The Impact of Price-sensitivity on Platform’s Service Effort Strategy in a Two-sided Market

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Abstract: In a two-sided market, the two-sided platform may choose to invest in service effort to attract buyers and sellers, meanwhile buyers and sellers are price-sensitive. This paper investigates how the two-sided platform sets her pricing and service effort strategies when the buyers and sellers are price-sensitive. The equilibrium strategies are derived when the platform does not offer service effort and when the platform offers service effort. The results indicate that, the cross-network externality does not impact on the price when the platform does not offer service effort, but it impacts on the price positively when the platform offers service effort. Meanwhile, the price-sensitivity impacts on the platform’s profit and optimal scales of buyers and sellers negatively. Then, the results show that the optimal strategy for the platform is offering service effort, but it may hurt the buyers and sellers’ surplus and social welfare in certain scenario.

1. Introduction

In a two-sided market, buyers and sellers trade or interact with each other via a two-sided platform. In practice, there are a lot of two-sided platforms, such as mobile phone operation system Android; E-commerce platform Amazon.com, Taobao.com; shared-car App Uber; Social network platform Facebook. The two-sided platform may charge both the buyers and sellers in forms of currency or valuable privacy information. But buyers and sellers are price-sensitive because both of them try to get more profits or utilities. On the other hand, the two-sided platform may invest in service effort to offer better experiences of the trade or interaction between sellers and buyers to diminish the disadvantage of charging. For example, E-commerce platform Taobao.com provides a service to improve the match between consumers’ demand and E-retailer’s product, which can help buyers to find their ideal products and sellers to push their products to most potential buyers. Since additional service effort is cost and may impact on the buyers and sellers negatively, the two-sided platform should carefully set her service effort strategy.
Nowadays, a lot of literatures studied on the mechanism of how two-sided market works. The major character of two-sided market is cross network externality which impacts on buyers, sellers and platform decisions. Several papers investigated how platform’s investment works on the two-sided market members’ decisions. Dou et al. (2016) analyzed how platform’s value-added services impacts on the members, and found that value-added service could increase the degree of participation and the platform’s profit. Anderson (2014) studied how a two-sided platform weighs the investment on platform’s performance against the cost. Jung et al. (2019) explain how network externality, asymmetry of competitive platforms and multi-homing characteristics of consumers influence on platform’s incentive method and pricing strategy. Tan et al. (2020) researched on how software/hardware platform and mixed retailing platform make their investing and pricing strategies under monopolistic and competitive scenarios separately. Meanwhile, some literatures investigated the pricing strategies of two-sided markets (Rochet and Tirole, 2003; Armstrong, 2006). Armstrong (2006) presented different two-sided market model to explain how to set prices. Bardey et al. (2014) discussed the platform competition with considering a common network externality in a two-sided market. Shekhar (2017) explained how to choose pricing mode in competition with a bottleneck model in a two-sided market. These literatures are mostly focuses on how to set pricing strategies in a two-sided market without considering pricing sensitivity, and few of them studied the platform’s service effort strategies.

On the other hand, several literatures studied how price-sensitivity impacts on firm’s decision. Han et al. (2001) examined consumers’ price sensitivity based on a model of probabilistic thresholds for price gains and losses. Natarajan et al. (2017) discussed how price-sensitivity impacts on consumers’ intention to use mobile commerce application for shopping purpose. Xue et al. (2019) studied the two-sided platform’s pricing strategies considering market size, service quality and price-sensitivity. Shaik et al. (2020) concluded that price-sensitivity of the consumers and transfer cost work on consumers’ repeating purchase behavior. Arevalillo (2021) explained how assessment of price sensitivity influences decision making for revenue management. These literatures mostly focused on how consumers’ price-sensitivity influences on firms’ decision, few of them considered in the context of two-sided market, and they have not studied the platform’s service effort strategies.

