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Fixed-fee Pricing and Entry

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Abstract

This study considers the anti-competitive effect of fixed-fee pricing, such as the one seen in a recent antitrust case in Japan. We show that fixed-fee pricing has stronger exclusionary effect than the per-use pricing's exclusionary effect. However, the restriction on usage of fixed-fee pricing may have a welfare-decreasing effect, although the restriction promotes entry.

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1 Introduction

Fixed-fee pricing is becoming popular, particularly in the information goods market. This study considers fixed-fee pricing in the context of a recent antitrust case in Japan, in which the Japanese Society for the Rights of Authors, Composers, and Publishers (JASRAC) opposed the Japan Fair Trade Commission (JFTC) (JASRAC v. JFTC, 2009).

The defendant in the case, JASRAC, is a dominant performance rights organization (PRO). A PRO collects fees from the users of copyrighted songs and pays the copyright holders a fee for the songs played. JASRAC has, historically, offered a fixed fee, the so-called blanket license, to broadcasting stations. Under fixed-fee pricing, a station can use all songs with no limitation. In 2006, a new company named e-License attempted to enter the PRO business for broadcasting stations and offered per-use pricing (or a per-use license) to broadcasting stations, according to which a user pays every time a song is played. However, few stations played e-License songs. In due course, copyright holders did not renew their contracts with e-License and instead signed agreements with JASRAC. As a result, e-License was prevented from entering the broadcasting PRO market. In 2009, JFTC asserted that fixed-fee pricing deterred the entry of competitors and ordered JASRAC to change its pricing scheme.

This study models the competition between fixed-fee and per-use pricing to clarify the entry deterrence effect of fixed-fee pricing. We develop a simple upstream-downstream model and show that fixed-fee pricing has a stronger exclusionary effect than per-use pricing's exclusionary effect. We show, however, that the restrictions on usage of fixed-fee pricing may have a welfare-decreasing effect, although such a restriction promotes entry. Moreover, we show that the entrant always prefers fixed-fee pricing to per-use pricing and fixed-fee pricing leads to market entry. It is sometimes argued that fixed-fee pricing itself has an anti-competitive effect. Our results suggest, however, that fixed-fee competition is optimal from a welfare perspective and promotes efficient entry.

In some countries, such as the US, fixed-fee pricing (blanket licensing) is used by PROs and this pricing method raises antitrust issues. Kleit (2000) models the competition between two existing PROs based on the US antitrust case (ASCAP v. BMI, 1979) and shows that fixed-fee pricing generates higher profits for PROs than per-use pricing. The author also shows that a PRO that uses fixed-fee pricing can block an entry of another PRO that uses per-use pricing. Our model differs from that of Kleit in several ways. First, Kleit's model neglects copyright holders' decisions concerning the choice of the PRO with whom to contract. Kleit assumes that a copyright holder obtains the same profit regardless of the PRO and its pricing schemes. In contrast, this paper assumes that a copyright holder's profit depends on the pricing schemes a PRO employs and the number of songs the PRO owns. Second, we consider the number of times a song is played to clarify the difference between fixed-fee pricing and per-use pricing. We incorporate the premise that consumers can buy a product without limitations under the fixed-fee pricing - an all-you-can-eat or buffet-pricing model.[1] In Kleit's model, however, unit demand for each song is assumed. Third, our model enables welfare analysis, which Kleit's model does not. Kleit shows that consumers prefer per-use pricing to fixed-fee pricing. We show, however, that welfare under monopoly fixed-fee pricing can be greater than welfare under per-use pricing even with efficient entry.

The remainder of the paper is organized as follows: Section 2 presents our basic model, and Section 3 discusses the effects of the pricing scheme on welfare. Section 4 discusses the entrant's optimal pricing scheme, and Section 5 contains concluding remarks. We relegate all proofs to the Appendix.

[1]Few papers analyze this type of pricing. Nahata et al (1999) consider a homogenous goods model with consumers that have either homogenous or heterogeneous preferences.

2 The Model

This section examines the effect of fixed-fee pricing using a simple model that is comprised of upstream and downstream firms. Assume that two upstream manufacturers (song writers), Manufacturer 1 (M1) and Manufacturer 2 (M2), produce differentiated products, and two downstream distributors (PROs), the incumbent (I) and the potential entrant (E), distribute manufacturers' goods to consumers (broadcasting stations). For simplicity, we assume that the fixed entry cost is zero.

