We can thus conclude that under vertical separation, Seller 1 is less likely to reveal information in the presence of competition, opting not to do so across a broader range of parameter values.

Next, consider Seller 2's decision on whether to join the platform. When $\sigma < \widehat{\sigma}$, Seller 2 knows that after joining the platform Seller 1 reveals information and a pro-competitive informational spillover effect will occur: the platform will display the ad of Seller 2 to the potential buyer, alongside Seller 1's, resulting in positive profit for Seller 2. Hence, Seller 2 joins the platform. Therefore, in this region, the platform leverages the information provided by Seller 1 to foster competition between the two sellers. Yet, if $\sigma > \widehat{\sigma}$, the information revealed by Seller 1 leads to a anti-competitive informational spillover effect. Now, the platform uses the information to suppress competition and grantsSeller 1 with monopoly power over the potential buyer; leaving Seller 2 to target the non-buyer. Anticipating this, Seller 2 elects to join the market only when σ is high enough. The following proposition summarizes the results.

Proposition 2. ***(vertical separation)***. *Suppose that the platform faces a seller with private information (Seller 1) and a seller with no information (Seller 2), then:*

(i) *When $\sigma > \widehat{\sigma}$, there is an anti-competitive informational spillover effect: Seller 2 does not enter, Seller* 1 *reveals its information and the platform advertises the product of Seller 1 to the potential buyer.*

(ii) *When $\sigma \leq \widehat{\sigma}$, there is a pro-competitive informational spillover effect: Seller 2 enters, Seller* 1 *reveals its information and the platform displays both sellers' ads to the potential buy*er.

This result indicates that informational spillover between the informed and the uniformed sellers does not always benefit the uniformed seller. When substitution is high, the informed seller uses its superior information to deter the uniformed seller from entering the market. Only when substitution is low, there is a pro-competitive informational spillover and the uniformed seller benefits from the information revealed by the informed seller.

The results above show that vertical separation differs from vertical integration in two key ways. First, firms have a stronger incentive to avoid competition under vertical separation than under vertical integration. Second. Seller 1's decision to reveal or conceal information depends on how revealing the information affects the platform's incentive to suppress or promote competition.

To see how these two dimensions determine the results, Figure 3 contrasts vertical integration with vertical separation, given our linear demand example. The figure shows that vertical separation is qualitatively different from vertical integration when $\sigma \in (\widehat{\sigma}(r), \widetilde{\sigma}(r))$ (the blue region), and when $\sigma \in (\widehat{\sigma}, \widehat{\sigma}(r))$ (the red region).