To fill up the research gap of existing literatures, this paper focuses on how price-sensitivity influence a two-sided platform’s service effort. A game theory model is used to analyze the following research questions:

How does the two-sided platform make her pricing strategy when she doesn’t offer service effort? Furthermore, explain the mechanism of how price-sensitivity influence the platform’s decisions and profits.

How does the two-sided platform make her pricing strategy when she offers service effort? Furthermore, explain the mechanism of how price-sensitivity influence the platform’s decisions and profits.

Should the two-sided platform offer service effort?

The rest of this paper is organized as follows. Section 2 gives the model setting where formulas the utility functions and profit functions. Section 3 provides equilibrium analysis under two different scenarios where the two-sided platform provides service effort or not. Section 4 concludes our main findings and limitations of this paper.

2. Model Setting

Consider in a two-sided platform, there are two parts of participants, $n_s$ sellers and $n_b$ buyers, trade via the two-sided platform. In the rest of this paper, we adopt subscript $s$ to
represent sellers and subscript b to represent buyers. The two-sided platform charges from buyers and sellers with \( p_b \) and \( p_s \) simultaneously. Furthermore, the two-sided platform may invest to promote the trade between sellers and buyers with service effort \( e \). Investing in service effort is costly, the cost of the platform’s service effort is given as \( C(e) = Ae^2 \), where \( A \) indicates the unit cost of the platform’s service effort, the cost function shows the property of diminishing marginal utility. Hence, the profit function of the platform is \( \pi = p_b n_b + p_s n_s - C(e) \). The platform is always profit-seeking and tries to maximize her profit.

When the participants trade via the platform, the utilities of sellers and buyers is given as
\[
u_i = v + a_i n_i + f_i e - p_i - x_i \]
Where \( i, j = b, s \). In the utility function, \( a_i \) represents cross-network externality parameter, \( f_i \) shows the impact of the platform’s service effort and is interpreted as the service effort parameter. \( x_i \in [0,1] \) represents the participants’ preferences over the platform, or the mismatch between the participant and the platform. When the participants are price sensitive, refer to Bordalo et al. (2013), they will enhance the weight of price, but reduce the weight of preference. Therefore, the utility functions of the buyers and sellers are shown as
\[
u_b = v + a_b n_s + f_b e - \frac{2}{1+\delta} p_b - \frac{2\delta}{1+\delta} x_b \]
\[
u_s = v + a_s n_b + f_s e - \frac{2}{1+\delta} p_s - \frac{2\delta}{1+\delta} x_s \]
Where \( \delta \in (0,1) \) captures the sensitivity over price and preference which is defined as the sensitivity parameter. Following Bordalo et al. (2013), parameter \( \frac{2}{1+\delta} \) indicates that participant is more sensitive to price, and parameter \( \frac{2\delta}{1+\delta} \) are less sensitive to preference. It is easy to find that with a smaller \( \delta \), the participant is more sensitive to price and the weight of price is greater. The participants join the two-sided platform only if they can get non-negative utility, and in this paper, we consider that the platform, buyers and sellers are all rational. To simplify the analysis, we assume the unit product cost and marketing cost is normalized to zero.

The timing sequence of the game are given as follows. In the first stage, the two-sided platform announces her prices charged from the buyers and sellers, and makes her service effort decision if she invests in service effort. In the second stage, both sellers and buyers make their decisions that whether join in or not. In the third stage, the trade is realized. With backward induction, we derive the equilibrium solutions.

3. Main Results

In this section, we firstly analyze the two-sided platform’s pricing strategies where she does not offer service effort as a benchmark scenario. Then, we derive the two-sided platform’s pricing strategies where she offers service effort. Finally, we compare the pricing strategies under two different scenarios and conclude whether the two-sided platform offers service effort or not. To distinguish two different scenarios, we adopt superscript “1” to represent the scenario where the platform doesn’t offer service effort, and superscript “2” to represent the scenario where the platform offers service effort.

