Resale Price Maintenance and Collusion in Two-Sided Markets

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Abstract: This paper investigates how RPM affects the collusion decision in two-sided market. This study indicates that duopoly platforms can adopt RPM and explores the relationship between RPM and collusion. This research concludes that (i) RPM consistently reduces retail-end prices, increases platform profits, and enhances consumer utility and social welfare; (ii) collusion uniformly raises retail-end prices and boosts platform profits but diminishes consumer utility and social welfare; (iii) RPM exerts differential effects on profit margins: under weak network effects, RPM amplifies collusion-driven profit differentials by lowering prices, whereas under strong network effects, RPM reduces retail-end prices while negatively impacting direct-end profits, thereby shrinking collusion-induced profit differentials. Consequently, this study proposes classifying RPM based on network effect thresholds: when network effects are weak, RPM is more likely to harm competition and should be subject to per se illegality; when network effects are strong, RPM holds potential procompetitive benefits and should be governed by the rule of reason. This framework aligns antitrust enforcement with the dual role of RPM in platform markets, balancing competitive risks against efficiency gains.

Keywords: Resale Price Maintenance; Collusion; Platform; Two-Sided Markets

1. Introduction

Two-sided markets are defined by platforms connecting two distinct user groups—usually called "buyers" and "sellers"—that gain value from each other's participation. Examples of such markets include video game consoles, payment card systems, and online auction platforms. As highlighted by Gabrielsen et al., bilateral platforms often impose pricing constraints on sellers, either by directly setting prices or through contractual mechanisms like resale price maintenance (RPM).

The rapid expansion of the platform economy has outpaced regulatory frameworks, leading to widespread anticompetitive inefficiencies. In China, antitrust authorities initiated investigations and imposed penalties on major platforms such as Alibaba, Meituan, starting in December 2020, sparking intense public debate on platform antitrust regulation. Key legislative advancements include: (i) The 2021 Antitrust Guidelines for the Platform Economy Sector released by China's central government Anti-Monopoly Commission; (ii) the 2022 revised Anti-Monopoly Law of the People's Republic of China, which clearly tackles platform monopolies.

Scholars remain divided on the appropriate governance principles for RPM. Some advocate for the per se illegality rule, while others endorse the rule of reason. Both positions are supported by theoretical and empirical arguments, but the debate remains unresolved. Building on existing literature, this paper proposes a classification-based antitrust governance framework that integrates per se illegality and rule of reason principles for RPM—a core theoretical contribution of this study.

Following the collusion logic of Hunold and Muthers [1], which posits that RPM facilitates collusion when it amplifies profit differentials among manufacturers under collusion compared to scenarios without RPM, this study identifies novel efficiency-enhancing and competition-restricting factors of RPM in two-sided markets. This study identifies novel efficiency-enhancing and competition-restricting factors of RPM in two-sided markets, providing theoretical foundations for context-specific governance. With weak network effects, RPM reduces retail prices but increases collusion-induced profit differentials, warranting per se illegality treatment. However, with strong network effects, RPM lowers retail prices while mitigating collusion incentives, justifying evaluation under the rule of reason.

We first review the literature on RPM in Section 2, Sections 3 and 4 then introduce the basic model and analytical findings, respectively. Subsequently, we compare the four scenarios in Section 5, and provide concluding remarks in Section 6.

2. Literature Review

This study connects primarily with three areas of academic research: resale price maintenance (RPM), collusion within vertical markets, and two-sided market platforms.

2.1 RPM

The efficiency implications of resale price maintenance (RPM) in industrial economics remain a subject of conflicting theoretical conclusions. On one hand, numerous studies emphasize RPM's procompetitive and efficiency-enhancing roles. For instance, RPM can resolve the double markup problem, prevent retailer price discrimination, mitigate contractual externalities between manufacturers and retailers, and avoid chaotic price competition. It fosters inter-brand competition, enhances economic efficiency, and improves consumer and social welfare [2]. RPM also addresses retailer "free-riding" on services and "free-riding" on reputation [3,4], incentivizing retailers to uphold service quality and brand integrity while encouraging innovation. On the other hand, RPM is criticized for suppressing competition and facilitating collusion. Studies argue that RPM reduces market competition [5], promotes price collusion and retail price inflation [6], ultimately leading to higher prices and diminished consumer and social welfare [7]. With the rise of large retailers, scholars increasingly highlight RPM's negative economic effects through the lens of buyer countervailing power, which may reduce product variety and exacerbate welfare losses [8].