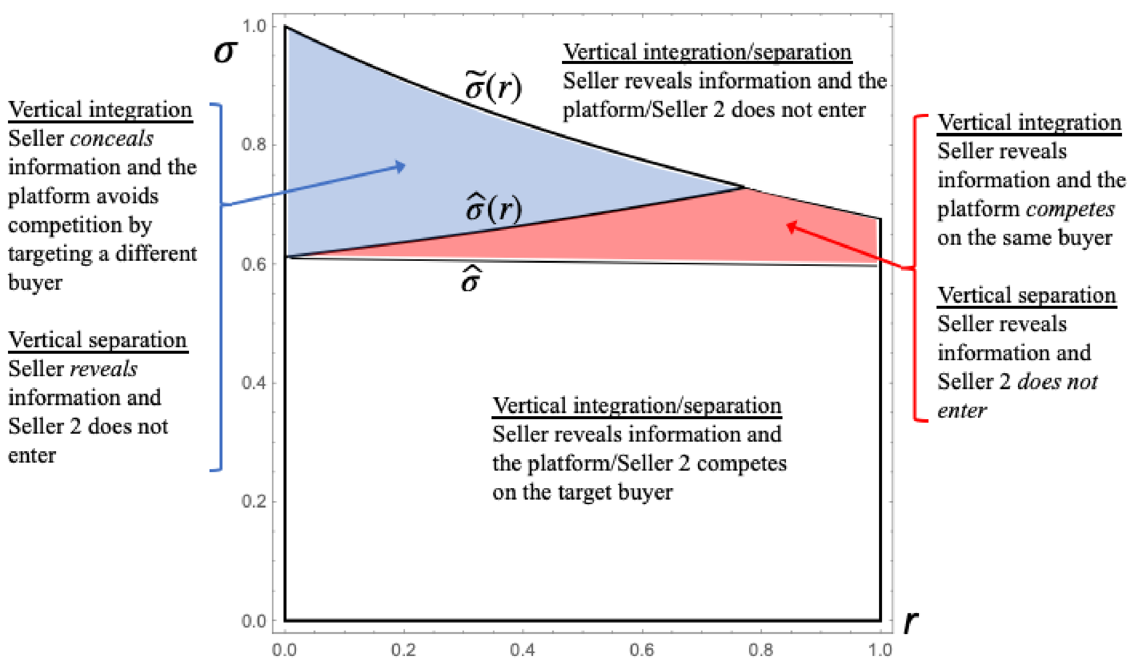

Figure 3: $\widetilde{\sigma}(r)$ and $\widehat{\sigma}(r)$ and $\widehat{\sigma}$ as a function of r, in the linear demand example

When $\sigma \in (\widehat{\sigma}(r), \widetilde{\sigma}(r))$, under vertical integration, Seller 1 withholds information from the platform due to the platform's strong incentive to compete. If disclosed, the platform would compete directly with the seller. Consequently, Seller 1 strategically decides not to disclose information, causing the platform to allocate ads across the two buyers without knowing the identity of the potential buyer. In contrast, under vertical separation alters the platform's incentives. Specifically, the platform is no longer interested in fostering competition , resulting in Seller 1 revealing its information without fearing it would be used to foster competition. As a result, in this region, competition does not arise under neither vertical integration nor separation, but vertical separation encourages information disclosure. The platform then focuses solely on advertising to the potential buyer, effectively excluding Seller 2 from the market. This property is summarized in the following corollary.

Corollary 2. ***(conditions under which vertical separation improves welfare)*** *When $\sigma \in (\widehat{\sigma}(r), \widetilde{\sigma}(r))$, under both vertical integration and separation, there is no competition on the potential buyer. Yet, no-information is revealed by Seller 1 under vertical integration and the platform advertises to both buyers. Under vertical separation, information is revealed and the platform advertises only to the potential buyer. Hence, vertical separation improves welfare.*

While Corollary 2 indicates that vertical separation promotes information revelation and improves welfare, this welfare enhancing effect does not extend to the region $\sigma \in (\widehat{\sigma}, \widehat{\sigma}(r))$ – the red region in Figure 3. In this parameters space, Seller 1 reveals its information under both structures, but for two different reasons. Under vertical integration because Seller 1 anticipates the platform not to compete too fiercely and is thus willing to disclose its information, even when knowing that this will result in a pro-competitive informational spillover effect. Under vertical separation, Seller 1 reveals its information because it knows that the platform would refrains from allocating Seller 2's ad to the same buyer, and the information will have an anti-competitive informational spillover effect. We summarize this result by noting that policymakers should exercise extreme caution when considering regulation that prevents platforms from selling their own products and enforces vertical separation, as such a policy may unintentionally result in a reduction of overall welfare.

Corollary 3. ***(conditions under which vertical separation reduces welfare)*** *When $\sigma \in (\widehat{\sigma}, \widehat{\sigma}(r))$, under both vertical integration and separation, the seller reveals information. Yet, under vertical integration there is competition on the potential buyer while under vertical separation the platform avoids competition. Thus, vertical separation is welfare reducing.*

Notably, there are two regions where the two market structures result in qualitatively similar equilibrium outcomes. First, when differentiation is low, $\sigma \leq \widehat{\sigma}$, under both structures information is revealed, and the market exhibits competition on the potential buyer. Still, payoffs and consumer surplus differ across the structures. Specifically, under vertical integration, the seller and the platform benefit from softer competition, compared with vertical separation, resulting in higher total payoff for the firms and lower consumer surplus.The second region is when differentiation is high, $\sigma > \widetilde{\sigma}(r)$. In this case, information is again revealed under both structures. Yet, here, the platform avoids competition and lets Seller 1 to operate monopolistically. As result, overall payoffs and consumer surplus are identical under both market structures. The following corollary summarizes these observations.

