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Abstract

This paper investigates the welfare effects of price parity (most-favored-nation, MFN) clauses in platform markets characterized by cross-platform investment externalities. Although price parity clauses can reduce fee competition and elevate retail prices, they may also improve efficiency by incentivizing platforms to increase demand-enhancing investments. Using a representative consumer model, we demonstrate that under conditions of substantial investment leakage and moderate marginal investment costs, the efficiency gains from enhanced investment can outweigh the negative impact of higher prices. We derive sufficient conditions under which platform profits, consumer surplus, and overall social welfare are all increased by the presence of price parity clauses. The stronger the platform competition, the greater the likelihood that price parity clauses will reduce consumer welfare.

Keywords: Price parity (MFN) clauses, Investment externalities, Antitrust, Platform

JEL Classification Code: L1, L4, D4, D8

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1. Introduction

Price parity clauses (PPCs), also called platform most-favored nation clauses or across-platform parity agreements, refer to contractual provisions whereby an online platform requires sellers to offer goods or services on the platform at prices no less favorable than those available on other platforms or on the seller's own website. The emergence of these clauses is closely linked to the shift in online platforms' business models from the traditional wholesale (resale) model to the agency model, under which platforms set transaction fees while sellers retain control over retail pricing. This transition has spurred platforms' interest in price parity requirements as a strategic instrument for influencing retail prices. Depending on their scope, PPCs are typically categorized into two types: "narrow PPCs," which prevent sellers from offering lower prices only on their own websites, and "wide PPCs," which prohibit lower prices on any alternative channel, including both competing platforms and the seller's direct website.

The competitive effects of PPCs have long been a focal point for competition authorities in many jurisdictions. Notable cases involving the use of PPCs include Apple's e-book case in the U.S. and EU, Amazon in Germany and the UK, car insurance platforms in the UK, food delivery platforms in South Korea, as well as online travel agencies (OTAs) such as Booking.com and Expedia across several European countries. There are significant variations in regulatory approaches regarding PPCs. Some countries like Austria, Belgium, France, Italy have fully banned PPCs for OTAs, while others such as Germany, Sweden, UK adopted more nuanced rules depending on the platform or the scope of the clause (narrow vs. wide).

A prominent policy concern related to PPCs is that they can soften platform competition over transaction fees charged to independent sellers and thereby raise sellers' retail prices, as well established in theoretical work by Boik and Corts (2016), Johnson (2017), Carlton and Winter (2018), Wang and Wright (2020), among others. Under MFN clauses, transaction fees fail to drive market share because sellers cannot price-discriminate across platforms to steer demand toward those offering better terms. Also, by impeding new entrants from undercutting incumbents, PPCs can entrench the market power of dominant platforms and heighten entry barriers in otherwise competitive markets (see Boik and Corts (2016)), and the combination of narrow price parity clauses and best-price guarantees by platforms can effectively lead to platform monopolization and entry deterrence, even in the absence of wide PPCs (see Wals and Schinkel (2018)). Conversely, there is a limited set of studies that identify scenarios in which PPCs can be pro-competitive and raise consumer welfare, including Johansen and Vergé (2017), Bisceglia *et al.* (2021), and Mariotto and Verdier (2020).

On the other hand, platforms (such as Booking.com) often justify PPCs on efficiency grounds, arguing that these clauses reduce across-platform free-riding incentives in investments. Without PPCs, consumers may showroom, searching on one platform but purchasing elsewhere at a lower price, which can dampen platforms' incentives to invest in search engines. For example, Booking.com invoked this rationale in European antitrust proceedings. According to OECD (2016), some competition authorities recognize the need to protect platform investments while being wary of possible anti-competitive effects.

The two contrasting viewpoints underscore the necessity of a more comprehensive welfare analysis of PPCs in markets where platforms make substantial investments. Specifically, the analysis should account for both the fee-raising effects and the investment-enhancing effects of PPCs to assess their overall welfare impact. There are only a small number of studies on this topic, and their results indicate that PPCs continue to have a negative welfare effect even after incorporating the investment-enhancing channel. Wang and Wright (2023) show that PPCs spur platform investment by removing free-rider incentives, yet they restrict competition and enable platforms and sellers to capture the entire surplus, ultimately reducing consumer welfare. Edelmen and Wright (2015) find that PPCs lead to an overinvestment in the convenience benefit in competing transactions, pushing beyond the social optimum. On the other hand, accounting for demand-enhancing investments with spillovers, Maruyama and Zennyo (2020) show that PPCs can raise platform investment if platform competition is more intense than seller competition, but the platforms' preference for PPCs can conflict with the interests of sellers and consumers.

Despite recent advances, the effects of price parity clauses on platform investment incentives and their welfare implications appear to be underexplored. Although studies like Wang and Wright (2023) and Edelmen and Wright (2015) examine price parity clauses' effects on platform investment and welfare, they rely on homogeneous consumer preferences and thus predict that restricting price competition always reduces consumer welfare, regardless of investment. Meanwhile, Maruyama and Zennyo (2020) focus exclusively on the investment effects of price parity clauses, assuming platform fees are exogenously fixed; as a result, their analysis does not capture how price parity affects fee dynamics, limiting the generality of their conclusions.

As platform business models expand to include services like search, recommendations, logistics, and other digital offerings, it is essential to systematically evaluate the welfare effects of price parity clauses in environments with diverse investment externalities—including showrooming and free-riding. Such an analysis should allow for endogenous changes in platform fees and investment decisions, which is especially important in dynamic, innovation-driven markets.

This study investigates the welfare effects of price parity clauses using a tractable model with downward-sloping demand and heterogeneous consumers. By introducing a parameter that captures both the strength and direction of investment externalities, the analysis systematically examines how the impact of price parity varies across different externality environments. Unlike models that explicitly account for consumer search or showrooming behaviors—such as those in Wang and Wright (2020) and Wang and Wright (2023)—our framework employs a flexible externality parameter, allowing for a nuanced treatment of partial free-riding (as opposed to extensive showrooming) and a clear analysis of how price parity clauses affect platform investment incentives under these conditions. In our model, price parity modifies but does not fully eliminate investment externalities, whereas it would completely remove the incentive for showrooming if that behavior were explicitly modeled. We believe this setup more accurately represents real-world situations in which consumer switching costs and sellers' reliance on platform services limit the extent of free-riding, as emphasized by Baker and Scott Morton (2018).

Our analysis shows that price parity clauses lead platforms to raise transaction fees and also to increase their investment levels relative to laissez-faire. While the fee-raising effect is well established in the literature, we show that a similar mechanism works for investment as well. Under laissez-faire, greater platform investment leads sellers to increase their prices, thereby dampening the demand-expanding impact of investment. When price parity is imposed, this mitigating effect is eliminated, causing platforms to invest even more aggressively to boost demand.

Also, price parity shifts platform competition away from transaction fees toward investment.

Under price parity, indirect demand effects—mediated through sellers' price changes—become minor, while direct investment effects remain intact. This mechanism echoes the Stigler effect discussed by Stigler (1968), in which restrictions on price competition redirect rivalry toward non-price strategies.

The effect of price parity on investment efficiency crucially depends on the nature of cross-platform externalities. When spillovers are positive (e.g., investment leakage), price parity promotes efficiency; when externalities are negative (e.g., business stealing), its impact on efficiency can be either beneficial or detrimental, depending on the strength of the externality.