We model the actual case, JASRAC v. JFTC, by focusing on the following situation. First, we assume that one of the manufacturers (M1, without loss of generality) has exclusively contracted with the incumbent distributor. Consumers must contract with the incumbent to purchase M1's goods. Second, following the usual economic model of PRO, we assume that a manufacturer can contract with only one distributor (so-called single homing). In the model, only M2 chooses the distributor with which to contract. Third, as seen in the practical example of the contract between a composer and a PRO, we assume that a manufacturer and a distributor share the integrated profits through a lump sum transfer specified in the contract.[2] Finally, the incumbent offers its price to consumers before the entrant.[3]

The timing of this game is as follows. In the first stage, the entry decision is made by E. In the second stage, I and E offer M2 a share of their profits. In the third stage, I makes a take-it-or-leave-it fixed-fee offer (denoted by F_I) or unit price offer (denoted by p_I) to final consumers, and the consumers decide whether to accept or reject this offer. In the fourth stage, E makes a take-it-or-leave-it fixed-fee offer (denoted by F_E) or unit price offer (denoted by p_E) to the final consumers, and the consumers decide whether to accept or reject this offer and how many of each product to buy. We look at a subgame perfect Nash equilibrium by solving this game using backward induction.

We use a standard representative consumer model where consumer' utility from the two retailers is defined by:

$$U(q_1, q_2) = \alpha(q_1 + q_2) - \frac{1}{2}\beta(q_1^2 + 2\gamma q_1 q_2 + q_2^2),$$

where q_i is the quantity of goods from manufacturer i and the parameter γ $(0 \leq \gamma < 1)$ measures the degree of differentiation between the goods produced by M1 and M2. The lower γ implies a higher degree of differentiation. Hence, M1 and M2 provide independent goods when $\gamma = 0$. For simplicity, we assume that $\alpha = \beta = 1$.

We also assume that both manufacturers face the same constant marginal cost c, which is normalized to zero (a zero marginal production cost can be justified when we consider information goods). Further, distributors incur a constant marginal distribution cost. The incumbent's distribution cost and the entrant's distribution cost are denoted by d_I and d_E, respectively. We assume that $d_I \geq d_E = 0$; thus, the entrant is more efficient than the incumbent. The incumbent's distribution cost (d_I) represents the difference in efficiency between the incumbent and the entrant. We also assume that $1/2 > d_I$, implying that the entrant cost advantage is non-drastic.[4]

In the second stage, two distributors compete for a product produced by M2. M2 compares

[2] Such revenue sharing contracts are widely used by platform providers, such as Apple and Google. See Foros, et. al (2013).

[3] By the final assumption, we avoid a no-equilibrium problem in the competition between fixed fee and per-use pricing. In competition where both distributors use the same pricing scheme, there is a unique equilibrium with simultaneous offers and the result remains the same substantially.

[4] Non-drastic cost advantage means that if two goods are homogenous ($\gamma = 1$) with the demand function $q_E = 1 - p_E$ under per-unit pricing, the entrant cannot offer a monopoly price (that is, argmax $(1 - p_E)p_E = 1/2$) when $1/2 > d_I$.

both distributors' offers and chooses the incumbent, if M2 obtains a higher profit by selling through a monopoly distributor than through an efficient entrant. Each distributor attracts M2 using a lump-sum transfer. Let x_I and x_E denote the lump-sum transfer from the incumbent and the entrant to M2, respectively. Similarly, let y_I^M and y_I^D denote the lump-sum transfer from the incumbent to M1 under monopoly and duopoly, respectively. In addition, the incumbent's monopoly profit is denoted by Π_I^M, which represents the total profit earned from the selling of goods produced by both M1 and M2. Similarly, the entrant's duopoly profit is denoted by Π_E, which represents the total profit earned from the selling of M2's goods. M2 chooses the incumbent's offer (x_I) if $x_I \geq x_E$. Because the entrant cannot enter the market without M2's goods, $x_E = \Pi_E$ at most.[5] The incumbent's incentive to compete for M2's goods must also be considered. It may be preferable to accommodate the entrant and only sell M1's goods, when the cost of attracting M2 is high. Thus, the incumbent has an incentive to attract M2 if $\Pi_I^M - x_I - y_I^M \geq \Pi_I^D - y_I^D$ holds, where Π_I^D represents the duopoly profit the incumbent earns by selling only M1's goods in a duopoly market. Exclusion equilibrium exists when these two conditions ($x_I \geq x_E$ and $\Pi_I^M - x_I - y_I^M \geq \Pi_I^D - y_I^D$) simultaneously hold. For analytical simplicity, we assume that $y_I^M = y_I^D$.[6] In the equilibrium, we also have $x_I = x_E$ and $x_E = \Pi_E$. Hence, exclusion equilibrium exists if the following condition holds:

$$\Pi_I^M \geq \Pi_I^D + \Pi_E. \tag{1}$$

This condition implies that exclusion equilibrium exists when exclusion (i.e., monopoly by the incumbent) increases the joint profit of M2 and the incumbent. To show the possibility of deterring entry, we derive parameters γ and d_I that satisfy condition (1).

Competition between fixed-fee and per-use pricing As seen in the JASRAC case, we investigate the case where the incumbent relies on fixed-fee pricing, and the entrant uses per-use pricing. We thus obtain the following proposition.

Proposition 1 *Suppose that the incumbent distributor uses fixed-fee pricing and the entrant distributor uses per-use pricing. If the difference in distribution costs between the incumbent and the entrant is sufficiently small, a unique exclusion equilibrium exists.*

An exclusion equilibrium exists when the incumbent's distribution cost is sufficiently low to satisfy $1/(4 - 2\gamma) \geq d_I$. Figure 1 illustrates the range of parameters within which exclusion occurs in the equilibrium (shaded area). Intuitively, if two goods are approximately homogenous, the entrant's unit price (p_E) should be close to zero. Thus, consumers anticipate that even if they reject the incumbent's fixed fee offer (F_I), they can purchase a similar product from the entrant at a price close to zero. Thus, when γ is high, consumers accept F_I only if it is sufficiently low. Therefore, both Π_E and Π_I^D are low with higher γ and the decrease in $\Pi_I^D + \Pi_E$ with respect to γ is larger than the decrease of Π_I^M. Thus, the higher γ, the greater the possibility of exclusion.[7]

[5] In the basic model, we assume that there is no fixed entry fee for the entrant. If the entry fee (denoted by f) is positive, $x_E = \Pi_E - f$ at most. Therefore, exclusion is likely to occur in this case.

[6] If $y_I^M > y_I^D$, entry is likely to occur, whereas if $y_I^M < y_I^D$, exclusion is likely to occur.

[7] Based on Microsoft's per-processor contract case in the US, Gilbert and Shapiro (1997), Gilbert (1998) showed using a simple model that when a product is sold at a fixed fee, another product's profit tends to be small using per-unit pricing, because the latter product should have greater value according to its positive per-unit price. Our model extends this model and considers the extent of product differentiation. We show that the extent of product differentiation affects the profit of a seller using per-unit pricing.

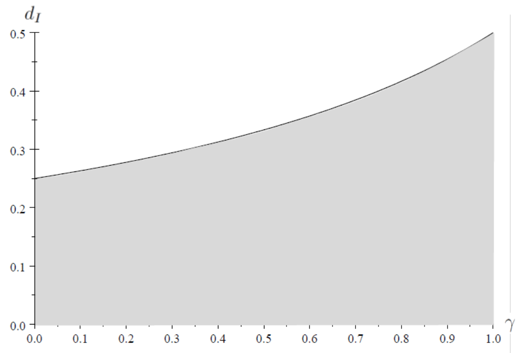

Figure 1: Exclusion area under fixed fee and per-use price competition

Fixed-fee pricing represents a type of bundling.[8] Even if a distributor has only one product to sell, it can sell multiple units of the product for the fixed fee. Our findings show that if one distributor adopts this pricing method, the retail market competition will become so intense that one free manufacturer (M2) will ultimately prefer the bundler: the incumbent distributor. Therefore, if the incumbent, who has existing contracts with other manufacturers (or is vertically integrated), adopts fixed-fee pricing, the incumbent can exclude the efficient entrant distributor from the market. The existing literature finds that when the incumbent bundles two goods, an entrant whose product is homogenous to an incumbent's product can not enter the market. In contrast, in our model, the incumbent's fixed-fee pricing induces a manufacturer to be bundled with a competitor's product and results in the exclusion of a new efficient distributor.

