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The effects of parallel trade in two-sided markets

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ABSTRACT

This study investigates the effects of parallel imports in two-sided markets, which may increase profits for manufacturers when products have a two-sided market nature. Additionally, parallel imports increase consumer surplus and social welfare in all countries if the network externalities from both sides are large enough. However, if one externality is small while the other is large, parallel imports can hurt consumers and welfare in all countries.

1. Introduction

In 2002, the European Commission fined Nintendo and its seven distributors in Europe €167.8 million for colluding to prevent parallel imports (PIs) for Nintendo products.[1] Maskus and Chen (2004) and Malueg and Schwartz (1994) suggested that allowing PIs decreases the profit of the manufacturer because it limits its ability to make international price discriminations. However, Nintendo's case is different from conventional PIs, because the products take the form of a platform on a two-sided market, where the demands of different groups are mutually affected through this platform.

Specifically, more users on one side increase the number of users on the other, and vice versa. Consumers have higher incentives to buy a game console, such as the Nintendo Switch, if there are more games for the console, and developers have higher incentives to develop new games if there are more consumers. Therefore, the utility of consumers and profitability of game developers are mutually affected. Many products have this two-sided market nature, including digital single-lens reflex cameras and printers. This study investigates the effects of PIs for two-sided markets, which has been overlooked in the literature.

2. Model

Firm H is a single manufacturer of a game console, located in country H, and selling the game console in counties H and F. The firm sells the console by itself in country H, but relies on local retailer X to sell it in country F. We assume firm H makes a take-it-or-leave-it offer retailing contract with retailer X, with a two-part tariff consisting of a per-unit wholesale price, w, and a lump-sum fixed fee, T.[2] The model setup is the same as Maskus and Chen (2004).

The inverse demand for game console in countries H and F are:

$$P = v + \alpha m - Q \text{ and } P^* = v + \alpha m - Q^*, \tag{1}$$

respectively, where v is the intercept of demand, P is the price, and Q is the sales of the console in country H. The variables with asterisks correspond to those in country F. Each game is provided by an independent game developer in a third country and m is the number of games. Variable α denotes the magnitude of the externality on the consumers' side, where a higher α implies consumers have a higher utility from increased game varieties.

To create a game, developers buy a game development kit (GDK) from firm H at fixed price G. There are M potential game developers, each with different efficiencies in developing games who decide whether to provide a game on this platform. The R&D costs of game developers are given by f, being uniformly

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1 See https://ec.europa.eu/competition/publications/cpn/2003_1_50.pdf for details.

2 Firm H is willing to use a two-part tariff contract (see Online Appendix A). Our result holds even if firm H negotiates the two-part tariff with firm X, as long as firm H has a sufficiently large negotiation power over firm X.

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distributed over interval $[0, \bar{f}]$. Let $m \in [0, M]$ denote the active number of game developers in the market.[3] The profit of a game developer is given by $\pi = \phi(Q + Q^*) - G - f$, where ϕ is the per-unit revenue, which also captures the degree of the network externality on the game developers' side. For simplicity, we assume no pricing games or other strategic interactions among developers and that ϕ is exogenously given.[4] Developers earn higher profits as more consumers purchase the console.

Game developers enter the market if $\pi \geq 0$. Let $\hat{f}$ be the critical R&D cost, such that $\pi = 0$ holds. The total number of game developers in the market becomes:

$$m = M\left(\frac{\hat{f}}{\bar{f}}\right) = \frac{M}{\bar{f}}\left[\phi(Q + Q^*) - G\right]. \tag{2}$$

As game consoles have a nature of two-sided markets and consumers' utilities are higher if more games are available, game developers' profits increase when there are more game console buyers. Therefore, there are mutual interactions between consumers and game developers. Based on (1) and (2), we can rewrite the inverse demands as:

$$P = v + \frac{\alpha M}{\bar{f}}(\phi Q^* - G) - \left(1 - \frac{\alpha M\phi}{\bar{f}}\right)Q, \tag{3}$$

$$P^* = v + \frac{\alpha M}{\bar{f}}(\phi Q - G) - \left(1 - \frac{\alpha M\phi}{\bar{f}}\right)Q^*. \tag{4}$$

Note that the demands for game consoles in the two countries are correlated, although the markets are segmented. If there are more game consoles sold in one country, there will be more game developers, leading to an increase in another country's willingness to pay for game consoles. If α and ϕ are large, then $\alpha M\phi/\bar{f}$ is large, where $\alpha\phi$ reflects the reinforcing effect of the network externalities in the two-sided market. From (3) and (4), a higher $\alpha M\phi/\bar{f}$ not only increases the intercept of the inverse demand function, but also makes its slope flatter. To focus on interior solutions for when firm H sells the console in both countries, we assume $2\bar{f} - M(\alpha + \phi)^2 > 0$. This assumption ensures the existence of profit-maximizing outputs of firms in all circumstances and also guarantees that the demand curves are downward-sloping ($\alpha M\phi/\bar{f} < 1$).