Consequently, the net effect of price parity on consumers depends on whether the efficiency gains from stimulating investment outweigh the losses from higher platform fees. Using a quadratic investment cost function, price parity clauses raise total output and consumer surplus only when positive spillovers (e.g., investment leakages) are sufficiently strong and investment costs increase moderately—enough to mitigate severe underinvestment under laissez-faire. Otherwise, the efficiency gains are too limited to counteract the negative impact of higher fees. When negative externalities (business stealing) are strong enough, price parity instead intensifies overinvestment and reduces consumer surplus. The likelihood that price parity clauses diminish consumer welfare increases as platform competition becomes more intense.

Finally, we derive more stringent sufficient conditions under which platforms have an incentive to adopt price parity clauses and both consumer surplus and overall welfare improve. Although this result lends partial support to the efficiency rationale for price parity, the required conditions are highly restrictive, highlighting the importance of careful policy evaluation to determine whether they hold in practice.

2. Model

Let us consider a third-party seller (hereafter, "seller") distributing homogeneous goods through two intermediary platforms (platforms 1 and 2). This seller is a representative of numerous differentiated sellers in a monopolistically competitive market, each of them possessing some degree of market power but not interacting strategically with one another. For simplicity, we assume that the seller has no alternative distribution channels other than the two platforms.[1] Each platform earns revenue from transaction fees charged on sales made through its intermediary service, and can increase demand by investing in search algorithms, recommendation systems, convenience features, and other improvements that enhance the quality of platform service offered to consumers. For example, platforms' investments in search and recommendation systems raise consumers' valuation of the service by lowering search and matching costs. Consumers have horizontally differentiated preferences for the two platforms, causing them to perceive the same seller's good differently depending on which platform they use to purchase it.

We adopt a linear demand system for differentiated products derived from the representative consumer's utility function $V = y + U(q_1, q_2)$, where

$$U(\mathbf{q}) = \sum_{i=1}^{2}(v + E_i)q_i - \frac{1}{2(1+\gamma)}\left[2\sum_{i=1}^{2} q_i^2 + \gamma\left(\sum_{i=1}^{2} q_i\right)^2\right] \tag{1}$$

and

$$E_i = \frac{2(1-\lambda)+\gamma}{2(1+\gamma)}e_i + \frac{2\lambda+\gamma}{2(1+\gamma)}e_j, \quad j \neq i. \tag{2}$$

Here, v denotes the intrinsic value of each platform's basic service, and $e_i \geq 0$ is the investment level of platform $i = 1, 2$.[2] The parameter $\lambda \in [\underline{\lambda}, 1/2]$ captures how platform investments influence the demand shifter E_i via spillover effects between platforms. The quantity q_i represents consumer purchases from platform i, and $\gamma > 0$ measures the substitutability between the two platforms. The composite good y is priced at one (i.e., $p_y = 1$).

A key parameter in our analysis is λ, which governs the extent of investment spillovers to a rival platform. The upper bound of $1/2$ is set to rule out implausible scenarios where a rival gains more from an investment than the investing platform itself.[3] We allow the lower bound $\underline{\lambda}$ to be negative, accommodating cases where a platform's investment not only raises consumer

[1] Accordingly, the narrow price parity clause—which prevents sellers from offering lower prices on their own direct sales channels—is not relevant to the current analysis.

[2] When $e_1 = e_2 = 0$, the utility functional form reduces to the Shubik and Levitan (1980) demand system for two products.

[3] Our results extend to $\lambda < \frac{3(2+\gamma)}{2(5+2\gamma)} \in (\frac{3}{5}, \frac{3}{4})$, which exceeds $1/2$.

preference for its own service but also enhances its relative attractiveness compared to the rival, thereby decreasing the rival's appeal.[4] Positive λ captures positive externalities (e.g., showrooming), while negative λ reflects negative externalities (e.g., network effects) arising from platform investments.[5]

Maximizing the representative consumer's utility subject to the budget constraint $y + \sum_{i=1}^{2} p_i q_i = I$ yields the following demand function for platform i:

$$q_i(\mathbf{p}) \;=\; \frac{1}{2}\left[v + (1-\lambda)e_i + \lambda e_j - \left(1 + \frac{\gamma}{2}\right) p_i + \frac{\gamma}{2} p_j\right]. \tag{3}$$

Let $c_S \geq 0$ denote the seller's marginal cost of production and $c \geq 0$ the platform's per-transaction cost of facilitating exchanges, both assumed to be constant. In addition, each platform faces an investment cost function $C(\cdot)$ that is increasing, strictly convex, and normalized such that $C(0) = C'(0) = 0$. We assume that all necessary regularity conditions—such as the second-order conditions—are satisfied so that the equilibrium investment levels can be characterized by the standard first-order conditions.

The timeline of the model proceeds as follows:

- Stage 1 (Platform Decisions): Two platforms simultaneously choose transaction fees charged to the seller and their investment levels in service quality.
- Stage 2 (Price-Setting): After observing all transaction fees and quality investments, the seller sets product prices on the two platforms.

To ensure the existence of a meaningful interior solution and to rule out trivial equilibria, we impose the following condition throughout the analysis.

Assumption 1. $\tilde{v} \;\equiv\; v - c - c_S \;>\; 0.$

[4] For example, consumers observing a platform's investment may revise expectations about the platform's user base upward while downgrading expectations for the rival, affecting relative merits in markets with strong network effects.

[5] The utility and demand formulation resembles those in Motta (2004) and Gabrielsen and Johansen (2017) analyzing resale price maintenance with externalities, but with a monotonic scaling of the externality parameter for clarity.

We consider two different regimes: in one, the seller can freely set distinct prices p_i for each platform ($i = 1, 2$); in the other, both platforms impose price parity (wide MFN), requiring the seller to set an identical price $p_i = p$ across platforms. By comparing these two regimes, we can assess how price parity restrictions influence competition and welfare. To avoid the analytical complexity associated with the lack of a pure-strategy equilibrium in the fee-setting subgame—specifically when only one platform adopts price parity—we abstract from the issue of endogenous adoption of PPCs. Instead, following Boik and Corts (2016), we focus on pure-strategy equilibria by assuming that both platforms simultaneously choose their transaction fees, investment levels, and the adoption of price parity clauses.

Given that all players possess complete information about the relevant payoff structures, and the platforms and the seller make decisions sequentially, the solution concept employed is subgame perfect equilibrium.

2.1. Laissez-Faire

Let us first consider a laissez-faire regime in which the seller's pricing behavior faces no restrictions. This case will serve as the baseline for assessing the impact of regulations on price parity clauses later.