Corollary 4. ***(conditions under which both structures are identical)*** *(i) When $\sigma > \widetilde{\sigma}(r)$, under both market structures, seller 1 reveals its information, and there is no competition over the potential buyer. Thus, firms' payoffs and consumer surplus are identical across both market structures.*

(ii) When $\sigma \leq \widehat{\sigma}$, under both market structures, information is revealed and there is competition over the potential buyer. However, under vertical separation competition is more intense. Thus: (a) Firms' total payoff under vertical separation is lower than under vertical integration. (b) Consumer surplus under vertical separation is higher than under vertical integration.

Finally, we turn to ask whether the platform prefers vertical integration over vertical separation. The next result shows that the platform's profit under vertical integration is higher than under vertical separation. Therefore, the platform will never choose to voluntarily vertically separate, even when doing so motivates the seller to reveal information. This implies that whenever vertical separation is welfare enhancing, it must be imposed by regulation.

Proposition 3. ***(Platform always prefers vertical integration)*** *When $\sigma < \widetilde{\sigma}(r)$ (vertical separation is meaningful), the platform's profits under vertical integration are higher than under vertical separation.*

4.2 Vertical integration with an informational firewall

The second policy we examine is the implementation of an informational firewall. In this case, the platform's decision regarding whether to be active in the product market and if so which buyer to target is independent of Seller 1's information, even when the seller chooses to reveal its information.

As discussed in the Introduction, the issue of an informational firewall has been a topic of regulatory debate. For example, in the European Union, The Digital Markets Act (DMA), which came into effect in 2023, includes provisions designed to limit how large online platforms, identified as "gatekeepers," use data from third-party sellers. One of the key requirements is that these platforms must not use non-public data obtained from their business users to compete against those users. This is effectively a mandate for data separation, ensuring that data collected in one part of the business (e.g., the marketplace) cannot be exploited by another part (e.g., the platform's own retail operations). In the U.S., The American Innovation and Choice Online Act, introduced in the U.S. Congress, includes provisions that would prevent dominant platforms from using non-public data from business users to unfairly benefit their own products. This has been described as a "data firewall" approach, where the platform's marketplace operations would be separated from its own retail business operations. This bill represents a legislative attempt to enforce data separation and limit how dominant platforms can use sellers' data, preventing them from unfairly leveraging this information to compete with third-party sellers.

Proposition 4 below provides a characterization of the equilibrium outcome when an informational firewall is implemented. In this case, Seller 1 chooses to always reveal its information and the platform chooses to enter the market only when the substitution level is below the threshold $\widetilde{\sigma}(r)$. In this case, the platform chooses randomly between the two buyers, and therefore competes with Seller 1 with a probability of $\frac{1}{2}$.

Proposition 4. ***(informational firewall).*** *Suppose that an informational firewall is implemented. Then, the seller always reveals information. Moreover:*

(i) *if $\sigma > \widetilde{\sigma}(r)$, the platform does not enter and the seller serves the potential buyer monopolistically.*

(ii) *if $\sigma \leq \widetilde{\sigma}(r)$, the platform enters and randomly advertises to one of the two buyers. There is competition or monopoly on the potential buyer with equal probabilities.*

Figure 4 illustrates the comparison between vertical integration with and without an informational firewall. There are three regions to consider. The most interesting region is the blue region, where $\sigma \in [\widehat{\sigma}(r), \widetilde{\sigma}(r)]$. This is the only region where a firewall, in fact, changes the seller's behavior and facilitates information sharing. Specifically, without a firewall, Seller 1 withholds information, and the platform randomly displays ads of each product to a different buyer. This creates two types of inefficiencies. the potential buyer's market is monopolized, and the non-buyer suffers a disutility D from receiving an irrelevant ad. An informational firewall improves welfare through these two avenues. Specifically, because the seller reveals information, the potential buyer's market is monopolized only with probability half, and competitive with probability half. Moreover, the non-buyer receives an irrelevant ad only with probability of a $\frac{1}{2}$.