3. Equilibrium without PIs

This section derives the equilibrium when PIs are prohibited. In stage 1, firm H determines the take-it-or-leave-it retailing contract, (w, T), to retailer X and the price of GDK. Then, retailer X determines whether to accept the contract and developers decide whether to enter the game market. In stage 2, firm H determines the amount of sales in country H, q, and retailer X determines the amount of sales in country F, x^*. Note that $Q = q$ and $Q^* = x^*$ hold when PIs are prohibited. Backward induction derives the subgame perfect equilibrium.

In stage 2, firm H and retailer X determine their sales simultaneously. The profit function of firm H and retailer X are:

$$\Omega = (P - c)q + mG + (w - c)x^* + T, \tag{5}$$

$$\Pi = (P^* - w)x^* - T. \tag{6}$$

By profit-maximizations, the equilibrium sales become Eqs. (7) and (8) as given in Box I . In stage 1, firm H exploits all profits that retailer X earns by setting $T = (P^* - w)x^*$. Accordingly, firm H determines w and G to maximize the joint profit, $\Omega + \Pi$. The equilibrium wholesale price and the price of GDK respectively become:

$$w^N = c - \frac{M(v - c)\phi^2\left[8\bar{f}^2 - 8\bar{f}M\alpha\phi + M^2\alpha^2\phi(\alpha + \phi)\right]}{\Gamma^N}, \tag{9}$$

$$G^N = \frac{\bar{f}(v - c)(\phi - \alpha)\left[8\bar{f}^2 - 8\bar{f}M\alpha\phi + M^2\alpha^2\phi(\alpha + \phi)\right]}{\Gamma^N}, \tag{10}$$

where $\Gamma^N \equiv 16\bar{f}^3 - 8\bar{f}^2M(\alpha^2 + 4\alpha\phi + \phi^2) + 4\bar{f}M^2\alpha\phi(2\alpha + \phi)(\alpha + 2\phi) - M^3\alpha^2\phi^2(\alpha + \phi)^2 > 0$, and superscript N denotes equilibrium. The equilibrium profit of firm H is derived by substituting Eqs. (7) to (10) into (5), which yields:

$$\Omega^N = \frac{\bar{f}(v - c)^2\left[8\bar{f}^2 - 8\bar{f}M\alpha\phi + M^2\alpha^2\phi(\alpha + \phi)\right]}{\Gamma^N}. \tag{11}$$

Without PIs, firm H has an incentive to set a lower-than-marginal -cost wholesale price, $w^N < c$, to entice retailer X to increase sales in country F, x^*, and reinforces network externalities on both sides of the market.

4. Equilibrium with PIs

When PIs are allowed, the game structure is the same, except that retailer X can now resell game consoles to country H in the final stage. Let x be the volume of PIs; we have $Q = q + x$. We assume no trade cost of PIs, since it complicates the equations without qualitatively affecting the results.

In the final stage, firm H determines q and firm X determines x and x^* to respectively maximize:

$$\Omega = (P - c)q + mG + (w - c)(x + x^*) + T, \tag{12}$$

$$\Pi = (P - w)x + (P^* - w)x^* - T. \tag{13}$$

The profit-maximizing sales are:

$$q = \frac{\bar{f}(v + w - 2c) - GM(\alpha - 2\phi)}{3(\bar{f} - M\alpha\phi)}, \tag{14}$$

$$x^* = \frac{\bar{f}(v - w) - M\alpha G}{2(\bar{f} - 2M\alpha\phi)}, \text{ and } x = x^* - \frac{1}{2}q. \tag{15}$$

In stage 1, the fixed retailing fee will be $T = (P - w)x + (P^* - w)x^*$ and firm H determines w and G to maximize $\Omega + \Pi$, which yields:

$$w^{PI} = c + \frac{(v - c)\left[\begin{array}{l} 8\bar{f}^3 - 5\bar{f}^2M\phi(3\alpha + 5\phi) + 8\bar{f}\alpha M^2\phi^2(3\alpha + 5\phi) \\ -16M^3\alpha^2\phi^3(\alpha + \phi) \end{array}\right]}{\Gamma^{PI}}, \tag{16}$$

$$G^{PI} = \frac{\bar{f}(\phi - \alpha)(v - c)(5\bar{f} - 4M\alpha\phi)^2}{\Gamma^{PI}}, \tag{17}$$

where $\Gamma^{PI} \equiv 52\bar{f}^3 + 40\bar{f}M^2\alpha\phi(\alpha^2 + 3\alpha\phi + \phi^2) - 16M^3\alpha^2\phi^2(\alpha + \phi)^2 - \bar{f}^2M(25\alpha^2 + 138\alpha\phi + 25\phi^2) > 0$, and superscript PI denotes equilibrium. The equilibrium profit of firm H is derived by substituting Eqs. (14) to (17) into (12), which yields:

$$\Omega^{PI} = \frac{(v - c)^2\bar{f}(5\bar{f} - 4M\alpha\phi)^2}{\Gamma^{PI}}. \tag{18}$$