Given transaction fees $\mathbf{f} = (f_1, f_2)$ and platform investments $\mathbf{e} = (e_1, e_2)$, the seller chooses prices $\mathbf{p} = (p_1, p_2)$ to maximize profits:

$$\pi_S(\mathbf{p}; \mathbf{f}, \mathbf{e}) \;=\; \sum_{i=1}^{2} (p_i - c_S - f_i) q_i(\mathbf{p}; \mathbf{f}, \mathbf{e}).$$

Solving the system of first-order conditions yields the following optimal prices under the laissez-faire regime:

$$p_i(\mathbf{f}, \mathbf{e}) \;=\; \frac{v}{2} + \frac{E_i}{2} + \frac{c_S + f_i}{2}, \qquad i = 1, 2. \tag{4}$$

The seller treats platform fees as an increase in marginal cost and, consistent with monopoly pricing behavior, passes on half of this cost increase to the retail price. Platform investments raise retail prices by expanding demand. This effect operates through two channels: a direct effect, whereby investment increases demand on the investing platform itself, and an indirect effect, due to substitutability between platforms. The combined impact of these two effects is captured by E_i in equation (2).

Substituting the optimal prices into equation (3), the induced demand faced by platform i in the first stage is given by:

$$q_i(\mathbf{f}, \mathbf{e}) \;=\; \frac{1}{4}\left[v + (1-\lambda)e_i + \lambda e_j - (c_S + f_i) + \frac{\gamma}{2}(f_j - f_i)\right]. \tag{5}$$

Each platform then chooses transaction fees and investment levels to maximize its profit. Using equation (5), platform i's profit-maximization problem can be written as:

$$\max_{f_i \geq c,\, e_i \geq 0} \; \pi_i(\mathbf{f}, \mathbf{e}) = (f_i - c)q_i(\mathbf{f}, \mathbf{e}) - C(e_i).$$

The corresponding first-order conditions are given by:

$$\begin{aligned} [f_i]: \;& q_i - \frac{1}{4}\left(1 + \frac{\gamma}{2}\right)(f_i - c) \;=\; 0, \\ [e_i]: \;& \frac{1-\lambda}{4}(f_i - c) - C'(e_i) \;=\; 0. \end{aligned}$$

Plugging in $q_i(\mathbf{f}, \mathbf{e})$ and rearranging, the symmetric equilibrium values of the transaction fee and investment, denoted by f^* and e^*, are jointly determined by the following two equations:[6]

$$[f]: \; f^* \;=\; c + \frac{2}{4+\gamma}\tilde{v} + \frac{2}{4+\gamma}e^*, \tag{6}$$

$$[e]: \; f^* \;=\; c + \frac{4}{1-\lambda}C'(e^*). \tag{7}$$

Proposition 1 (Laissez-Faire)**.** *The symmetric equilibrium (e^*, f^*) in the laissez-faire environment is characterized by the following two equations:*

$$C'(e) \;=\; \frac{1-\lambda}{2(4+\gamma)}(\tilde{v} + e) \quad \textit{and} \quad f \;=\; c + \frac{2}{4+\gamma}(\tilde{v} + e). \tag{8}$$

[6] The second-order condition for e_i requires that $C''(e^*) > \frac{(1-\lambda)^2}{4(2+\gamma)}$.

2.2. Price Parity (MFN)

We now examine the environment in which both platforms impose price parity (MFN) clauses on the seller. Given the pricing constraint, the demand for each platform as a function of a single price p is given by:

$$q_i^M(p) \;=\; \frac{1}{2}\left[v + (1-\lambda)e_i + \lambda e_j - p\right].$$

Under price parity, each platform's demand is independent of relative prices across platforms; only the overall level of the common price affects demand.

Proceeding as before, solving the seller's profit maximization problem in the second stage yields the following optimal price:

$$p^M(\mathbf{f}, \mathbf{e}) \;=\; \frac{v}{2} + \frac{\bar{e}}{2} + \frac{c_S + \overline{f}}{2}, \tag{9}$$

where $\bar{e}$ and $\overline{f}$ denote the average levels of investment and transaction fees, respectively. That is, under price parity clauses, the seller's optimal price depends only on the average of the decision variables chosen by the two platforms. This occurs because enforcing a common price across platforms reduces the pass-through of each platform's own decision variables, while increasing the influence of the rival's decisions.

By comparing equations (4) and (9), we can observe that the coefficients of e_i and f_i are smaller under price parity than under laissez-faire, whereas those of e_j and f_j are larger. Note that the term E_i in equation (4) represents a weighted average of the two platforms' investments, with greater weight placed on platform i's investment relative to j's. In contrast, the term $\bar{e}$ in equation (9) is an unweighted arithmetic average of both platforms' investments. Also, note that as the degree of substitutability between the two platforms—captured by γ—increases, the weight on platform i in E_i decreases while that on its rival j increases.[7]

Substituting the optimal price from (9) allows us to express the induced demand faced by

[7] In the limit as $\gamma \to \infty$, E_i converges to $\bar{e}$.

platform i as:

$$q_i^M(\mathbf{f}, \mathbf{e}) \;=\; \frac{1}{4}\left[v + \frac{3-4\lambda}{2}e_i + \frac{4\lambda-1}{2}e_j - (c_S + \overline{f})\right]. \tag{10}$$

The optimization problem of platform i under price parity can thus be written as:

$$\max_{f_i \geq c,\, e_i \geq 0} \; \pi_i^M(\mathbf{f}, \mathbf{e}) = (f_i - c)q_i^M(\mathbf{f}, \mathbf{e}) - C(e_i).$$

Differentiating with respect to f_i and e_i yields the first-order conditions:

$$\begin{aligned} [f_i] : \; q_i - \frac{1}{8}(f_i - c) \;&=\; 0, \\ [e_i] : \; \frac{3-4\lambda}{8}(f_i - c) - C'(e_i) \;&=\; 0. \end{aligned}$$

Plugging in $q_i^M(\mathbf{f}, \mathbf{e})$ and rearranging, the symmetric equilibrium transaction fee and investment under price parity clauses, denoted by f^M and e^M, are determined by the following two equations:[8]

$$[f] : \; f^M \;=\; c + \frac{2}{3}\tilde{v} + \frac{2}{3}e^M, \tag{11}$$

$$[e] : \; f^M \;=\; c + \frac{8}{3-4\lambda}C'(e^M). \tag{12}$$

Proposition 2 (Price Parity Clauses)**.** *The symmetric equilibrium* (e^M, f^M) *in the price parity environment is characterized by the following two equations:*

$$C'(e) \;=\; \frac{3-4\lambda}{12}\left(\tilde{v} + e\right) \quad \textit{and} \quad f \;=\; c + \frac{2}{3}\left(\tilde{v} + e\right). \tag{13}$$

2.3. The Impacts of the Price Parity (MFN) Clauses

Analyzing the induced demand functions in (5) and (10) highlights several key effects of price parity (MFN) clauses on platform competition. Under price parity, platforms refrain from competing through their transaction fees to attract consumers, and the parameter γ—which previously cap-

[8]The second-order condition for e_i requires that $C''(e^M) > \frac{(3-4\lambda)^2}{16}$.

tured fee-based rivalry under laissez-faire—no longer appears in the demand equations. Sellers now base retail prices on the average transaction fee rather than platform-specific ones, shifting fee competition from strategic complements to strategic substitutes, as shown by Boik and Corts (2016). This introduces Cournot's classic problem of complements (Cournot (1838)) into the model, as noted by Carlton and Winter (2018). Together, these mechanisms lead to higher transaction fees under price parity than in laissez-faire settings.

Price parity clauses also reshape investment incentives. When sellers cannot adjust prices in response to investment levels, platforms have stronger incentives to invest in demand enhancement. In a laissez-faire setting, greater platform investment leads sellers to increase retail prices, which tempers the expansion of demand. When price parity is imposed, this moderating channel is removed, further intensifying platforms' incentives to invest in demand growth.