In addition, the antitrust treatment of RPM cases remains highly contentious. Two dominant perspectives prevail: some scholars advocate for the per se illegality rule, asserting RPM inherently harms competition, while others endorse the rule of reason, emphasizing RPM's efficiency benefits [9-10].

2.2 Collusion in Vertical Markets

Classical literature identifies three mechanisms through which RPM facilitates collusion [10]. First, RPM reduces deviation gains, thereby stabilizing collusive agreements. Second, it increases collusion gains, making coordinated behavior more profitable. Third, RPM lowers the threshold for achieving collusion compared to other contractual arrangements. These mechanisms are interdependent: higher collusion gains and lower deviation gains collectively ease collusion sustainability.

Hunold and Muthers propose an alternative perspective by incorporating retailers' external options (interpreted as bargaining power) [11,12]. They model four scenarios—wholesale pricing with and without collusion, and RPM with and without collusion—and find that collusion under RPM yields higher wholesale prices and manufacturer profits than wholesale pricing alone. This demonstrates that RPM outperforms simple wholesale contracts in facilitating collusion, as manufacturers achieve greater profit differentials when implementing RPM.

2.3 Two-Sided Markets

The market characteristics of platform economies differ fundamentally from traditional markets in three key aspects. First, internet platforms act as intermediaries for interdependent users, where transactions and interactions between "buyers" and "sellers" generate mutual value [13]. Second, platforms leverage cross-network externalities to accelerate value creation by efficiently matching consumers and producers [14]. Third, platforms typically subsidize one user group (e.g., consumers) while charging higher prices to the other (e.g., sellers) to offset losses, a strategy termed asymmetric pricing.

Antitrust research on platform economies spans diverse angles, including personalized pricing [15], regulatory strategies for platform monopolies, and ex-ante oversight mechanisms. Scholars agree that platform monopolies are inherently opaque, complicating detection and enforcement.

Additionally, research on vertical price restraints in platform markets remains limited. Gabrielsen et al. [16] explore platform incentives for RPM and its impact on end-users, while Sánchez-Cartas and León argue that traditional antitrust frameworks fail to address platform-specific dynamics, emphasizing three pillars—price structures, network effects, and platform control—as critical to redefining antitrust analysis in digital ecosystems [17].

3. The Model

We analyze a scenario where two platforms serve both sides of the market. On one side, platforms sell directly, while on the other, each platform relies on an intermediary or retailer to resell products to end consumers. The direct and retail sides are denoted as D and R, respectively. Platforms incur zero marginal costs for transactions on both sides. Retailers bear no costs aside from platform payments, with all fixed costs normalized to zero. We specify the demand assumptions for sides R and D in a two-platform context.

Platform-specific prices for each side are designated as $p_{R1}, p_{R2}, p_{D1}, p_{D2}$, with corresponding resale prices w_1, w_2. Resulting demand quantities on each side are represented by $q_{R1}, q_{R2}, q_{D1}, q_{D2}$. The utility function of the consumer in side R and side D is defined by:

$$U_R = \sum_{i=1,2} (q_{Ri} + \alpha q_{Di} q_{Ri} - \frac{1}{2} q_{Ri}^2) - b q_{R1} q_{R2} + \alpha b (q_{D1} q_{R2} + q_{D2} q_{R1}),$$
$$U_D = \sum_{i=1,2} (q_{Di} + \beta q_{Di} q_{Ri} - \frac{1}{2} q_{Di}^2) - b q_{D1} q_{D2} + \beta b (q_{D1} q_{R2} + q_{D2} q_{R1}) \quad (1)$$