3.1 Platform Does not Offer Service Effort

When the platform does not offer service effort, the utility functions of the buyers and sellers are shown as
As mentioned in Section 2, the buyers and sellers join the platform only if their utilities are non-negative, so we derive the marginal locates at participants whose utilities are equal to zero.

\[
x_b^* = \frac{1 + \delta}{2\delta} \left( v + a_b n_b - \frac{2}{1 + \delta} p_b \right)
\]

\[
x_s^* = \frac{1 + \delta}{2\delta} \left( v + a_s n_b - \frac{2}{1 + \delta} p_s \right)
\]

Therefore, the response functions of the scales of the sellers and buyers in the platform are given as

\[
n_b = \max \left\{ \frac{1 + \delta}{2\delta} \left( v + a_b n_b - \frac{2}{1 + \delta} p_b \right), 0 \right\}
\]

\[
n_s = \max \left\{ \frac{1 + \delta}{2\delta} \left( v + a_s n_b - \frac{2}{1 + \delta} p_s \right), 0 \right\}
\]

To ensure there exists pure strategy, the cross-network externality parameters should be less than the weight of price-sensitivity, that is, \( a_b < \frac{2}{1 + \delta}, \ a_s < \frac{2}{1 + \delta} \). Based on the upper-mentioned response functions of the scales of the sellers and buyers, we can derive the scales of the sellers and buyers as follows.

\[
n_b^1 = \frac{(1 + \delta)[2\delta + (1 + \delta)a_b]v - 2(1 + \delta)a_b p_s - 4\delta p_b}{4\delta^2 - (1 + \delta)^2a_b a_s}
\]

\[
n_s^1 = \frac{(1 + \delta)[2\delta + (1 + \delta)a_s]v - 2(1 + \delta)a_s p_b - 4\delta p_s}{4\delta^2 - (1 + \delta)^2a_b a_s}
\]

Based on the above formulas, we can have Lemma 1: In a two-sided platform, a greater charge price of the buyers (sellers) will lead to a less scale of the sellers (buyers), i.e., \( \frac{\partial n_b}{\partial p_s} < 0, \frac{\partial n_s}{\partial p_b} < 0 \).

Consequently, the profit function of the platform is

\[
\pi = \frac{(1 + \delta)[2\delta + (1 + \delta)a_b]v - 2(1 + \delta)a_b p_s - 4\delta p_b}{4\delta^2 - (1 + \delta)^2a_b a_s} p_b
\]

\[
+ \frac{(1 + \delta)[2\delta + (1 + \delta)a_s]v - 2(1 + \delta)a_s p_b - 4\delta p_s}{4\delta^2 - (1 + \delta)^2a_b a_s} p_s
\]

With F.O.C, we can derive the equilibrium pricing strategy as proposition 1. To simplify the analysis, in the rest of this paper, we assume that \( a_b = a_s = a \).

Proposition 1: In equilibrium, the two-sided platform charges the buyers and the sellers with \( p_b^1 = p_s^1 = \frac{(1 + \delta)}{4} v \), and the two-sided platform can earn \( \pi^1 = \frac{(1 + \delta)^2}{4[2\delta - (1 + \delta)a]} v^2 \).

In Proposition 1, we derive the equilibrium pricing strategies and the equilibrium profit of the two-sided platform. Based on Proposition 1, we can derive the optimal scales of buyers and sellers in the platform.

Corollary 1: When the platform does not offer service effort, the optimal scales of buyers and sellers join in the two-sided platform in equilibrium are \( n_b^1 = n_s^1 = \frac{(1 + \delta)}{2[2\delta - (1 + \delta)a]} v \).

Corollary 1 gives the optimal scales of buyers and sellers join in the two-sided platform, if the buyers or sellers are not equal to the optimal scales, the platform may not maximize her profit. Hence, in practice, the two-sided platform should control the scales of the participants.