Comparison with per-use pricing competition The per-unit pricing of all PROs is sometimes discussed as a potential alternative that promotes entry. We consider the possibility of exclusion when both the incumbent and entrant distributors compete under a per-use pricing method and compare this with the result in Proposition 1. We thus obtain the following proposition.

Proposition 2 *Exclusion is more likely to occur when the incumbent employs fixed fee pricing than when the incumbent employs per-unit pricing.*

Under per-use pricing competition, if d_I is sufficiently small, there is a unique equilibrium in which the efficient entrant cannot enter the market, and the inefficient incumbent can be a monopolist.[9] Figure 2 suggests that fixed-fee pricing has a stronger exclusionary effect than per-unit pricing. In the exclusion area of each type of competition, M2 obtains a higher profit by avoiding downstream competition and M2 sells at a collusive price using a common agent: the incumbent distributor. The result suggests that regulating fixed-fee pricing may not always lead to a pro-competitive result.

[8]Nalebuff (2004) shows that bundling can function as a deterrent to entry. See also Bakos and Brynjolfsson (1999; 2000) and Armstrong (2010) for the exclusionary effect of bundling of information goods.

[9]The exclusion region under per-unit pricing competition can be divided into two cases; $0.84 > \gamma$ and $\gamma \geq 0.84$. If $0.84 > \gamma$, exclusion is likely to occur with higher γ. As the two goods become homogenous, the market becomes more competitive, and the duopoly profits of the incumbent and the entrant decrease. Therefore, M2 chooses the incumbent to obtain a share of monopoly profit. However, if $\gamma \geq 0.84$, exclusion is likely to occur with lower γ. In this region, the incumbent's unit price (p_I) is always higher than the entrant's unit price (p_E). The incumbent's monopoly profit decreases as two goods become more homogenous, whereas the entrant's profit increases because many consumers purchase only M2's goods at a low price.

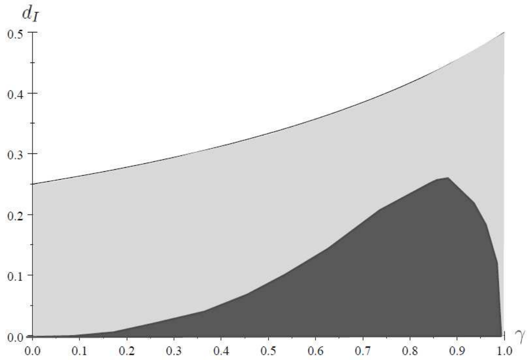

Figure 2: Comparison of the exclusion area

3 Welfare analysis

This section compares welfare in per-use pricing competition with welfare under competition between fixed-fee and per-use pricing. Welfare in this economy, denoted by W, is defined as follows:

$$W = U(q_1, q_2) - d_I q_1 - d_i q_2,$$

where $U(q_1, q_2) = (q_1 + q_2) - (q_1^2 + 2\gamma q_1 q_2 + q_2^2)/2$, and $d_i = d_I$ if M2's goods are distributed by the incumbent, whereas $d_i = d_E(= 0)$ if M2's goods are distributed by the entrant. We present two cases as follows: case (i) represents exclusion under both types of competition, and case (ii) represents entry under per-use pricing competition and exclusion under fixed-fee and per-use pricing competition. We show that in case (i), welfare is always higher when the incumbent employs a fixed-fee pricing. In case (ii), with particular γ and d_I, welfare is higher when the incumbent employs a fixed-fee pricing. We summarize this result in the following proposition.