5. Comparison

Now, we investigate the effect of PIs on firm H's profit. Subtracting (11) from (18) yields:

[3] It is natural to assume that game developers have different efficiencies because games are usually provided by both large companies (such as Tencent, Electronic Art, Bandai Namco, and Square Enix) and small-sized developers known as "indie game developers". See also Online Appendix A.

[4] The same setup is used in Rasch and Wenzel (2013), for instance. See also Online Appendix A.

$$q = \frac{\bar{f}\left[2(v-c)(\bar{f}-\alpha M\phi)+(v-w)\alpha M\phi\right]+GM\left[\alpha M\phi(\alpha-2\phi)+2\bar{f}(\phi-\alpha)\right]}{(2\bar{f}-3\alpha M\phi)(2\bar{f}-\alpha M\phi)}, \tag{7}$$

$$x^* = \frac{\bar{f}\left[(v-c)\alpha M\phi+2(v-w)(\bar{f}-\alpha M\phi)\right]-GM\alpha\left[2\bar{f}-M\phi(\alpha+\phi)\right]}{(2\bar{f}-3\alpha M\phi)(2\bar{f}-\alpha M\phi)}. \tag{8}$$

Box I.

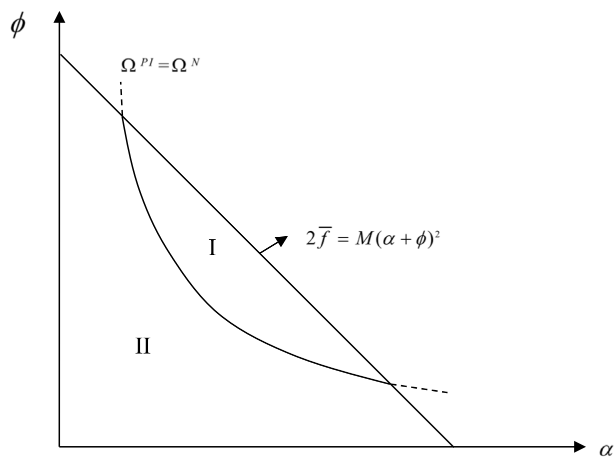

Fig. 1. Profit comparison.

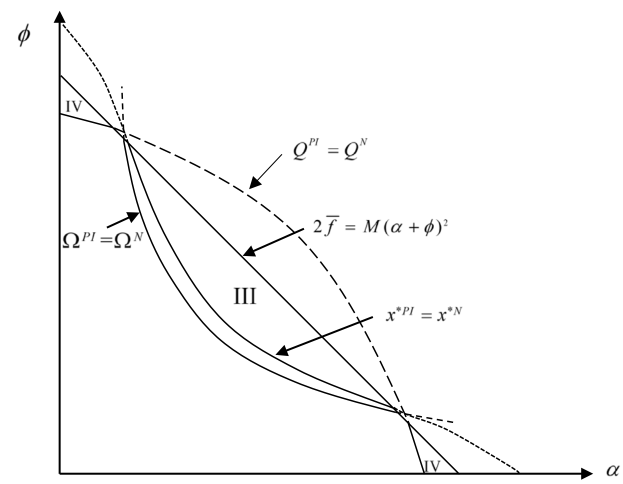

Fig. 2. Output comparison.

$$\Omega^{PI}-\Omega^{N} = \frac{8\bar{f}^5(\bar{f}-M\alpha\phi)(v-c)^2}{\Gamma^N\Gamma^{PI}} \times\left[-2+8\left(\frac{M\alpha\phi}{\bar{f}}\right)-2\left(\frac{M\alpha\phi}{\bar{f}}\right)^2-3\left(\frac{M\alpha\phi}{\bar{f}}\right)^3\right]. \tag{19}$$