Corollary 2: When the platform does not offer service effort, (1) The cross-network
externality parameter \( a \) does not impact on the equilibrium price strategies, i.e., \( \frac{dp^*_b}{da} = \frac{dp^*_s}{da} = 0; \)

(2) The cross-network externality parameter \( a \) impacts on the platform’s equilibrium profit and the optimal scales of buyers and sellers positively, i.e., \( \frac{dp^*_s}{da} > 0, \frac{dn^*_b}{da} = \frac{dn^*_s}{da} > 0; \)

(3) The sensitivity parameter \( \delta \) impacts on the equilibrium prices positively, i.e., \( \frac{dp^*_b}{d\delta} = \frac{dp^*_s}{d\delta} > 0; \)

(4) The sensitivity parameter \( \delta \) impacts on the platform’s equilibrium profit and the optimal scales of buyers and sellers negatively, i.e., \( \frac{dp^*_s}{d\delta} < 0, \frac{dn^*_b}{d\delta} = \frac{dn^*_s}{d\delta} < 0. \)

Corollary 2 indicates the impact of cross-network externality parameter \( a \) and sensitivity parameter \( \delta \) on the equilibrium solutions. It’s interesting that in the two-sided market, the cross-network externality doesn’t influence the optimal equilibrium price (shown as Corollary 2(1)) when the platform doesn’t offer any service effort, the reason is the buyers and sellers are symmetric in cross-network externality. On the other hand, the platform’s profit and optimal scales of sellers and buyers increases with a greater cross-network externality, because a greater cross-network externality makes more participants of the other side of the two-sided market to join in the platform, and the price is fixed with cross-network externality, the platform gets more profit as a result. In Corollary 2(3) and Corollary 2(4), we have that a greater price sensitivity parameter will lead to a greater price, but a lower platform’s profit and optimal scales of buyers and sellers. The buyers and sellers are more sensitive to price with a greater price sensitivity parameter, less buyers and sellers will join in the platform because their utilities decrease. To maximize the platform’s profit, the platform should increase her prices, otherwise she would suffer more loss if she decreases her prices. But the negative impact of the greater price sensitivity parameter is greater than the positive impact of greater price, the platform gets less profit.

Moreover, the surplus function of the buyers and sellers can be expressed as

\[
CS = \int_0^{x^*_b} \left( v + a_b n_s - \frac{2}{1+\delta} p_b - \frac{2\delta}{1+\delta} y \right) dy + \int_0^{x^*_s} \left( v + a_s n_b - \frac{2}{1+\delta} p_s - \frac{2\delta}{1+\delta} y \right) dy
\]

And social welfare is

\[
SW = CS + \pi
\]

Based on Proposition 1 and Corollary 1, we can have

Corollary 3: When the platform does not offer service effort, in equilibrium, the buyers and sellers’ surplus is \( CS^*_1 = \frac{\delta(1-\delta)}{2(2\delta-(1+\delta)a)^2} v^2 \), social welfare \( SW^*_1 = \frac{(1+\delta)[4\delta-(1+\delta)a^2]}{4[2\delta-(1+\delta)a]^2} v^2 \).

Corollary 3 indicates the buyers and sellers’ surplus and social welfare when the platform offers no service effort. Similarly, we can easily have that when the cross-network externality parameter increases, the buyers and sellers’ surplus will increase, that is, \( \frac{dCS^*_1}{da} > 0 \). Because more buyers and sellers will join the platform and they have surplus, the gross surplus increases. On the other hand, the social welfare decreases with a greater cross-network externality parameter, that is, \( \frac{dSW^*_1}{da} < 0 \). The reason is, the buyers and sellers get more surplus, while the unit profit of the platform decreases and is greater than the unit surplus, in other word, the marginal social welfare decreases, hence, the equilibrium social welfare decreases with a greater cross-network externality parameter.