Interestingly, in the red region where $\sigma < \min\{\widehat{\sigma}(r), \widetilde{\sigma}(r)\}$, an informational firewall reduces welfare. Specifically, without a firewall, the seller reveals information, and the platform competes with the seller for the potential buyer. With a firewall, the platform allocates its ad randomly, leading to competition with only a probability of a $\frac{1}{2}$. That is, with probability $\frac{1}{2}$, not only the seller has monopolistic power over the potential buyer but also the non-buyer bears the cost of an irrelevant ad.

Finally, when $\sigma > \widetilde{\sigma}(r)$, an informational firewall does not affect the equilibrium outcome or overall welfare. Therefore, similar to Corollary 3, implementing a regulation that mandates an informational firewall should be done with careful consideration of different market parameters, as imposing such a policy under certain conditions could unintentionally reduce welfare.

The following Corollary summarizes the effect of the informational firewall on overall welfare.

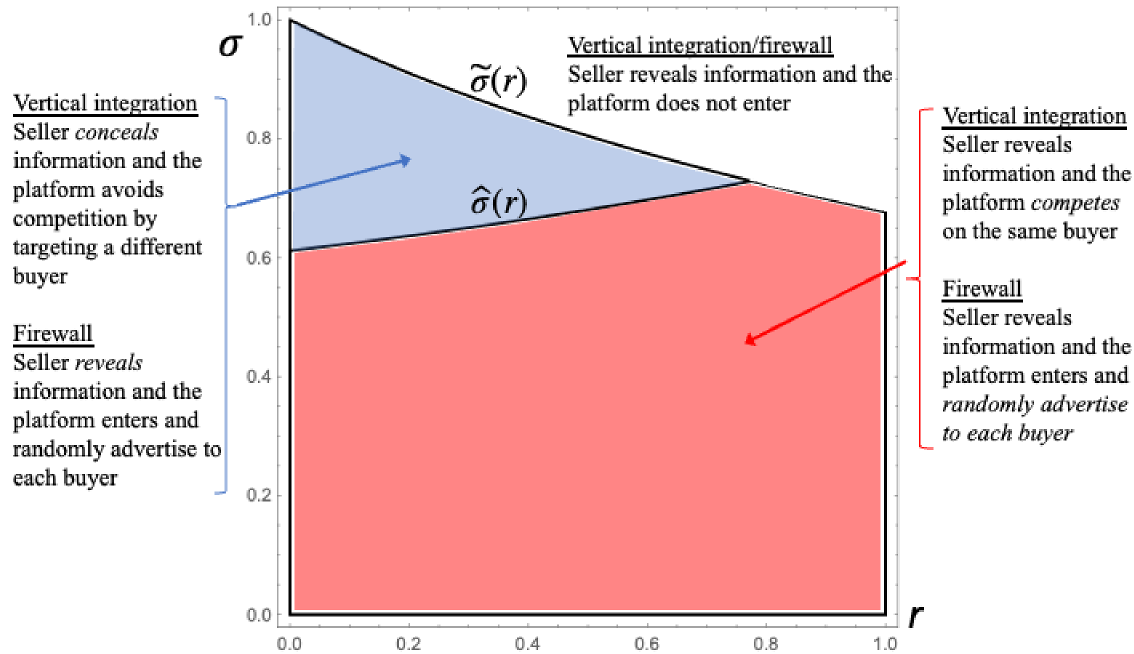

Figure 4: Comparison of the market outcome with and without firewall in the linear demand example

Corollary 5. ***(welfare implications of a firewall)*** *Consider an informational firewall between the platform's marketplace and product divisions. In comparison with vertical integration with no firewall:*

(*i*) *When* $\sigma < \min\{\widehat{\sigma}(r), \widetilde{\sigma}(r)\}$, *an informational firewall is welfare reducing.*