At the same time, the impact of a rival platform's investment diminishes because it raises the common retail price, which in turn dampens cross-platform externalities by reducing the resulting increase in demand. This can be seen directly from the induced demand equations: the weight on a platform's own investment e_i rises, while the weight on its rival's investment e_j falls.

Moreover, price parity shifts competitive focus away from transaction fees and toward platform investment by reducing indirect demand effects—those mediated by sellers' price adjustments—while leaving direct investment effects unchanged. This effect mirrors the Stigler effect (Stigler (1968)), where curbing price competition redirects rivalry to non-price strategies.

In summary, price parity clauses induce platforms to set higher transaction fees and greater investments compared to laissez-faire. The induced demand functions confirm this outcome: the coefficient on a platform's own investment increases, while the coefficient on its transaction fee decreases.

Comparing equations (6) and (11) reveals that, for any given investment level, the symmetric transaction fee is higher under price parity than under laissez-faire. Likewise, conditions (7) and (12) indicate that, for any given transaction fee, the symmetric investment level is also greater under price parity than under laissez-faire. Furthermore, the complementarity between transaction fees and investment levels amplifies platforms' incentives to raise both decision variables simultaneously.

Direct inspection of the first equations in (8) and (13) confirms that, under the assumed model primitives, price parity clauses lead to a higher investment level in symmetric equilibrium (see Figure 1). This conclusion holds for any general convex investment cost function $C(\cdot)$. It then follows from the second equations in (8) and (13) that the symmetric equilibrium transaction fee must also be higher under price parity (see Figure 2). We formalize this result in the following proposition.

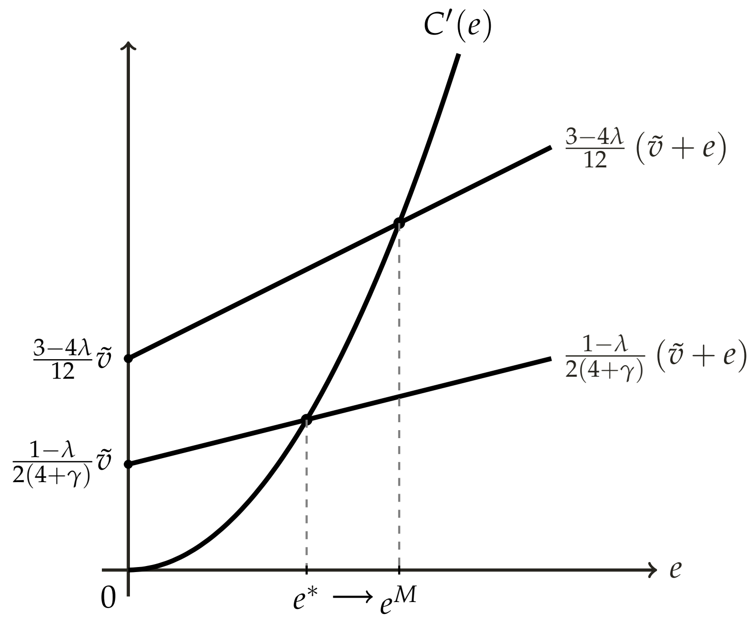

Figure 1: The Impact of Price Parity Clauses on Investment

Proposition 3. *Price parity clauses lead to higher transaction fees and greater investment in service quality in a symmetric equilibrium.*

3. Welfare Analysis

An increase in transaction fees unambiguously raises retail prices, thereby reducing both consumer and social welfare. In contrast, the welfare implications of increased investment in service quality are inherently ambiguous: intensified competition may lead to investment levels that exceed the consumer- or socially-optimal threshold (see, for example, Edelmen and Wright (2015)), so the net welfare effect depends on whether such investment is excessive or insufficient. Hence,

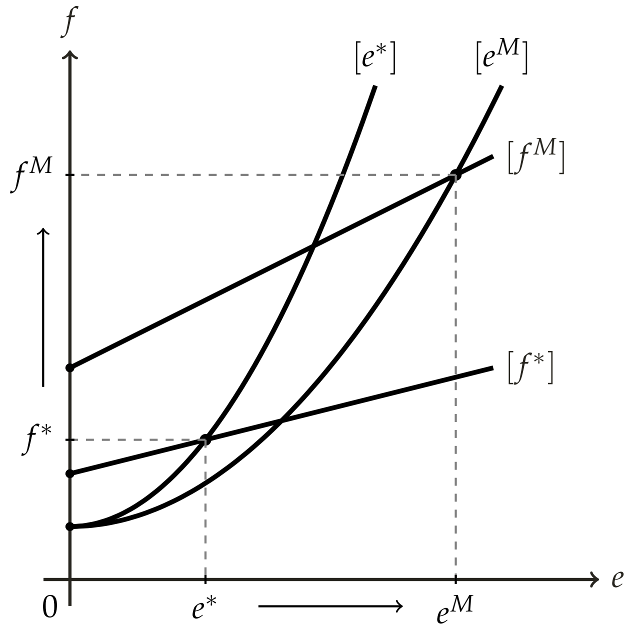

Figure 2: Equilibrium Fees and Investments in the Two Regimes

the overall welfare impact of price parity clauses cannot be inferred solely from the comparisons in Proposition 3.

3.1. First-Best Scenario

To gain deeper insight into the welfare effects of increased investment in service quality, we consider a first-best scenario in which a social planner determines the allocation (q_i) and investment level (e_i) for each platform to maximize total welfare.[9] Social welfare is defined as:

$$\mathrm{SW}(\mathbf{q}, \mathbf{e}) \;\equiv\; U(\mathbf{q}) - (c + c_S)\sum_{i=1}^{2} q_i - \sum_{i=1}^{2} C(e_i).$$

The first-order conditions for welfare maximization are:

$$\begin{aligned} [q_i]: \; & v + E_i - \frac{1}{1+\gamma}\left[2q_i + \gamma\sum_{i=1}^{2} q_i\right] \;=\; 0, \\ [e_i]: \; & \frac{2(1-\lambda)+\gamma}{2(1+\gamma)}q_i + \frac{2\lambda+\gamma}{2(1+\gamma)}q_j - C'(e_i) \;=\; 0. \end{aligned}$$

[9]Operating two platforms may not be socially optimal given the convex cost function. However, to ensure comparability with the results in Section 2, we treat the platform market structure as exogenously fixed.