3.2 Platform Offers Service Effort
Just as mentioned in Section 2, the platform could invest in service effort to attract buyers and sellers to join in the platform. In this section, we discuss the platform’s equilibrium strategies under the scenario that she offers service effort. When the platform offers service effort, the buyers’ and sellers’ utility functions are shown as follows.

\[
u_b = v + a_b n_b + f_b e - \frac{2}{1 + \delta} p_b - \frac{2\delta}{1 + \delta} x_b
\]

\[
u_s = v + a_s n_b + f_s e - \frac{2}{1 + \delta} p_s - \frac{2\delta}{1 + \delta} x_s
\]

As mentioned in Section 2, the buyers and sellers join the platform only if their utilities are non-negative, so we derive the marginal locates at \( x_i^* \) participants whose utilities are equal to zero.

\[
x_b^* = \frac{1 + \delta}{2\delta} \left( v + a_b n_b + f_b e - \frac{2}{1 + \delta} p_b \right)
\]

\[
x_s^* = \frac{1 + \delta}{2\delta} \left( v + a_s n_b + f_s e - \frac{2}{1 + \delta} p_s \right)
\]

Therefore, the response functions of the scales of the sellers and buyers in the platform are given as

\[
n_b = \max \left\{ \frac{1 + \delta}{2\delta} \left( v + a_b n_b + f_b e - \frac{2}{1 + \delta} p_b \right), 0 \right\}
\]

\[
n_s = \max \left\{ \frac{1 + \delta}{2\delta} \left( v + a_s n_b + f_s e - \frac{2}{1 + \delta} p_s \right), 0 \right\}
\]

To ensure there exists pure strategy, the cross-network externality parameters should be less than the weight of price-sensitivity, that is, \( a_b < \frac{2}{1 + \delta} \), \( a_s < \frac{2}{1 + \delta} \). Based on the upper-mentioned response functions of the scales of the sellers and buyers, we can derive the scales of the sellers and buyers as follows.

\[
n_b = \frac{(1 + \delta)[2\delta + (1 + \delta)a_b]v + [(1 + \delta)a_s f_b + 2\delta f_s]e - 2(1 + \delta)a_b p_b - 4\delta p_b}{4\delta^2 - (1 + \delta)^2 a_b a_s}
\]

\[
n_s = \frac{(1 + \delta)[2\delta + (1 + \delta)a_s]v + [(1 + \delta)a_b f_s + 2\delta f_b]e - 2(1 + \delta)a_s p_b - 4\delta p_s}{4\delta^2 - (1 + \delta)^2 a_b a_s}
\]

Consequently, the profit function of the platform is

\[
\pi = \frac{(1 + \delta)[2\delta + (1 + \delta)a_b]v + [(1 + \delta)a_s f_b + 2\delta f_s]e - 2(1 + \delta)a_b p_b - 4\delta p_b}{4\delta^2 - (1 + \delta)^2 a_b a_s} p_b
\]

\[
+ \frac{(1 + \delta)[2\delta + (1 + \delta)a_s]v + [(1 + \delta)a_b f_s + 2\delta f_b]e - 2(1 + \delta)a_s p_b - 4\delta p_s}{4\delta^2 - (1 + \delta)^2 a_b a_s} p_s - \text{A} e^2
\]

With F.O.C, we can derive the equilibrium pricing strategy as proposition 2. To simplify the analysis, we assume that \( a_b = a_s = a \), and \( f_b = f_s = f \). To ensure there exists equilibrium solutions, \( A > \frac{(1 + \delta)^2 f^2}{4[2\delta - a(1 + \delta)]} \).

**Proposition 2:** In equilibrium, the two-sided platform charges the buyers and the sellers with \( p_b^* = p_s^* = \frac{A(1 + \delta)}{4[2\delta - a(1 + \delta)]} - v \), and the two-sided platform can earn \( \pi^* = \frac{(1 + \delta)^2 A}{4[2\delta - a(1 + \delta)] - (1 + \delta)^2 f^2} v^2 \), her optimal service effort is \( e^* = \frac{(1 + \delta)^2 f}{4[2\delta - a(1 + \delta)] - (1 + \delta)^2 f^2} v \).