We have $\Omega^{PI} > \Omega^N$ if $0.2739 < \frac{M\alpha\phi}{\bar{f}} < 1$, and $\Omega^{PI} < \Omega^N$ otherwise. A higher $\alpha\phi$ implies that the two network externalities are mutually better reinforced.[5] If this reinforcing effect is large enough, then PIs increase the profit of the manufacturer. Fig. 1 illustrates this result, where the combinations of α and ϕ that are below the line $2\bar{f} = M(\alpha+\phi)^2$ guarantee the existence of profit-maximizing outputs of firms.[6] If the combinations of α and ϕ fall into Region I (Region II), then we have $\Omega^{PI} > \Omega^N$ ($\Omega^{PI} < \Omega^N$).[7]

Proposition 1. *If the network externalities on both sides are large enough, then parallel imports of the platform product increase the profit of the platform manufacturer.*

Intuitively, PIs intensify competition in country H, which directly reduces firm H's profit. However, the resulting increase in the total sales of platform products enhances the profitability of game developers and also consumers' willingness to pay. This network effect leads to higher game console prices in country F and higher GDK prices, thus benefiting firm H. Therefore, permitting PIs can be a commitment devise to expand retailer sales, which enables firm H to internalize network externalities.

5 Note that $M\alpha\phi/\bar{f} < 1$ guarantees downward-sloping demands.

6 See Online Appendix B for more detailed explanations of Fig. 1.

7 Since only the area below $2\bar{f} = M(\alpha+\phi)^2$ is meaningful, the part of $\Omega^{PI} = \Omega^N$ which is out of $2\bar{f} = M(\alpha+\phi)^2$ is depicted in a dashed line.

Since the positive effects from network externalities are mutually reinforced, they dominate the competition effect of PIs when α and ϕ are high.

Considering the welfare effects of PIs, the consumer surplus in each country is respectively calculated as:

$$CS = \int_0^{Q}\left[v+\frac{\alpha M(\phi Q^*-G)}{\bar{f}}-\left(1-\frac{\alpha M\phi}{\bar{f}}\right)z-P\right]dz = \frac{\bar{f}-M\alpha\phi}{2\bar{f}}(Q)^2, \tag{20}$$

$$CS^* = \int_0^{x^*}\left[v+\frac{\alpha M(\phi Q-G)}{\bar{f}}-\left(1-\frac{\alpha M\phi}{\bar{f}}\right)z^*-P^*\right]dz^* = \frac{\bar{f}-M\alpha\phi}{2\bar{f}}(x^*)^2. \tag{21}$$

These are directly related to total outputs, where $Q = q$ without PIs and $Q = q + x$ with PIs. We use Fig. 2 to illustrate the output comparison, where $Q^N = Q^{PI}$ and $x^{*N} = x^{*PI}$ are added to Fig. 1.[8] This shows that $Q^N < Q^{PI}$ in the area below the $Q^N = Q^{PI}$ curve, which means $CS^N < CS^{PI}$ holds. Additionally, $x^{*N} < x^{*PI}$ in the area above the $x^{*N} = x^{*PI}$ curve implies that $CS^{*N} < CS^{*PI}$ holds. Therefore, if the network externalities are large such that the combinations of α and ϕ fall into Region III, PIs benefit consumers in all countries.

Proposition 2. *PIs that increase firm H's profit benefit consumers and improve welfare in country H. There is also a case for which PIs benefit consumers in all countries.*

Without network externalities (i.e., $\alpha = \phi = 0$), PIs intensify competition and benefit consumers in country H. Additionally, PIs

8 See Online Appendix B for the detailed explanation of Fig. 2.

induce firm H to increase the wholesale price to soften competition in country H, which decreases consumer surplus in country F. However, in two-sided markets, PIs enhance the entry of game developers and consumers' willingness to pay, leading firm H to increase the prices of GDK and of the game console in the two countries. If network externalities are close and large, they are mutually reinforced and PIs benefit consumers in both countries. However, if the difference between these two externalities is sufficiently large and the combinations of α and ϕ fall into Region IV, the outputs and consumer surplus decrease in both countries.

Proposition 3. *PIs damage consumers and welfare in both countries when the difference between α and ϕ is sufficiently large.*

These propositions are related to the literature of economic integration because permitting PIs enhances cross-border arbitrages. Although Ishikawa (2004) derived a similar result that economic integration can either benefit or hurt all consumers and the monopolist, he did not consider network externalities and the mechanism differs from ours.[9]

6. Conclusions

When products have a two-sided market nature, the PIs of platform products increase the competition in country H and profitability for game developers, as well as consumers' willingness to pay. When externalities from both sides are large enough, PIs increase manufacturer profits, as well as the consumer surplus and social welfare in all countries. However, if PIs reduce manufacturer profits, they may affect consumers in all countries.

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Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.econlet.2020.109721.

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9 In Ishikawa (2004), a switch in the market structure changes the monopolist's pricing behaviors, and a decreasing marginal cost magnifies the effect.