Proposition 3 *A region of γ and d_I exists where welfare is higher when the incumbent employs a fixed-fee pricing than it employs a per-use pricing, although fixed-fee pricing blocks efficient entry into the market.*

The intuition behind Proposition 3 is as follows. Efficient entry has two welfare-increasing effects: it reduces the unit price and the marginal costs. However, in the context where the incumbent uses fixed-fee pricing, the unit price of each good is zero although the market is monopolized. When entry occurs, the good's price of M2 becomes higher than zero because the entrant relies on the per-use price. Thus, entry raises the unit price. Note that the incumbent's distribution cost may not be zero ($d_I \geq 0$); a zero unit price under fixed-fee pricing induces over-consumption and the efficient entry controls this over-consumption. However, this welfare-increasing effect of an efficient entry is limited, especially when the efficiency gap between the incumbent and entrant (d_I) is sufficiently small. Welfare analysis shows that regulation on fixed-fee pricing may decrease welfare.

4 The entrant's optimal pricing

Finally, we extend the basic model and consider the entrant's optimal choice of pricing when competing with the fixed-fee-pricing incumbent. In this model, the entrant can choose a fixed-fee pricing or per-use pricing in the fourth stage. The remainder is the same as the basic model. We obtain the following proposition.

Proposition 4 *If the incumbent distributor uses fixed-fee pricing and the entrant distributor can choose fixed-fee or per-use pricing, the entrant always chooses fixed-fee pricing and enters the market.*

If the entrant can choose an optimal pricing scheme, it will always choose fixed-fee pricing. Through fixed fee, a distributor can extract all utility from consumers. Thus, Π_E is higher when the entrant uses fixed-fee rather than per-use pricing. The incumbent and the entrant share the total surplus at zero price $(1/(1+\gamma))$.[10] This renders $\Pi_E + \Pi_I^D$ high and induces $\Pi_I^D + \Pi_E \geq \Pi_I^M$, where equality holds if $d_I = 0$.[11] As a result, condition (1) does not hold, and efficient entry always occurs.[12] Under fixed-fee competition, the quantities consumed of both goods are the same in monopoly and duopoly. Therefore, the efficient entry taking fixed-fee pricing increases welfare compared to welfare in a monopoly by the inefficient incumbent.

According to the JFTC report, in the JASRAC case, although the entrant attempted to offer a fixed fee before a per-unit price, the broadcasting stations rejected it. Then, the entrant was resigned to offer per-use pricing. This implies that fixed-fee pricing is optimal for the entrant, as Proposition 4 suggests. Therefore, the antitrust authority should investigate why the entrant's fixed fee was rejected and it should provide a remedy that enables the entrant to avail fixed-fee pricing.[13] Removing the cause that discourages the entrant's usage of fixed-fee pricing is more desirable than regulating the usage of fixed-fee pricing itself from a welfare perspective.

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[10] In the equilibrium, $F_I = 1/2$ and $F_E = (1-\gamma)/2(1+\gamma)$. We have $F_I \geq F_E$ because the incumbent offers the price to the consumers before the entrant.

[11] In our model, we assume that there is no fixed entry fee. If the entry fee (f) is positive, the condition becomes $\Pi_I^M \geq \Pi_I^D + (\Pi_E - f)$ and exclusion may occur with sufficiently high f (that is $f > d_I/(1+\gamma)$).

[12] Bakos and Brynjolfsson (2000) show that large bundlers (that is distributors with more products to bundle than small bundlers) are willing to pay more for upstream firms than small bundlers, because the value of a bundle increases with the number of goods and it exceeds the value of a product sold by smaller bundlers because of demand uncertainty. Thus, large bundlers have an advantage in competition for a new product. In contrast, our model shows that the entrant (i.e., a smaller bundler) can obtain a new product, because without uncertainty, the value of the bundle exactly equals the aggregated value of products, and the entrant is more efficient than the incumbent.

[13] Our model suggests that if the incumbent's fixed fee is adjustable depending on M2's choice, fixed-fee pricing ensures efficient entry. In the JASRAC case, however, the incumbent had offered the same fixed-fee as it was a monopoly. The factor responsible for determining the incumbent's fixed fee exogenously should be eliminated to facilitate efficient entry.