(*ii*) *When* $\sigma \in [\widehat{\sigma}(r), \widetilde{\sigma}(r)]$, *an informational firewall is welfare enhancing.*

(*iii*) *When* $\sigma > \widetilde{\sigma}(r)$, *an informational firewall does not affect welfare.*

Given that an informational firewall motivates the seller to reveal its information and the platform receives a commission fee of r from advertising the seller's product to the potential buyer, one may wonder whether the platform will voluntarily elect to impose an informational firewall within its organization. The platform will choose such an option, if its payoff when using the informational firewall is higher than when such a mechanism is absent. The next result shows that the platform will never choose to voluntarily implement an informational firewall. This implies, that if an informational firewall is welfare enhancing, as shown in Corollary 5 for some market conditions, a regulator may consider to impose it by legislation.

Proposition 5. *Under vertical integration, the platform's profits are always higher when an informational firewall is not implemented.*

5 Conclusion

We consider a seller that is privately informed about the characteristics of its potential buyers. The seller can ask an uninformed marketplace platform to advertise its product to its potential buyers. Doing so may result in a pro-competitive informational slipover, as the platform can advertise its own substitute product to the same buyers.

We find that for intermediate levels of substitution between the products of the platform and the seller, the seller does not reveal its private information to the platform in order to prevent the pro-competitive informational slipover. This creates a market inefficacy for two reasons. First, advertising does not necessarily target the potential buyers and, second, there is no competition on the potential buyers.

To solve this market inefficacy, we study the effect of two potential remedies. The first remedy is vertical separation between the platform and the unit selling its product, making it an independent and uninformed seller. We find that vertical separation intensifies competition and therefore has the welfare enhancing effect of motivating the seller to reveal its private information. However, vertical separation may create an anti-competitive informational spillover, such that when the informed seller reveals its private information, the platform avoids competition and grant this seller a monopoly position.

The second remedy that our paper considers is an informational firewall between the informed seller and the platform. We find that an informational firewall motivates the informed seller to reveal its private information, but may prevent the platform from competing with the seller in the potential buyers.

For public policy, our paper identifies under which market conditions, each remedy can increase or decrease social welfare.

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Appendix A

Below are the proofs for all lemmas and propositions in the text.

Proof of Lemma 1:
The first order conditions are:

$$\frac{\partial \pi_S^C(p_1, p_2; \sigma)}{\partial p_1} = q_1(p_1, p_2; \sigma) + p_1 \frac{\partial q_1(p_1, p_2; \sigma)}{\partial p_1} = 0, \tag{5}$$

$$\frac{\partial \pi_P^C(p_2, p_1; \sigma)}{\partial p_2} = p_1 \frac{\partial q_1(p_1, p_2; \sigma)}{\partial p_2} r + q_2(p_2, p_1; \sigma) + p_2 \frac{\partial q_2(p_2, p_1; \sigma)}{\partial p_2} = 0. \tag{6}$$

From symmetry and because $\frac{\partial q_1(p_1,p_2;\sigma)}{\partial p_2} > 0$ and $r > 0$, we have that evaluated at $p_1 = p_2 = p$, $\frac{\partial \pi_P^C(p,p;\sigma)}{\partial p_2} > \frac{\partial \pi_S^C(p,p;\sigma)}{\partial p_1}$, implying that the solution to (5) and (6) satisfies $p_2^C(r,\sigma) > p_1^C(r,\sigma)$. Because $\frac{\partial \pi_P^C(p,p;\sigma)}{\partial p_2}$ is increasing in r, $p_2^C(r,\sigma)$ is increasing in r and because by Assumption 1, prices are strategic complements, $p_1^C(r,\sigma)$ is also increasing in r. The result that $p_M > p_2^C(r,\sigma) > p_1^C(r,\sigma) > 0$ follows directly from Assumption 2.