In Proposition 2, we derive the equilibrium pricing and service effort strategies and the equilibrium profit of the two-sided platform when the platform offers service effort. Based on Proposition 2, we can derive the optimal scales of buyers and sellers in the platform.

**Corollary 4:** When the platform offers service effort, the optimal scales of buyers and
sellers join in the two-sided platform in equilibrium are \( n_b^2 = n_s^2 = \frac{2A(1+\delta)}{4A[2\delta-a(1+\delta)]-(1+\delta)^2(1+\delta)^2V} \).

Corollary 4 gives the optimal scales of buyers and sellers join in the two-sided platform when the platform offers service effort. Proposition 2 and Corollary 4 shows the equilibrium solutions of the game. Based on Proposition 2 and Corollary 4, we can derive

Corollary 5: When the platform offers service effort, (1) The cross-network externality parameter \( a \) impacts on the equilibrium price positively, i.e., \( \frac{dp^a}{da} > 0 \). Meanwhile, the cross-network externality parameter \( a \) impacts on the equilibrium service effort positively, i.e., \( \frac{de^a}{da} > 0 \). The cross-network externality parameter \( a \) impacts on the platform’s equilibrium profit and the optimal scales of buyers and sellers positively, i.e., \( \frac{dn^a}{da} > 0 \), \( \frac{dn^a}{da} = \frac{dn^a}{da} > 0 \);

(2) The sensitivity parameter \( \delta \) impacts on the equilibrium prices positively, i.e., \( \frac{dp^\delta}{d\delta} > 0 \). The sensitivity parameter \( \delta \) impacts on the equilibrium service effort negatively, i.e., \( \frac{de^\delta}{d\delta} < 0 \). The sensitivity parameter \( \delta \) impacts on the platform’s equilibrium profit and the optimal scales of buyers and sellers negatively, i.e., \( \frac{dn^\delta}{d\delta} < 0 \), \( \frac{dn^\delta}{d\delta} = \frac{dn^\delta}{d\delta} < 0 \);

(3) The unit cost of service effort \( A \) impacts on the equilibrium price negatively, i.e., \( \frac{dp^A}{dA} < 0 \). The unit cost of service effort \( A \) impacts on the equilibrium service effort negatively, i.e., \( \frac{de^A}{dA} < 0 \). The unit cost of service effort \( A \) impacts on the platform’s equilibrium profit and the optimal scales of buyers and sellers negatively, i.e., \( \frac{dn^A}{dA} < 0 \), \( \frac{dn^A}{dA} = \frac{dn^A}{dA} < 0 \);

(4) The service effort parameter \( f \) impacts on the equilibrium price positively, i.e., \( \frac{dp^f}{df} > 0 \). The service effort parameter \( f \) impacts on the equilibrium service effort positively, i.e., \( \frac{de^f}{df} > 0 \). The service effort parameter \( f \) impacts on the platform’s equilibrium profit and the optimal scales of buyers and sellers positively, i.e., \( \frac{dn^f}{df} > 0 \), \( \frac{dn^f}{df} = \frac{dn^f}{df} > 0 \).

Based on Corollary 5, we can see that a greater service effort can lead to greater optimal scales of buyers and sellers, i.e., \( \frac{dn^f}{df} = \frac{dn^f}{df} > 0 \). Because a greater service effort can increase the buyers and sellers’ utilities, and more buyers and sellers will join in the platform. Meanwhile, the service effort parameter also positively impacts on the optimal scales of buyers and sellers, i.e., \( \frac{dn^f}{df} = \frac{dn^f}{df} > 0 \). The reason is a greater service effort parameter could increase the participants’ utilities and more buyers and sellers will join in the platform.