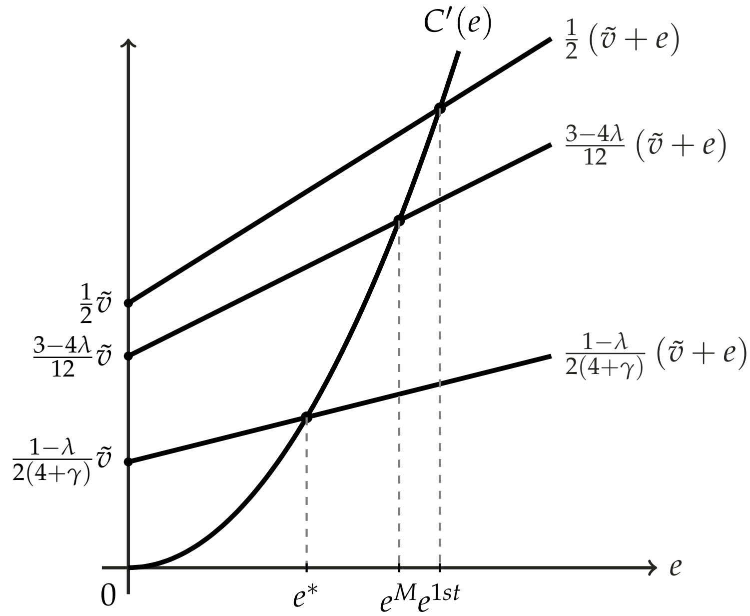

Figure 3: Comparison of Equilibrium Levels of Investment

Assuming symmetry, the first-best investment level is derived as follows:[10]

$$C'(e) \;=\; \frac{1}{2}\left(\tilde{v}+e\right). \tag{14}$$

Consider the case where $\lambda > 0$, such that investment leakage occurs across platforms. Direct comparison of the left-hand sides of (8) and (13) with equation (14) shows that profit-maximizing platforms consistently invest at levels below the first-best benchmark, irrespective of the presence of price parity clauses. Figure 3 illustrates the equilibrium investment levels across the laissez-faire, price parity, and first-best regimes. The following proposition follows immediately under the assumption that the welfare function is strictly quasi-concave.

Proposition 4. *Suppose $\lambda > 0$, indicating that investment leakage occurs across platforms. For any given output level, an increase in platform investment induced by price parity clauses enhances investment efficiency, provided the welfare function is strictly quasi-concave.*

Two key insights emerge from this result. First, under a convex cost structure, platforms tend

[10] As before, the second-order condition must be considered. Denoting the optimal symmetric investment level by e^{1st}, the necessary and sufficient condition for the negative definiteness of the Hessian matrix is $C''(e^{1st}) > \frac{(2+\gamma)(1+\gamma)-(2(1-\lambda)+\gamma)(2\lambda+\gamma)}{4(1+\gamma)}$.

to underinvest in service quality due to imperfect appropriation of investment benefits, and this problem becomes more pronounced as investment leakage to rivals increases. Second, price parity clauses can help alleviate this underinvestment problem.

Consider now the case where $\lambda < 0$, implying that business stealing occurs between platforms. The resulting outcomes depend on the magnitude of this effect. If business stealing is mild ($\lambda \in (-3/4, 0)$), both platforms' equilibrium investment levels remain below the first-best level, similar to the case with investment leakage. As the extent of business stealing grows, the two lower y-axis intercepts depicted in Figure 3 rise. When $\lambda = -3/4$, the first-best investment e^{1st} exactly coincides with the price parity equilibrium level e^M. For even stronger business stealing (i.e., when $\lambda < -3 - \gamma$), e^{1st} falls below the laissez-faire equilibrium investment e^*. Hence, when business stealing is substantial, price parity clauses can shift investment incentives from underinvestment to overinvestment, or further amplify overinvestment when the effect is sufficiently strong.

Proposition 5. *Suppose $\lambda < 0$, indicating that business stealing occurs between platforms. In this case, an increase in investment induced by price parity clauses may either improve or reduce investment efficiency, depending on the intensity of the business-stealing effect.*

3.2. Laissez-Faire vs. MFN

We now examine how price parity clauses affect consumer surplus and social welfare when platforms invest in service quality. First, note that in each environment, the price and quantity at the symmetric equilibrium satisfy the following relationship:

$$q \;=\; \frac{1}{2}(v + e - p).$$

Accordingly, the representative consumer's net utility can be expressed as:[11]

$$\mathrm{CS}(q;p) \;\equiv\; I + U(q,q) - 2pq \;=\; I + 2(v+e-p)q - 2q^2 \;=\; I + 2q^2 \quad\Longrightarrow\quad \mathrm{CS}(Q) \;=\; I + \frac{Q^2}{2},$$

[11]Note that the consumer's net utility, $\mathrm{CS}(Q)$, takes the same functional form regardless of the number of platforms. See Section 4 for details.

which depends solely on the equilibrium (total) quantity Q. Therefore, to evaluate the welfare implications of price parity clauses, it suffices to compare the equilibrium quantities in the two regimes. In other words, any change in equilibrium quantity translates directly into a change in consumer surplus in the same direction; that is, $\text{sign}(\Delta Q) = \text{sign}(\Delta \text{CS})$.[12]

To obtain a closed-form expression for the symmetric equilibrium quantity Q, we assume a quadratic cost function of the form:

$$C(e_i) = \frac{k}{2}e_i^2,$$

which has been widely used in the literature, for instance, by Motta (2004) and Gabrielsen and Johansen (2017) in studies of vertical restraints. Here, $k = C''(e_i)$ represents the slope of the marginal investment cost. As will be shown shortly, there is no need to employ a more complex cost structure, since this simple specification is sufficient to yield meaningful welfare results.

Substituting the quadratic cost function into the first equations in (8) and (13), respectively, yields the following equilibrium investment levels under the two regimes:[13]

$$e^* = \frac{\frac{1-\lambda}{2(4+\gamma)}}{k - \frac{1-\lambda}{2(4+\gamma)}}\tilde{v} \quad \text{and} \quad e^M = \frac{\frac{3-4\lambda}{12}}{k - \frac{3-4\lambda}{12}}\tilde{v}.$$

Using these equilibrium investments together with equilibrium fees or retail prices, we can derive the corresponding equilibrium quantities as follows:

$$Q^* = \frac{\frac{2+\gamma}{2(4+\gamma)}k}{k - \frac{1-\lambda}{2(4+\gamma)}}\tilde{v} \quad \text{and} \quad Q^M = \frac{\frac{1}{6}k}{k - \frac{3-4\lambda}{12}}\tilde{v}.$$

The ratio of the equilibrium quantity under price parity to that under laissez-faire is then given

[12]This result stems from the assumption of platform symmetry rather than from linear demand. Specifically, the equivalence between changes in equilibrium quantity and consumer surplus holds even when demand takes the following additively separable form:

$$q_i = \phi_1(e_i) + \phi_2(e_j) - \rho_1(p_i) + \rho_2(p_j) \quad \text{for} \quad j \neq i,$$

provided that, in addition to standard regularity conditions (e.g., $\rho_1'' < 0$), the conditions $\rho_1' > \rho_2'$ and $\rho_1(0) = \rho_2(0)$ are satisfied. A formal proof of this result is provided in Appendix A.1.