Proof of Lemma 2:
When $\sigma = 1$, $p_1^C(r,1) = p_2^C(r,1) = 0$, hence $\pi_P^C(r,1) - r\pi_M = -r\pi_M < 0$. When $\sigma = 0$, $p_1^C(r,0) = p_2^C(r,0) = p_M$, hence $\pi_P^C(r,0) - r\pi_M = r\pi_M + \pi_M - r\pi_M = \pi_M > 0$. Because by Assumption 3, $\pi_P^C(r,\sigma)$ is decreasing in σ, $\pi_P^C(r,\sigma) - r\pi_M$ is decreasing in σ and there is a unique solution to $\pi_P^C(r,\widetilde{\sigma}(r)) = r\pi_M$, such that $\pi_P^C(r,\sigma) - r\pi_M > 0$ if and only if $\sigma < \widetilde{\sigma}(r)$. We further have that $\widetilde{\sigma}(0) = 1$ because when $r = 0$ and $\sigma = 1$, $\pi_P^C(0,1) - 0\pi_M = 0$ as $p_1^C(0,1) = p_2^C(0,1) = 0$. Moreover, by the first part of the proof, when $r = 1$, $\pi_P^C(1,1) - \pi_M = -\pi_M < 0$ and $\pi_P^C(1,0) - \pi_M = \pi_M + \pi_M - \pi_M = \pi_M > 0$, implying that $1 > \widetilde{\sigma}(1) > 0$.

Proof of Lemma 3:
Let $q_i^C(r,\sigma) \equiv q_i(p_i^C(r,\sigma), p_j^C(r,\sigma); \sigma)$. We have:

$$\pi_M + r\pi_M - \pi_P^C(r,\sigma) = \pi_M + r\pi_M - \left(rq_1^C(r,\sigma)p_1^C(r,\sigma) + q_2^C(r,\sigma)p_2^C(r,\sigma)\right)$$

$$= \left(\pi_M - q_2^C(r,\sigma)p_2^C(r,\sigma)\right) + r\left(\pi_M - q_1^C(r,\sigma)p_1^C(r,\sigma)\right) > 0,$$

where the inequality follows because the terms in the two brackets of the second line are positive, as by Lemma 1, $p_M > p_i^C(r,\sigma)$.

Proof of Lemma 4:
Giver r, $\pi_S^C(r,\sigma) = p_1^C(r,\sigma)q_1^C(r,\sigma)(1-r) > \frac{1}{2}\pi_M(1-r)$ if and only if $p_1^C(r,\sigma)q_1^C(r,\sigma) - \frac{1}{2}\pi_M > 0$. Evaluated at $\sigma = 0$, $p_1^C(r,0)q_1^C(r,0) - \frac{1}{2}\pi_M = \pi_M - \frac{1}{2}\pi_M = \frac{1}{2}\pi_M > 0$. At $\sigma = 1$,

$p_1^C(r,1)q_1^C(r,1) - \frac{1}{2}\pi_M = 0 - \frac{1}{2}\pi_M < 0$. Because by Assumption 3, $p_1^C(r,\sigma)q_1^C(r,\sigma)$ is decreasing in σ, there is a unique $\widehat{\sigma}(r)$ such that $\pi_S^C(r,\sigma) > \frac{1}{2}\pi_M(1-r)$ if and only if $\sigma < \widehat{\sigma}(r)$, where $\widehat{\sigma}(r)$ is the solution to $\pi_S^C(r,\widehat{\sigma}(r)) = \frac{1}{2}\pi_M(1-r)$. Moreover, this solution satisfies $0 < \widehat{\sigma}(r) < 1$ for all r. Next, $\widehat{\sigma}(r)$ is increasing in r because by Lemma 1, as r increases, $p_1^C(r,\sigma)$ and $p_2^C(r,\sigma)$ increases, implying that $\pi_S^C(r,\sigma)$ increases. Hence, as r increases, to satisfy $\pi_S^C(r,\widehat{\sigma}(r)) = \frac{1}{2}\pi_M(1-r)$, $\widehat{\sigma}(r)$ has to increase (as recall that by Assumption 3, $\pi_S^C(r,\sigma)$ is decreasing in σ.