Parameter α captures the cross-group effect flowing from side D to R, whereas β denotes the reverse effect from side R to D. Meanwhile, b reflects the degree of substitutability between platforms—higher values of b correspond to greater substitutability. These utility functions give rise to the following linear direct demand functions at equilibrium:

$$q_{Ri} = \frac{1 + \alpha - b - \alpha b - p_{Ri} + b p_{Rj} - \alpha p_{Di} + \alpha b p_{Dj}}{1 - \alpha\beta + \alpha\beta b^2 - b^2}$$
$$q_{Di} = \frac{1 + \beta - b - \beta b - p_{Di} + b p_{Dj} - \beta p_{Ri} + \beta b p_{Rj}}{1 - \alpha\beta + \alpha\beta b^2 - b^2} \quad (2)$$

For simplicity, the cross-group effect from side R to side D is assumed zero. We define social welfare as the sum of industry profits and consumer surplus:

$$SW = \sum_{i=1,2} (\pi_{Ri} + \pi_{Di}) + U_R + U_D \quad (3)$$

In the utility function, demand functions, and social welfare function presented above, several key symbols are introduced to characterize market features and variable relationships. To clearly define the economic meaning of each symbol and avoid potential ambiguity, we provide a unified summary of the core variables used in the model in Table 1.

Table 1. Variables in Our Model

Symbols	Variables
i,j	Firms
D	The direct side of the market
R	The retail side of the market
p	The price of products
q	Products quantities
w	The resale price
U	The utility function
α	The cross-group impact from side D to side R
β	The cross-group impact from side R to side D
b	The degree of substitutability between the platforms
π	Firm's profits
SW	Social welfare

4. RPM and Collusion

4.1 No RPM and No Collusion

We consider a case of no RPM and no collusion in this section. We therefore frame the interaction as a two-stage game: in the first stage, the platforms determine the optimum resale price in side R to maximize their respective profit. In stage two, the platforms determines the optimum price in side D to maximize platforms profit. At the same time, the retailers choose the optimum price in side R. We therefore employ backward induction to derive the subgame perfect Nash equilibrium.

In stage two, the first-order condition of the profit function is:

$$\frac{\partial \pi_{R1}}{\partial p_{R1}} = 0, \frac{\partial \pi_{R2}}{\partial p_{R2}} = 0,$$
$$\frac{\partial \pi_{P1}}{\partial p_{P1}} = 0, \frac{\partial \pi_{P2}}{\partial p_{P2}} = 0 \quad (4)$$

In stage one, the platforms determine the optimum resale price in side R to maximize their respective profit. The first-order condition is:

$$\frac{\partial \pi_{P1}}{\partial w_1} = 0, \frac{\partial \pi_{P2}}{\partial w_2} = 0 \quad (5)$$

Solving the above equations yields the following equilibrium result for the optimal price:

$$p_R^{nn*}=\frac{\begin{array}{c}\alpha^3b^4-3\alpha^3b^2+4\alpha^3\\+\alpha^2b^4-\alpha^2b^3-2\alpha^2b^2\\-4\alpha^2b+8\alpha^2+3\alpha b^4\\-18\alpha b^2+24\alpha-2b^5\\+4b^4+14b^3-28b^2\\-24b+48\end{array}}{\begin{array}{c}2\alpha b^2+2b^4+b^3\\-12b^2-4b+16\end{array}}\times\frac{1-b}{(b-2)^2},$$
$$p_D^{nn*}=\frac{\begin{array}{c}\alpha^2b^3+3\alpha^2b^2-4\alpha^2b\\-4\alpha^2-4\alpha^2+\alpha b^3\\+2\alpha b^2-4\alpha b-8\alpha\\+2b^4+b^3-12b^2\\-4b+16\end{array}}{\begin{array}{c}2\alpha b^2+2b^4+b^3\\-12b^2-4b+16\end{array}}\times\frac{b^2+b-2}{b^2-4} \tag{6}$$

Submitting the optimal price to the above equations, we have the equilibrium firms' profits, the utility and social welfare.

4.2 No RPM and Collusion

This section analyzes a scenario devoid of both RPM and collusion, wherein platforms set prices to maximize their joint profits. The sequence of actions remains consistent with the non-RPM, non-collusion case. Subgame perfect Nash equilibria are derived through backward induction.