[13]For the quadratic cost function, this symmetric equilibrium is unique.

by:

$$\frac{Q^M}{Q^*} = \frac{2\left[(2(4+\gamma)k-(1-\lambda)\right]}{(2+\gamma)[12k-(3-4\lambda)]}. \tag{15}$$

It will be useful to define three key threshold values of k. First, second-order conditions for platform profit maximization require that $k > \frac{(3-4\lambda)^2}{16} \equiv k_1$. Second, for symmetric equilibria to exist in both regimes, it is necessary that $k > \frac{3-4\lambda}{12} \equiv k_2$.[14] Hence, for the analysis to be meaningful, k must satisfy $k > \max\{k_1, k_2\}$—that is, the investment cost function is not too flat. Third, define $k_3 \equiv \frac{4+3\gamma-2(3+2\gamma)\lambda}{8(1+\gamma)}$ such that $Q^M = Q^*$. When $k < k_3$, the equilibrium output under price parity, Q^M, exceeds that under laissez-faire, Q^*, indicating that price parity clauses enhance both output and consumer surplus. Conversely, when $k > k_3$, consumer surplus decreases relative to laissez-faire. This implies that for consumer surplus to rise with price parity, the increase in investment must be large enough to offset the adverse effect of higher fees, requiring the marginal cost of investment k to be sufficiently low. In summary, a low enough k is necessary for consumer surplus gains under price parity, whereas the existence of symmetric equilibria and the second-order conditions require k to be sufficiently high. Accordingly, it is important to determine whether a range of k exists in which both conditions are satisfied, allowing consumers to benefit from price parity clauses.

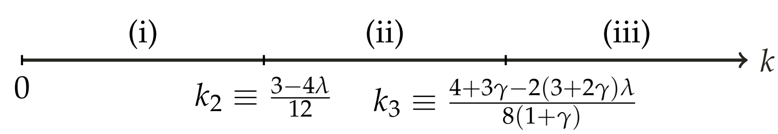

Figure 4: Threshold Values of the Slope of the Marginal Investment Cost

It can be readily verified that the inequality $k_2 < k_3$ holds for all admissible parameter values. Because the condition $k > \max\{k_1, k_2\}$ must be satisfied, the relationship between k_1 to k_3 is pivotal in determining whether price parity clauses increase consumer surplus. Note that

$$k_1 \ > \text{(resp. } <\text{)}\ k_3 \qquad \Longleftrightarrow \qquad \lambda\ < \text{(resp. } >\text{)}\ \frac{3+4\gamma-\sqrt{5+8\gamma+4\gamma^2}}{8(1+\gamma)} \equiv \lambda^*, \tag{16}$$

where $\lambda^* > 0$ is strictly increasing in γ and approaches the limit $1/4$ as $\gamma \to \infty$. If $\lambda > \lambda^*$, then

[14] Otherwise, the cost function would be too flat, causing platform investments to diverge without bound.

$k_1 < k_3$ (meaning k_1 lies within region (i) or (ii) in Figure 4), and consumer surplus increases under price parity when $\max\{k_1, k_2\} < k < k_3$, but decreases when $k > k_3$. Conversely, if $\lambda < \lambda^*$, then $k_1 > k_3$ (meaning k_1 lies in region (iii) in Figure 4), and consumer surplus always decreases under price parity. These findings give rise to the following proposition regarding the impact of price parity clauses on consumer welfare.

Proposition 6 (Consumer Surplus)**.** *Consumer surplus increases under price parity if and only if*

$$(i)\ \lambda\ >\ \lambda^* \quad \textit{(strong positive externalities)}, \tag{17}$$

$$(ii)\ \max\{k_1, k_2\}\ <\ k\ <\ k_3 \quad \textit{(moderately flat marginal cost of investment)}. \tag{18}$$

Two conditions must be met for price parity to benefit consumers. First, the degree of investment leakages must be sufficiently high (condition (17)), so that the positive impact of increased investment outweighs the negative fee-raising effect. Such scenarios are plausible because the maximum value of λ^* is strictly less than $1/4$, while the parameter λ is allowed to vary over the interval $[\underline{\lambda}, 1/2]$.[15] This finding indicates that when platform investments generate negative externalities—such as those arising from business stealing—price restrictions imposed by parity clauses consistently reduce consumer surplus. Second, the slope of the marginal investment cost should not be too steep (condition (18)), allowing platforms to substantially increase investment levels (see Figure 5). However, the slope should also not be too flat, to ensure the existence of symmetric equilibria that satisfy the second-order condition.

In summary, price parity clauses increase output and consumer surplus only when investment leakages across platforms are sufficiently strong and the marginal cost of investment lies within an appropriate intermediate range. More specifically, when positive investment externalities are substantial, severe underinvestment occurs under laissez-faire, so the investment-enhancing effect of price parity clauses more than offsets the adverse impact of higher fees and prices. By contrast, in the presence of negative externalities such as business stealing—particularly when they are

[15]The statement that the maximum value of the threshold λ^* is less than $1/4$ applies only to the case with two platforms. As the number of platforms increases and the investment spillover becomes stronger, the fee-raising effect of price parity tends to outweigh its investment-efficiency effect, thereby raising the threshold value. Further details are provided in Section 4.

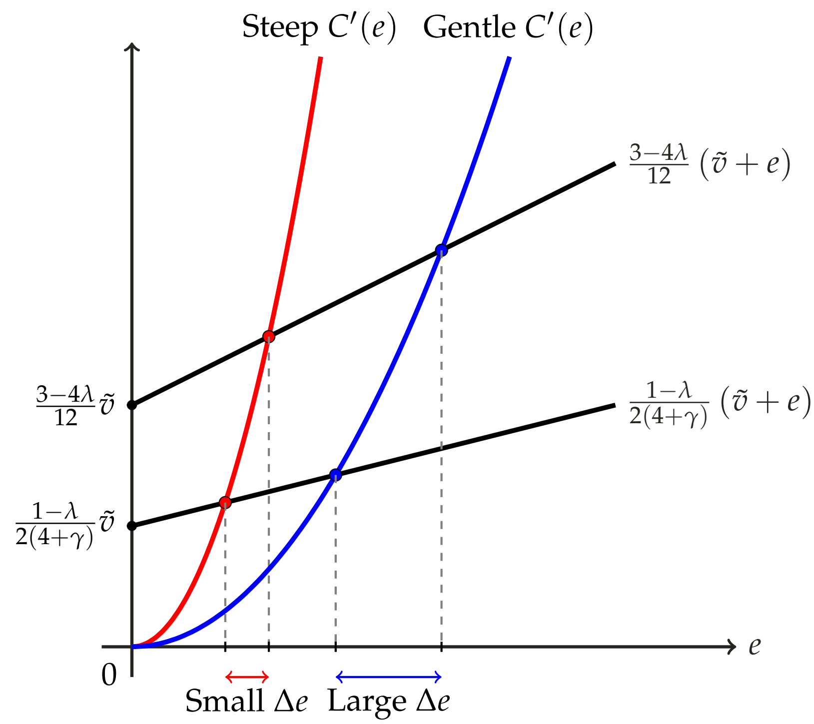

Figure 5: The Impact of the Marginal Investment Cost Slope on Equilibrium Investment

mild—the underinvestment problem is limited, so the investment-enhancing effect of price parity clauses is weak, leading to a decline in consumer welfare. If negative externalities are strong, laissez-faire already results in overinvestment, and additional investment induced by price parity clauses exacerbates inefficiency and reduces consumer welfare.