Finally, we turn to show that $\widehat{\sigma}(1) > \widetilde{\sigma}(1)$. To this end, suppose that $r = 1$ and $\sigma = \widehat{\sigma}(1)$. To show that $\widehat{\sigma}(1) > \widetilde{\sigma}(1)$, we need to show that evaluated at $\sigma = \widehat{\sigma}(1)$, $\pi_P^C(1,\widehat{\sigma}(1)) < 1 \times \pi_M$. We have

$$\pi_P^C(1,\widehat{\sigma}(1)) - 1 \times \pi_M = p_1^C(1,\widehat{\sigma}(1))q_1^C(1,\widehat{\sigma}(1)) \times 1 + p_2^C(1,\widehat{\sigma}(1))q_2^C(1,\widehat{\sigma}(1)) - \pi_M$$

$$= p_1^C(1,\widehat{\sigma}(1))q_1^C(1,\widehat{\sigma}(1)) + p_2^C(1,\widehat{\sigma}(1))q_2^C(1,\widehat{\sigma}(1)) - 2p_1^C(1,\widehat{\sigma}(1))q_1^C(1,\widehat{\sigma}(1))$$

$$= p_2^C(1,\widehat{\sigma}(1))q_2^C(1,\widehat{\sigma}(1)) - p_1^C(1,\widehat{\sigma}(1))q_1^C(1,\widehat{\sigma}(1)) < 0,$$

where the first equality follows because evaluated at $\sigma = \widehat{\sigma}(1)$, $\frac{1}{2}\pi_M = p_1^C(1,\widehat{\sigma}(1))q_1^C(1,\widehat{\sigma}(1))$ and therefore $\pi_M = 2p_1^C(1,\widehat{\sigma}(1))q_1^C(1,\widehat{\sigma}(1))$ and the last inequality follows because by Lemma 1, $p_M > p_2^C(1,\widehat{\sigma}(1)) > p_1^C(1,\widehat{\sigma}(1))$

Proof of Proposition 3:

Suppose first that $\widehat{\sigma}(r) < \sigma < \widetilde{\sigma}(r)$. Under vertical integration, the platform earns $\frac{1}{2}r\pi_M + \frac{1}{2}\pi_M$. Under vertical separation, the platform earns $r\pi_M$. We have that $\frac{1}{2}r\pi_M + \frac{1}{2}\pi_M > r\pi_M$ because $r < 1$.

Next, suppose that $\widehat{\sigma} < \sigma < \min\{\widehat{\sigma}(r), \widetilde{\sigma}(r)\}$. Under vertical integration the platform earns $\pi_P^C(r,\sigma)$ while it earns $r\pi_M$ under vertical separation. From the definition of $\widetilde{\sigma}(r)$, recall that $\pi_P^C(r,\sigma) > r\pi_M$ if $\sigma < \widetilde{\sigma}(r)$.

Finally, suppose that $\sigma < \widehat{\sigma}$. Under vertical integration, the platform earns $\pi_P^C(r,\sigma)$, while under vertical separation, it earns $r\left(p_1^C(0,\sigma)q_1^C(0,\sigma) + p_2^C(0,\sigma)q_2^C(0,\sigma)\right)$. We have:

$$\pi_P^C(r,\sigma) = rp_1^C(r,\sigma)q_1^C(r,\sigma) + p_2^C(r,\sigma)q_2^C(r,\sigma)$$

$$> r\left(p_1^C(r,\sigma)q_1^C(r,\sigma) + p_2^C(r,\sigma)q_2^C(r,\sigma)\right)$$

$$> r\left(p_1^C(0,\sigma)q_1^C(0,\sigma) + p_2^C(0,\sigma)q_2^C(0,\sigma)\right),$$

where the first inequality follows because $r < 1$ and the second inequality follows because prices increase with r and become closer to the monopoly prices.