In stage two, the first-order condition of the profit function is

$$\frac{\partial\pi_{R1}}{\partial p_{R1}}=0,\frac{\partial\pi_{R2}}{\partial p_{R2}}=0,\quad \frac{\partial(\pi_{P1}+\pi_{P2})}{\partial p_{P1}}=0,\quad \frac{\partial(\pi_{P1}+\pi_{P2})}{\partial p_{P2}}=0 \tag{7}$$

In stage one, the platforms determine the optimum resale price in side R to maximize their sum profit. The first-order condition is

$$\frac{\partial(\pi_{P1}+\pi_{P2})}{\partial w_1}=0,\quad \frac{\partial(\pi_{P1}+\pi_{P2})}{\partial w_2}=0 \tag{8}$$

Solving the above equations, we obtain the equilibrium prices:

$$p_R^{nC*}=\frac{\alpha^2b^2-2\alpha^2b+\alpha^2-4b+6}{2(b-2)(\alpha^2b-4)}\times(\alpha+2),\quad p_D^{nC*}=\frac{\alpha(\alpha+2)+(b-2)(\alpha^2b-4)}{2(b-2)(\alpha^2b-4)} \tag{9}$$

Submitting the optimal price to the above equations, we have the equilibrium firms' profits, the utility and social welfare.

4.3 RPM and No Collusion

This section analyzes the scenario with RPM but without collusion, wherein platforms independently set optimal prices on both side D and side R to maximize their individual profits. The sequence of decisions remains consistent with the non-RPM, non-collusion case. Subgame perfect Nash equilibria are derived through backward induction.

In stage two, the first-order condition of the profit function is:

$$\frac{\partial(\pi_{R1}+\pi_{R2})}{\partial p_{R1}}=0,\quad \frac{\partial(\pi_{R1}+\pi_{R2})}{\partial p_{R2}}=0,\quad \frac{\partial\pi_{P1}}{\partial p_{P1}}=0,\frac{\partial\pi_{P2}}{\partial p_{P2}}=0 \tag{10}$$

In stage one, the platforms determine the optimum resale price to be the price in side R.

$$w_1=p_{R1},w_2=p_{R2} \tag{11}$$

Solving the above equations, we obtain the equilibrium prices:

$$p_R^{Rn*}=\frac{(1-b)(\alpha-b+2)}{\alpha^2b-\alpha^2+b^2-4b+4},\quad p_D^{Rn*}=\frac{(b-1)(\alpha^2+\alpha+b-2)}{\alpha^2b-\alpha^2+b^2-4b+4} \tag{12}$$

Submitting the optimal price to the above equations, we have the equilibrium firms' profits, the utility and social welfare.

4.4 RPM and Collusion

This section analyzes the scenario where platforms adopt RPM while colluding to set prices on both sides D and R, with the objective of maximizing their joint profit. The sequence of decisions remains consistent with the non-RPM, non-collusion case. Subgame perfect Nash equilibria are derived through backward induction.

In stage two, the first-order condition of the profit function is

$$\frac{\partial(\pi_{R1}+\pi_{R2})}{\partial p_{R1}}=0,\quad \frac{\partial(\pi_{R1}+\pi_{R2})}{\partial p_{R2}}=0,\quad \frac{\partial(\pi_{P1}+\pi_{P2})}{\partial p_{P1}}=0,\quad \frac{\partial(\pi_{P1}+\pi_{P2})}{\partial p_{P2}}=0 \tag{13}$$

In stage one, the platforms determine the optimum resale price to be the price in side R.

$$w_1 = p_{R1}, w_2 = p_{R2} \quad (14)$$

Solving the above equations, we obtain the equilibrium prices:

$$p_R^{RC*} = \frac{1}{2-\alpha}, \quad p_D^{RC*} = \frac{1-\alpha}{2-\alpha} \quad (15)$$

Submitting the optimal price to the above equations, we have the equilibrium firms' profits, the utility and social welfare.