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A Appendix

Proof of Proposition 1 To check whether condition (1) holds, first, we derive the entrant's profit (Π_E) and the incumbent's profit (Π_I^D) in duopoly (M2 chooses E in the second stage). Suppose that consumers accept F_I in the third stage. Then, in the fourth stage, consumers maximize $(q_1 + q_2) - (q_1^2 + 2\gamma q_1 q_2 + q_2^2)/2 - F_I - p_E q_2$. Then, E's profit becomes $\Pi_E = (1-\gamma)/4(1+\gamma)$ with $p_E = (1-\gamma)/2$. Consequently, consumers' net utility in this case (U_1) becomes $U_1 = (3\gamma - 8F_I - 8\gamma F_I + 5)/8(\gamma+1)$. If consumers reject F_I in the third stage, consumers' net utility (U_2) becomes $U_2 = 1/8$. Therefore, I's optimal F_I becomes $F_I = (2+\gamma)/4(1+\gamma)$ satisfying $U_1 \geq U_2$. Then, I's duopoly profit becomes $\Pi_I^D = (1-2d_I)(\gamma+2)/4(\gamma+1)$.

Next, we derive I's monopoly profit. Consumers maximize $(q_1+q_2)-(q_1^2+2\gamma q_1 q_2+q_2^2)/2-F_I$ and the optimal quantities consumed are $q_1 = q_2 = 1/(1+\gamma)$. Consumers accept F_I as long as their net utility is non negative. Therefore, the optimal fixed fee is $F_I = 1/(1+\gamma)$ which induces $\Pi_I^M = (1-2d_I)/(1+\gamma)$.

Therefore, condition (1) becomes $1/(4-2\gamma) \geq d_I$ and exclusion occurs if d_I and γ satisfy the condition above. Figure 1 shows the area where exclusion (shaded) can occur.■

Proof of Proposition 2 First, we derive the entrant's profit (Π_E) and the incumbent's profit (Π_I^D) in duopoly. Suppose that consumers accept p_I in the third stage. In the fourth stage, consumers maximize $(q_1+q_2)-(q_1^2+2\gamma q_1 q_2+q_2^2)/2-p_I q_1-p_E q_2$. Given p_I, E's profit becomes $(-\gamma+\gamma p_I+1)^2/4(1-\gamma)(\gamma+1)$, with $p_E = (1-\gamma+\gamma p_I)/2$. This price induces with the quantity consumed of each good is as follows:

$$\begin{aligned} q_1 &= \frac{-\gamma - 2p_I - \gamma^2 + \gamma^2 p_I + 2}{2(1-\gamma)(\gamma+1)}, \\ q_2 &= \frac{-\gamma + \gamma p_I + 1}{2(1-\gamma)(\gamma+1)}. \end{aligned}$$

Then, I's optimal per-unit price becomes $p_I = \max[(2-\gamma+2d_I-\gamma^2-\gamma^2 d_I)/2(2-\gamma^2), d_I]$ and we confirm that consumers accept it. Then, the profit of each distributor becomes:

$$\begin{aligned} \Pi_I^D &= \max\left[\frac{(-\gamma-2d_I-\gamma^2+\gamma^2 d_I+2)^2}{8(1-\gamma)(\gamma+1)(2-\gamma^2)}, 0\right], \\ \Pi_E &= \min\left[\frac{(2\gamma+3\gamma^2-\gamma^3-2\gamma d_I+\gamma^3 d_I-4)^2}{16(1-\gamma)(\gamma+1)(\gamma^2-2)^2}, \frac{(-\gamma+\gamma d_I+1)^2}{4(1-\gamma)(\gamma+1)}\right]. \end{aligned}$$

Next, we derive I's monopoly profit. Consumers maximize $(q_1+q_2)-(q_1^2+2\gamma q_1 q_2+q_2^2)/2-p_I(q_1+q_2)$ and the optimal quantities consumed are $q_1 = q_2 = (1-p_I)/(1+\gamma)$. Then, I's monopoly profit is $\Pi_I^M = (1-d_I)^2/2(\gamma+1)$ with $p_I = (1+d_I)/2$.