Proof of Proposition 4:

Given informational firewall, the seller always reveals information and asks to be placed on the target buyer, because revealing information has no effect on the platform's decision on whether to compete with the seller. The platform advertises the seller's product to the target buyer and has two options. First, to enter and advertise its own product to each buyer with probability $\frac{1}{2}$. In this case, with probability $\frac{1}{2}$ the platform advertises to the target buyer and there is competition between the platform and the seller, otherwise the platform advertises to the non-buyer and the seller is a monopoly on the target buyer. The platform earns from entry $\frac{1}{2}\pi_P^C(r,\sigma) + \frac{1}{2}r\pi_M$. Alternatively, the platform can stay out, in which case the seller is a monopoly on the target buyer and the platform earns $r\pi_M$. The platform prefers entry if: $\frac{1}{2}\pi_P^C(r,\sigma) + \frac{1}{2}r\pi_M - r\pi_M = \frac{1}{2}(\pi_P^C(r,\sigma) + r\pi_M) > 0$. Notice that this is the same condition that defined $\widetilde{\sigma}(r)$ (i.e., $\pi_P^C(r,\sigma) > r\pi_M$).

Proof of Proposition 5:

Consider first the region in which $\sigma \in [\widehat{\sigma}(r), \widetilde{\sigma}(r)]$. Then, the platform's profit without firewall is: $\frac{1}{2}\pi_M + \frac{1}{2}r\pi_M$. With firewall, the platform earns $\frac{1}{2}\pi_P^C(r,\sigma) + \frac{1}{2}r\pi_M$. Hence, the platform does not prefer firewall when $\frac{1}{2}\pi_M + \frac{1}{2}r\pi_M - \left(\frac{1}{2}\pi_P^C(r,\sigma) + \frac{1}{2}r\pi_M\right) = \frac{1}{2}\left(\pi_M - \pi_P^C(r,\sigma)\right) > 0$, or $\pi_M - \pi_P^C(r,\sigma) > 0$. To see that this condition holds, notice first that evaluated at $r = 0$, $\pi_M > \pi_P^C(0,\sigma)$, because $\pi_P^C(0,\sigma) = p_2^C(0,\sigma)q_2(p_2^C(0,\sigma), p_1^C(0,\sigma);\sigma) < p^M q^M = \pi_M$. From the envelop theorem and because $p_1^C(r,\sigma)$ increases with r, $\pi_P^C(r,\sigma)$ strictly increases with r. Yet, it is still the case that $\pi_M - \pi_P^C(r,\sigma) \geq 0$ as r approaches 1. To see why, evaluated at $r = 1$,

$$\begin{aligned}
\pi_P^C(1,\sigma) &= p_2^C(1,\sigma)q_2^C(1,\sigma) + p_1^C(1,\sigma)q_1^C(1,\sigma) \\
&< 2p_1^C(1,\sigma)q_1^C(1,\sigma) \\
&< \pi_M,
\end{aligned}$$

where the first inequality follows because $p_2^C(r,\sigma)q_2^C(r,\sigma) < p_1^C(r,\sigma)q_1^C(r,\sigma)$ (as been establishes in Lemma 4) and the second inequality follows because when $\sigma > \widehat{\sigma}(r)$, $\pi_S^C(r,\sigma) = p_1^C(r,\sigma)q_1^C(r,\sigma)(1-r) < \frac{1}{2}\pi_M(1-r)$, implying that $2p_1^C(r,\sigma)q_1^C(r,\sigma) < \pi_M$.

Next, consider the region in which $\sigma < \min\{\widehat{\sigma}(r), \widetilde{\sigma}(r)\}$. Without firewall, the seller reveals information and the platform competes on the target buyer and earns $\pi_P^C(r,\sigma)$. With firewall, recall that the platform earns $\frac{1}{2}\pi_P^C(r,\sigma) + \frac{1}{2}r\pi_M$. Hence, firewall is not profitable when $\pi_P^C(r,\sigma) - \left(\frac{1}{2}\pi_P^C(r,\sigma) + \frac{1}{2}r\pi_M\right) = \frac{1}{2}\left(\pi_P^C(r,\sigma) - r\pi_M\right) > 0$. To see that this holds, recall that when $\sigma < \widetilde{\sigma}(r)$, $\pi_P^C(r,\sigma) > r\pi_M$.