Next, we analyze platforms' incentives to adopt price parity clauses and their implications for social welfare. The ratios of platform profit and social welfare (net of consumer income) in the symmetric equilibria under the two regimes can be expressed as follows:[16]

$$\frac{\pi^M}{\pi^*} = \underbrace{\frac{(2+\gamma)^2}{4}\frac{16k-(3-4\lambda)^2}{4(2+\gamma)k-(1-\lambda)^2}}_{\equiv f(k)}\left(\frac{Q^M}{Q^*}\right)^2, \tag{19}$$

$$\frac{\mathrm{SW}^M - I}{\mathrm{SW}^* - I} = \underbrace{\frac{(2+\gamma)^2}{4}\frac{44k-2(3-4\lambda)^2}{(14+3\gamma)(2+\gamma)k-2(1-\lambda)^2}}_{\equiv g(k)}\left(\frac{Q^M}{Q^*}\right)^2. \tag{20}$$

Since $f(k)$, $g(k)$, and Q^M/Q^* are all ratios of first-order polynomials in k, it is challenging to di-

[16] The numerators and denominators of the $f(k)$ and $g(k)$ terms in equations (19) and (20) remain positive as long as $k > \max\{k_1, k_2\}$.

rectly compare equations (19) and (20) to assess platforms' incentives to adopt price parity clauses and their effects on social welfare. Therefore, we focus on the situation where equilibrium output increases under price parity clauses—a condition already established—and identify sufficient conditions under which platforms are incentivized to impose these clauses and total welfare consequently rises.

A straightforward calculation yields the following relationship:

$$f(k) > 1 \iff k > \frac{[8+3\gamma-2(5+2\gamma)\lambda][4+3\gamma-2(3+2\gamma)\lambda]}{16(2+\gamma)(1+\gamma)} \equiv k_4 \iff g(k) > 1,$$

introducing an additional threshold value of k. Assuming $Q^M > Q^*$, the condition $k > k_4$ ensures not only that platforms are incentivized to adopt price parity clauses but also that social welfare increases. It is therefore necessary to compare the threshold values k_3 and k_4, which govern changes in consumer surplus and in both social welfare and the platforms' incentives, respectively. The following relationship holds:

$$k_4 < k_3 \iff \lambda > \frac{4+\gamma}{2(5+2\gamma)} \equiv \hat{\lambda} \in \left(\frac{1}{4}, \frac{2}{5}\right),$$

implying that, whenever $\lambda > \hat{\lambda}$, the interval $(\max\{k_1, k_2, k_4\}, k_3)$ is non-empty. For all k within this range, platforms have mutual incentives to impose price parity clauses, and doing so increases equilibrium quantity—thereby enhancing both consumer surplus and total welfare. This result is formally summarized below.

Proposition 7 (PPC Incentives and Total Welfare)**.** *Platform profit, consumer surplus, and total welfare all increase under price parity clauses if the following two sufficient conditions are satisfied:*

$$(i)\ \lambda > \hat{\lambda},$$
$$(ii)\ \max\{k_1, k_2, k_4\} < k < k_3.$$

The result in Proposition 7 provides partial support for the efficiency defense advanced by platforms such as Amazon and OTAs, who argue that price parity agreements are necessary to deter free-riding on investments in ancillary services. However, since the conditions required for this justification are quite restrictive, it is essential to rigorously evaluate whether the current platform landscape satisfies them. Moreover, if the conditions in Proposition 7 are not satisfied, no definitive welfare conclusions can be drawn. Platforms may still have profit incentives to adopt price parity clauses, but it remains ambiguous whether such clauses ultimately increase or decrease consumer surplus or total welfare.[17]

4. N Platforms

In this section, we extend the analysis to a market consisting of N platforms to examine how the effects of PPCs vary with the intensity of platform competition. The representative consumer's utility function in equation (1) is modified accordingly as follows:

$$U(\mathbf{q}) \;=\; \sum_{i=1}^{N}(v+E_i)q_i - \frac{1}{2(1+\gamma)}\left[N\sum_{i=1}^{N}q_i^2 + \gamma\left(\sum_{i=1}^{N}q_i\right)^2\right]$$

and

$$E_i = \frac{N(1-2\lambda)+2\lambda+\gamma}{N(1+\gamma)}e_i + \frac{2\lambda+\gamma}{N(1+\gamma)}\sum_{j\neq i}e_j, \quad j\neq i. \tag{21}$$

Assuming the same parameter ranges as before, namely $\gamma > 0$ and $\lambda \in [\underline{\lambda}, 1/2]$, utility maximization yields the following demand function for platform i:

$$q_i(\mathbf{p}) \;=\; \frac{1}{N}\left[v + \left(1 - \frac{2(N-1)\lambda}{N}\right)e_i + \frac{2\lambda}{N}\sum_{j\neq i}e_j - \left(1+\frac{(N-1)\gamma}{N}\right)p_i + \frac{\gamma}{N}\sum_{j\neq i}p_j\right]. \tag{22}$$

The demand function in (22) provides a tractable representation of how investment externalities evolve as the number of competing platforms increases. As platform competition intensifies, each platform's incentive to invest diminishes because the marginal benefit from its own investment declines while the positive spillovers from rivals' investments become stronger. This mechanism is

[17]Platforms may find it profitable to adopt price parity clauses even when significant negative externalities are present. For example, as γ increases without bound, the right-hand side of equation (19) tends to infinity for any given value of λ. Similarly, when k becomes very large, the right-hand side of equation (19) exceeds 1 for $\gamma > 2$.

evident in equation (21), where the coefficient on e_i decreases with N, and the aggregate influence of rival platforms correspondingly increases.

Using backward induction, we derive the first-stage equilibrium under both regimes. Under laissez-faire, the symmetric equilibrium (e^*, f^*) satisfies

$$C'(e) \;=\; \frac{N-2(N-1)\lambda}{2N[2N+(N-1)\gamma]}\,(\tilde{v}+e) \quad \text{and} \quad f \;=\; c+\frac{N}{2N+(N-1)\gamma}\,(\tilde{v}+e)\,.$$

Under price parity, the symmetric equilibrium (e^M, f^M) is characterized by

$$C'(e) \;=\; \frac{2N-1-4(N-1)\lambda}{2N(N+1)}\,(\tilde{v}+e) \quad \text{and} \quad f \;=\; c+\frac{N}{N+1}\,(\tilde{v}+e)\,.$$

Comparing these equilibrium conditions shows that, as in the baseline case with $N = 2$, both the transaction fee and the equilibrium investment level are higher under price parity, given the standard assumptions on the cost function.

To examine how the intensity of platform competition affects the welfare implications of price parity, we adopt the same quadratic cost function as in the main analysis. The slope of the marginal investment cost continues to play a central role in determining equilibrium outcomes, although the corresponding threshold conditions now take more intricate forms. Specifically, the threshold value of k ensuring the second-order condition for platform profit maximization is $k_1 = \frac{[2N-1-4(N-1)\lambda]^2}{4N^2}$. Likewise, the threshold value guaranteeing the existence of symmetric equilibria is $k_2 = \frac{2N-1-4(N-1)\lambda}{2N(N+1)}$.