Similar with the analysis of the scenario where the platform doesn’t offer service effort, when the platform offers service effort, the surplus function of the buyers and sellers can be expressed as

\[
CS = \int_{0}^{X_b} \left( v + a_b n_b + f_b e - \frac{2}{1+\delta} p_b - \frac{2\delta}{1+\delta} y \right) dy \\
+ \int_{0}^{X_s} \left( v + a_s n_b + f_s e - \frac{2}{1+\delta} p_s - \frac{2\delta}{1+\delta} y \right) dy
\]

And social welfare is
Based on Proposition 2 and Corollary 4, we can have the buyers and sellers’ surplus and social welfare when the platform offers service effort in Corollary 6.

**Corollary 6** When the platform offers service effort, in equilibrium, the buyers and sellers’ surplus is

\[ CS^* = \frac{8A\delta}{4A[2\delta - a(1 + \delta)]} v^2 \],

and social welfare

\[ SW^* = \frac{A(1 + \delta)[8A\delta(2 + \delta) - 4aA(1 + \delta)^2 - (1 + \delta)^3]}{4A[2\delta - a(1 + \delta)]} v^2. \]

Corollary 6 indicates the buyers and sellers’ surplus and social welfare when the platform offers service effort. Similar with the analysis of Corollary 3, we can have, a greater service effort unit cost will reduce the buyers and sellers’ surplus, because buyers and sellers need to pay more. On the other hand, the platform’s profit decreases with a greater service effort unit cost, so the social welfare decreases.

### 3.3 Comparison Analysis

In this section, we compare the equilibrium solutions of the above-mentioned scenarios. Based on Proposition 1 and Proposition 2, we can derive

**Proposition 3** Compared with the scenario where the platform does not offer service effort, when the platform offers service effort,

- \[ p^*_2 = p^*_b > p^*_1 = p^*_b \];
- \[ \pi^*_1 < \pi^*_2 \];
- \[ n^*_2 = n^*_b > n^*_1 = n^*_b \];

if

\[ 4\delta - 2a(1 + \delta) + (1 - \delta)(1 + \delta)^3l^2 - 2\sqrt{[2\delta - a(1 + \delta)](2\delta - a(1 + \delta) + (1 - \delta)(1 + \delta)^3l^2)} < A < \]

\[ \frac{4\delta - 2a(1 + \delta) + (1 - \delta)(1 + \delta)^3l^2 - 2\sqrt{[2\delta - a(1 + \delta)](2\delta - a(1 + \delta) + (1 + \delta)^3l^2)}}{4[2\delta - a(1 + \delta)](1 - \delta^2)} \], \[ CS^1_* < CS^2_* \], otherwise,

\[ CS^1_* > CS^2_* \];

if \[ A < A < \bar{A} \], \[ SW^1_* < SW^2_* \], otherwise, \[ SW^1_* > SW^2_* \].

Based on Proposition 3, we can find that the two-sided platform always can get more profit by providing service effort, and her service effort will attract more buyers and sellers join in the platform. But the buyers and sellers’ surplus and social welfare may decrease in certain condition. Because buyers and sellers should pay more to join the platform which may reduce their surplus. Hence, when the two-sided platform offers service effort, it may be not good for buyers and sellers, and it may also hurt social welfare.

### 4. Conclusions

This paper investigates how price-sensitivity influences a two-sided platform’s service effort and pricing strategies with a game theory model. The equilibrium strategies are given under two different scenarios. The results show that, when the platform doesn’t offer service effort, the cross-network externality doesn’t impact on the equilibrium price, but if the platform offers service effort, the cross-network externality impacts on the equilibrium price positively. Moreover, the price-sensitivity parameter impacts on the platform’s equilibrium profit and optimal scales of buyers and sellers in the platform negatively in both scenarios, and it impacts on the optimal service effort negatively if the platform offers service effort. Then, the results indicate that it is always good for the platform when she offers service effort, but the platform’s service effort may hurt the buyers and sellers’ surplus and social welfare.

Our findings are meaningful to the platform managers and the participants in the two-sided
platform. But there are several limitations need to be further studied. Firstly, it is interesting to analyze the same topic in this paper considering the competition among the sellers. Secondly, we analyze the paper where only one platform exists, it will be meaningful to discuss the platform competition.

References