5. Price, Profits, and Social Welfare

The previous section characterizes equilibria under four cases: “no RPM +no collusion” (nn), “no RPM + collusion” (nC), “RPM +no collusion” (Rn), and “RPM + collusion” (RC). This part compares the equilibrium price, industry profits, consumer surplus, and social welfare. Finally, we present the effet of RPM on the profit difference of collusion. Compared to no RPM case, we find that the level of network effect plays an crucial role in the platform profit difference of collusion. The platform profit difference of collusion is positive with a low level of network effect and is negative with a high level of network effect.

5.1 The Comparision of Equilibrium

From the comparison of the equilibrium price in side R, we have $p_R^{nC*} > p_R^{nn*} > p_R^{RC*} > p_R^{Rn*}$. Hence, we obtain the following proposition.

Proposition 1: The price in side R under the “no RPM + collusion” case is highest, while under the “RPM +no collusion” case, the pricein side R is lowest.

The intuition from the above proposition is as follows. First, we analyze the impact of RPM (Resale Price Maintenance) on equilibrium prices. In both non-collusive and collusive scenarios, RPM reduces prices. Through price control mechanisms, RPM enables platform enterprises to achieve optimal pricing. This occurs because the presence of retailers creates a double markup effect, leading to artificially inflated consumer prices in the market. Consequently, platform enterprises have an incentive to implement RPM by setting price ceilings to lower retailers' selling prices. Second, we examine how collusion affects equilibrium prices. Regardless of RPM implementation, collusion increases prices. The primary reason is that collusion between platform enterprises allows them to prioritize total profit maximization, diminishes competitive incentives, and ultimately drives price inflation. Figure 1 show the equilibrium results under four cases.

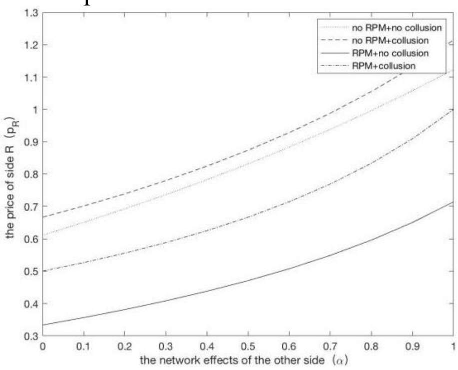

Figure 1. The Equilibrium Price of Side R under Four Cases

From the comparison of the equilibrium price in side D, we have $p_D^{nC*} > p_D^{RC*} > p_D^{Rn*} > p_D^{nn*}$. Hence, we obtain the following proposition.

Proposition 2: The price in side D under the “no RPM + collusion” case is highest, while under the “no RPM +no collusion” case, the price in side D is lowest.

First, we assess RPM's impact on equilibrium prices. Under both collusive and non-collusive scenarios, RPM increases prices. When network effects are weak, RPM's influence is limited. As network effects strengthen, RPM's price-raising effect intensifies. This is because stronger network effects amplify the profitability of direct-side sales, offsetting losses from higher prices. Thus, platforms raise direct-side prices to leverage network effects. Second, we analyze collusion's role. Regardless of RPM, collusion raises prices due to reduced competition and coordinated profit maximization. Figure 2 show the equilibrium results under four cases.

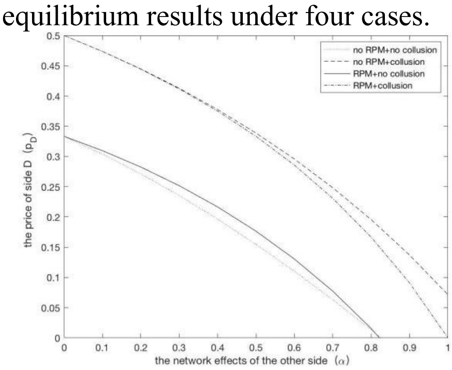

Figure 2. The Equilibrium Price of Side D under Four Cases

From the comparison of the equilibrium profit, we have $\pi_P^{RC*} > \pi_P^{Rn*} > \pi_P^{nC*} > \pi_P^{nn*}$. Hence, we obtain the following proposition.

Proposition 3: The profit of platform under the

"RPM + collusion" case is highest, while under the "no RPM +no collusion" case, the profit is lowest.