Therefore, condition (1) becomes as follows:

$$\min\left[\frac{(\gamma-1)\left(-2\gamma^2+\gamma^3+8\right)+2\sqrt{2}\sqrt{-16\gamma+20\gamma^3-9\gamma^4-7\gamma^5+4\gamma^6+8}}{\left(\gamma^2-2\right)\left(-8\gamma+\gamma^2+4\right)}, \frac{(\gamma+2)(1-\gamma)}{(2-\gamma^2)}\right] \geq d_I$$

and $$\frac{(\gamma+2)(\gamma-1)+\sqrt{2}\sqrt{1-\gamma}}{2\gamma+\gamma^2-2} \geq d_I > \frac{(\gamma+2)(1-\gamma)}{(2-\gamma^2)}.$$

Figure 2 shows the area where exclusion (black) can occur. Finally, we compare the exclusion area in competition between fixed-fee and per-use pricing (shaded) and per-use price competition (black). The exclusion area is wider when the incumbent employs fixed fee than when it employs per-unit price.■

Proof of Proposition 3 In case (i), we compare welfare in a monopoly for each type of competition. Welfare in a monopoly by fixed-fee pricing (W_{MF}) is $W_{MF} = (1-2d_I)/(\gamma+1)$, where $q_1 = q_2 = 1/(\gamma+1)$. Welfare in a monopoly by per-use pricing (W_{MP}) is $W_{MP} = 3\left(1-d_I\right)^2/4(\gamma+1)$, where $q_1 = q_2 = (1-d_I)/2(\gamma+1)$, and we have $W_{MF} \geq W_{MP}$ in case (i) area.

In case (ii), entry occurs under per-use pricing competition. There are two types of outcomes:1. the incumbent obtains a positive profit if $(\gamma+2)(1-\gamma)/(2-\gamma^2) \geq d_I$, and 2. the incumbent obtains zero profit if $d_I > (\gamma+2)(1-\gamma)/(2-\gamma^2)$. Let W_{D1} and W_{D2} denote welfare in the first case and the second case of duopoly, respectively. We have $W_{MF} \geq W_{D1}$ if d_I satisfies the following condition:

$$\frac{\left(\gamma^2-2\right)(\gamma-1)\left(-8\gamma-18\gamma^2+5\gamma^3+40\right)+4(\gamma-1)\sqrt{\left(\gamma^2-2\right)^3\left(20\gamma+29\gamma^2-10\gamma^3-62\right)}}{\left(5\gamma^2-12\right)\left(\gamma^2-2\right)^2} \geq d_I,$$

and $$d_I > \frac{(\gamma-1)\left(-2\gamma^2+\gamma^3+8\right)+2\sqrt{2}\sqrt{-16\gamma+20\gamma^3-9\gamma^4-7\gamma^5+4\gamma^6+8}}{\left(\gamma^2-2\right)\left(-8\gamma+\gamma^2+4\right)}.$$

In this case, welfare decreases when the incumbent uses per-use pricing, although entry occurs. On the other hand, we always have $W_{D2} > W_{MF}$ when $d_I > (\gamma+2)(1-\gamma)/(2-\gamma^2)$ holds.

Proof of Proposition 4 First, we derive the entrant's profit (Π_E) and the incumbent's profit (Π_I^D) in duopoly. Suppose that consumers accept F_I in the third stage. In the fourth stage, if the entrant chooses per-unit pricing, as in proof of Proposition 1 $\Pi_E = (1-\gamma)/4(1+\gamma)$. On the other hand, if the entrant chooses fixed fee, then $\Pi_E = (1-\gamma)/2(\gamma+1)$, which is larger than $(1-\gamma)/4(1+\gamma)$. Therefore, E chooses fixed-fee pricing. Consumers' net utility in this case becomes $U_1 = 1/2 - F_I$.

Next, suppose that consumers reject F_I in the third stage. If the entrant chooses fixed fee, $\Pi_E = 1/2 (= F_E)$, which is larger than 1/4, E's profit by per-unit pricing. Then, E chooses fixed-fee pricing and consumers' net utility becomes 0. In the third stage, consumers accept F_I as long as $1/2 \geq F_I$ (i.e., $U_1 \geq 0$) and I's profit becomes $\Pi_I^D = (1+\gamma-2d_I)/2(\gamma+1)$.

As shown in Proposition 1, the incumbent's monopoly profit is $\Pi_I^M = (1-2d_I)/(\gamma+1)$. Then, we always have $\Pi_I^D + \Pi_E \geq \Pi_I^M$ and equality holds when $d_I = 0$. Therefore, exclusion does not occur if E can choose its pricing scheme in the fourth stage.■