The ratio of equilibrium (total) quantities under the two regimes is given by

$$\frac{Q^M}{Q^*} \;=\; \frac{2N[2N+(N-1)\gamma]k-[N-2(N-1)\lambda]}{[N+(N-1)\gamma][2N(N+1)k-(2N-1-4(N-1)\lambda)]}.$$

Then, the key threshold satisfying $Q^M = Q^*$ is derived as $k_3 = \frac{2N+(2N-1)\gamma-2\lambda[2N-1+2(N-1)\gamma]}{2N^2(1+\gamma)}$. For quantity—and thus consumer surplus—to increase under price parity, it must hold that $k < k_3$, which corresponds to $\lambda > \lambda^* \equiv \frac{1}{2} - \frac{1+\sqrt{1+4(N-1)^2(1+\gamma)^2}}{8(N-1)^2(1+\gamma)}$. Hence, consumer surplus rises under price parity if and only if $\lambda > \lambda^*$ (indicating strong positive externalities) and $\max\{k_1, k_2\} < k < k_3$ (implying a moderately flat marginal cost of investment). These conditions correspond to those established in Proposition 6.

The threshold λ^* increases with N, implying that price parity is less likely to enhance consumer surplus as platform competition intensifies. Stronger competition heightens the fee-raising effect, while it simultaneously deepens investment externalities and strengthens the efficiency-enhancing effect on platform investment. However, as the number of platforms grows, the fee-raising effect dominates the efficiency effect, making it more likely that consumer welfare decreases under price parity. This outcome arises because, although price parity clauses increase investment relative to laissez-faire, the efficiency gains shrink and fee increases intensify as the number of competing platforms grows. In the limit, as N approaches infinity, λ^* converges to $1/2$, indicating that price parity can no longer improve consumer surplus.

In summary, although greater platform competition does not affect our main qualitative results, it increases the likelihood that price parity clauses will harm consumer welfare. There is also a range of parameters—akin to Proposition 7—where platform profit, consumer surplus, and total welfare all rise. However, since this does not yield additional analytical insight, we omit the specific conditions for brevity.[18]

5. Conclusion

This paper examines the welfare effects of price parity (MFN) clauses in platform markets where investments in ancillary services give rise to cross-platform externalities. Although such clauses are often criticized for dampening fee competition and raising prices, our analysis highlights a less explored yet important mechanism: their potential to mitigate investment inefficiencies resulting from these externalities. When a platform invests in quality-enhancing services, the benefits may spill over to rivals, thereby weakening each platform's incentive to invest optimally. By linking prices across platforms, price parity clauses can partially restore these incentives and enhance overall efficiency.

Within a representative consumer framework, we show that the welfare impact of price parity clauses depends jointly on the strength of investment externalities and the marginal cost of in-

[18] A detailed proof of this result is provided in Appendix A.2.

vestment. Consumer surplus may increase when positive externalities are strong and investment costs are moderate—conditions under which efficiency gains outweigh the adverse price effects of reduced competition. However, as platform competition intensifies, price parity clauses are more likely to harm consumer welfare. We formally identify the parameter ranges under which platform profit, consumer surplus, and total welfare are all higher under price parity. However, these conditions are quite stringent, highlighting the need for careful empirical validation in real-world markets.

From a policy perspective, these findings highlight that while price parity clauses are often viewed as anticompetitive tools that raise prices, this view overlooks their potential efficiency benefits when substantial cross-platform spillovers exist. In markets where platforms make significant quality investments, blanket bans on price parity clauses may inadvertently undermine efficiency. Regulatory policy should therefore balance the trade-off between preserving price competition and sustaining investment incentives, tailoring enforcement to market contexts where externalities play a decisive role.

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A. Omitted Proofs

A.1. Proof of Footnote 12

At the symmetric equilibrium of each environment, the equilibrium quantity for each platform satisfies the following condition:

$$q \;=\; (\phi_1 + \phi_2)(e) - (\rho_1 - \rho_2)(p).$$

Given that $\rho \equiv \rho_1 - \rho_2$ is an increasing function (i.e., $\rho_1' > \rho_2'$), the corresponding inverse demand function can be written as:

$$p \;=\; \rho^{-1}(\phi_1 + \phi_2)(e) - \rho^{-1}(q).$$

Hence, the difference in consumer surplus between the two regimes is given by:

$$\begin{aligned}
\mathrm{CS}^M - \mathrm{CS}^* \;&=\; 2\int_0^{q^M} \Big(\rho^{-1}(q^M) - \rho^{-1}(q)\Big)\; dq - 2\int_0^{q^*} \Big(\rho^{-1}(q^*) - \rho^{-1}(q)\Big)\; dq \\
&=\; \begin{cases} 2\int_0^{q^*} \left(\rho^{-1}(q^M) - \rho^{-1}(q^*)\right)\; dq + 2\int_{q^*}^{q^M} \left(\rho^{-1}(q^M) - \rho^{-1}(q)\right)\; dq & \text{if } \; q^M \;\geq\; q^* \\ -2\int_0^{q^M} \left(\rho^{-1}(q^*) - \rho^{-1}(q^M)\right)\; dq - 2\int_{q^M}^{q^*} \left(\rho^{-1}(q^*) - \rho^{-1}(q)\right)\; dq & \text{if } \; q^M \;<\; q^*. \end{cases}
\end{aligned}$$

Therefore, under the assumptions $\rho_1' > \rho_2'$ and $\rho_1(0) = \rho_2(0)$, it follows that $\mathrm{sign}(\mathrm{CS}^M - \mathrm{CS}^*) = \mathrm{sign}(q^M - q^*) = \mathrm{sign}(Q^M - Q^*)$ always holds. □

Footnote 12 clarifies that the equivalence $\mathrm{sign}(\mathrm{CS}^M - \mathrm{CS}^*) = \mathrm{sign}(Q^M - Q^*)$ holds only when the demand function is additively separable. This result does not generally extend to more complex forms of demand—for instance, demand functions including interaction terms such as $e_i p_i$. In this setting, the equilibrium effort level e affects both the intercept and the slope of the demand curve, in contrast to the present model, where it enters only as a constant term. Consequently, the direction of change in consumer surplus may not align with that of the change in equilibrium quantity.

A.2. Proof of Footnote 18

Applying the same procedure as in the baseline model, we derive the functions $f(k)$ and $g(k)$ for the generalized case with N platforms, corresponding to equations (19) and (20):

$$\begin{aligned} f(k) &= \frac{4N^2(N+(N-1)\gamma)^2 k - (2N-1-4(N-1)\lambda)^2(N+(N-1)\gamma)^2}{4N^2(N+(N-1)\gamma)k - (N-2(N-1)\lambda)^2}, \\ g(k) &= \frac{N(4N+3)(N+(N-1)\gamma)^2 k - (2N-1-4(N-1)\lambda)^2(N+(N-1)\gamma)^2}{N(7N+3(N-1)\gamma)(N+(N-1)\gamma) - (N-2(N-1)\lambda)^2}. \end{aligned}$$

For any N, there exists a threshold value

$$k_4 = \frac{[2(N-2(N-1)\lambda)(N+(N-1)\gamma) - (N+(N-1)\gamma)]^2 - [N-2(N-1)\lambda]^2}{4N^2(N-1)(N+(N-1)\gamma)(1+\gamma)}$$

such that $f(k) > 1$ if and only if $g(k) > 1$.

Thus, we obtain the generalized threshold for λ, analogous to condition (i) in Proposition 7:

$$\hat{\lambda} = \frac{2N+(2N-3)\gamma}{2(2N+1+2(N-1)\gamma)} \in \left(\frac{2N-3}{4(N-1)}, \frac{2N}{2(2N+1)}\right).$$

In conclusion, increasing the intensity of platform competition does not change the qualitative nature of the core results.