First, we evaluate RPM's effect on equilibrium profits. Under both collusive and non-collusive scenarios, RPM lowers retail prices but increases platform profits. RPM's price control resolves the double markup problem, allowing platforms to capture higher profits by constraining retailer margins. Second, collusion consistently boosts platform profits, as coordination minimizes competition and maximizes joint profits. Figure 3 show the equilibrium results under four cases.

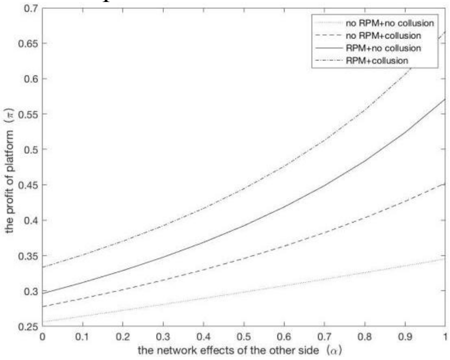

Figure 3. The Equilibrium Profit under Four Cases

From the comparison of the equilibrium utility, we have $U^{Rn*} > U^{nn*} > U^{RC*} > U^{nC*}$. Hence, we obtain the following proposition.

Proposition 4: The utility under the "RPM +no collusion" case is highest, while under the "no RPM +collusion" case, the utility is lowest.

We firstly explore RPM's impact on consumer utility. RPM lowers prices and enhances consumer welfare in both collusive and non-collusive settings by mitigating the double markup distortion. Second, collusion reduces consumer utility by raising prices, as platforms prioritize profit maximization over competitive pricing. Figure 4 show the equilibrium results under four cases.

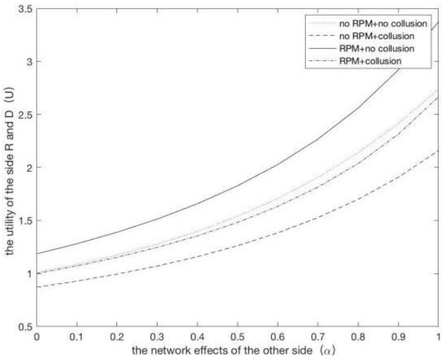

Figure 4. The Equilibrium Utility under Four Cases

From the comparison of the equilibrium social welfare, we have $SW^{Rn*}>SW^{RC*}>SW^{nn*}>SW^{nC*}$ with a low level of network effect and $SW^{Rn*} > SW^{nn*} > SW^{RC*} > SW^{nC*}$ with a high level of network effect. Hence, we obtain the following proposition.

Proposition 5: The social welfare under the "RPM +no collusion" case is highest, while under the "no RPM +collusion" case, the social welfare is lowest.

The intuition from the above proposition is as follows. First, we analyze the impact of RPM on equilibrium welfare. Under both collusive and non-collusive scenarios, RPM reduces prices and enhances welfare. By imposing price controls, RPM enables platforms to achieve optimal pricing. This mechanism addresses the double markup effect caused by retailers, which artificially inflates consumer prices. Consequently, platforms are incentivized to implement RPM through retail price ceilings, lowering retail prices and improving welfare. Second, we examine the effect of collusion on equilibrium welfare. Regardless of RPM implementation, collusion raises prices and reduces welfare. The primary reason lies in the coordinated profit-maximization strategy of colluding platforms, which weakens competitive incentives, leading to price hikes and welfare losses. This dual dynamic underscores RPM's welfare-enhancing role in mitigating market distortions, while collusion systematically degrades welfare by prioritizing joint profits over competitive outcomes. Figure 5 show the equilibrium results under four cases.

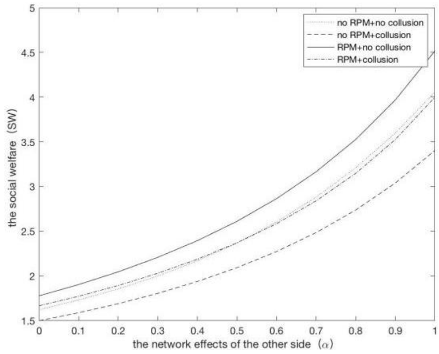

Figure 5. The Equilibrium Welfare under Four Cases

5.2 RPM and Collusion

From the comparison of the platform profit difference of collusion, we have $\Delta\pi^{R*} > \Delta\pi^{nR*}$ with a low level of network effect and $\Delta\pi^{nR*}>\Delta\pi^{R*}$ with a high level of network effect.

Hence, we obtain the following proposition.

Proposition 6: The platform profit difference of collusion by RPM is positive with a low level of network effect and is negative with a high level of network effect.

Collusion raises prices and enhances platform profits, but RPM alters profit differentials between colluding firms. Under weak network effects, RPM reduces retail prices, amplifying profit differentials generated by collusion. Conversely, with strong network effects, RPM lowers retail prices while negatively impacting direct-side profits (e.g., sellers or service providers), thereby diminishing collusion-induced profit differentials. Consequently, network effects makes RPM suppress collusion by reducing profit incentives for coordination between platforms. This duality underscores RPM's context-dependent role in antitrust governance, where network intensity dictates whether RPM acts as a collusion accelerator or inhibitor. Figure 6 show the results under two cases.

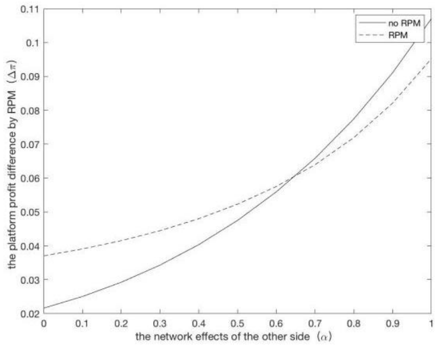

Figure 6. The Platform Profit Difference of Collusion by RPM

The classification of RPM in this study aims to identify the efficiency boundaries of RPM practices. If RPM is likely to harm competition, it should be subject to the per se illegality rule; if RPM holds potential procompetitive effects or its competitive implications are inherently ambiguous, the rule of reason should apply. To swiftly categorize RPM into these two classes, the criterion of whether RPM facilitates collusion can be adopted. As is well recognized, collusion in any form diminishes market competition, distorts social supply and pricing away from optimal levels, and results in welfare losses. Collusion is strictly prohibited under antitrust law and universally acknowledged as the most detrimental practice to competition. This criterion allows for rapid differentiation between "likely anticompetitive" RPM and "potentially benign" RPM. If a manufacturer implements RPM primarily to facilitate collusion, the per se illegality rule should govern; if RPM implementation is unrelated to collusion, the rule of reason should prevail. The classification framework concludes that, in two-sided markets, RPM should be bifurcated based on its impact on horizontal collusion: under low network effects, platform-initiated RPM is categorized as collusion-promoting, whereas under high network effects, RPM does not facilitate horizontal collusion. This approach aligns antitrust enforcement with the nuanced dynamics of platform markets, where network effects critically shape RPM's competitive consequences.

6. Conclusion

In recent years, the influence of the platform economy has been growing increasingly significant. This paper investigates how RPM affects the collusion decision in two-sided market. This study indicates that duopoly platforms can adopt RPM and explores the relationship between RPM and collusion. This research concludes that (i) RPM consistently reduces retail-end prices, increases platform profits, and enhances consumer utility and social welfare; (ii) collusion uniformly raises retail-end prices and boosts platform profits but diminishes consumer utility and social welfare; (iii) RPM exerts differential effects on profit margins: under weak network effects, RPM amplifies collusion-driven profit differentials by lowering prices, whereas under strong network effects, RPM reduces retail-end prices while negatively impacting direct-end profits, thereby shrinking collusion-induced profit differentials. Consequently, this study proposes classifying RPM based on network effect thresholds: when network effects are weak, RPM is more likely to harm competition and should be subject to per se illegality; when network effects are strong, RPM holds potential procompetitive benefits and should be governed by the rule of reason. This framework aligns antitrust enforcement with the dual role of RPM in platform markets, balancing competitive risks against efficiency gains.

Our current model works under several limitations. An interesting extension would be to examine the bargaining power in the model. In addition, we could incorporate more than two players into our basic model. This extension may also be considered for future research.

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