

## Research Article

# Quality Assurance Competition Strategy under B2C Platform

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This paper examines the platform competition strategy in offering quality assurance policy based on two-sided B2C markets with buyers and sellers who trade through the B2C platform. We model this as a strategy decision whether control rights of quality assurance level are better held by the seller or by the platform. Whether the seller or the platform that provides quality assurance policy is preferred depends on their influence on network effects. We show that the seller and the platform have no strong intention to improve the quality assurance level in the monopoly markets. When all buyers multihome and all sellers single-home, sellers who hold the control rights of quality assurance are better than platforms. However, platforms that hold quality assurance drive more profits than sellers in the B2C markets where all buyers and all sellers multihome. Our findings connect platform competitive strategies to market and microfoundation of quality, which applies directly to managerial decisions in the B2C two-sided platform.

## 1. Introduction

Platform business models of electronic commerce are becoming increasingly prevalent in the recent decade. They are characterized by an intermediary service that is offered to two or more sides on board and enabled interactions between them, such as Amazon, eBay, and the Alibaba Group. The B2C as an online platform is also flourishing, especially the total amount of transactions entered into the trillion yuan era in China. Recently, the competition between the B2C platforms is becoming more and more intense. Most B2C platforms have modified the quality assurance rules to get more customers trust and transactions. For example, customers can return items sold by Amazon within 30 days of delivery for a full refund; Tmall of Alibaba Group and JingDong Mall also provide no reason return policy to improve the quality commitment and protect the customer's benefits.

For many B2C platforms, transactions among users play an important role in the platform's decision problem. On these platforms, users' benefits are influenced by transaction policies, such as sellers' products pricing and platform's promotion strategy. These policies affect users' decision and the platform competition advance. The literature on two-sided platforms competition strategy is prolific in the B2C

markets; however, many studies take pricing as only one way. Few studies fully integrated the pricing and quality strategy into the B2C model. Our study aims to address this gap.

In this paper, we firstly study how a monopoly B2C two-sided platform's quality assurance strategy depends on sellers' entry decision and buyers' purchasing choice. Then, we study quality assurance strategies with sellers' and buyers' different homing under competitive platforms. More specifically, how does quality assurance strategy play in the competitive B2C transaction? And how does the pricing and quality assurance affect the two-sided utility and cost? And which side holds quality commitments policy to drive the optimal trade-offs in the different competitive structure? We investigate these questions by analyzing the B2C quality commitment strategy problem. The entry of users not only depends on the pricing and entry fee but also is connected to quality assurance policy. We propose the model of B2C platform by introducing quality assurance to the Hotelling competitive model to capture product quality differentiation. The platform's optimal strategy in offering quality assurance with cross-side network effects is developed. We identify the conditions that which side holding the quality assurance can lead to optimal decision. We also illustrate the impact of quality assurance on the different users' homing.

The remainder of the paper is organized as follows: In Section 2, we discuss the related literature. We describe the monopoly model setup in Section 3 and analyze the competitive model in Section 4. Finally, we conclude the paper in Section 5.

## 2. Literature Review

The early development of the literature began with platform's pricing strategy on network externalities. Rochet and Tirole [1, 2], Armstrong [3], and Parker and Van Alstyne [4] focus on the strength of cross-side network effect exerted by platform's entry fee and product pricing. Recent studies explore same-side network effect and other platform markets. Economides and Katsamakas [5] develop a framework to characterize the optimal two-sided pricing strategy of a technology platform and study the optimal determination of pricing and access fee in the context of an open-source platform and a proprietary platform. Hagiu [6] analyzes the platform pricing strategy with negative same-side network effects. He finds that when consumers have stronger preferences for variety, the platform relies more on the seller side for generating profits. Lin et al. [7] show that a platform may subsidize buyers when their valuation for quality is more dispersed. Chao and Derdenger [8] analyze mixed bundling in two-sided markets where installed base effects are presented and find that the pricing structure deviates from traditional bundling as well as the standard two-sided markets literature. Hagiu and Wright [9] establish several fundamental trade-offs faced by an intermediary when choosing whether to function more as a marketplace or more as a reseller.

An important development in the recent literature is the focus on competitive platform strategy (Belleflamme and Peitz [10], Casadesus-Masanell and Halaburda [11], Halaburda and Piskorski [12], and others). Godes et al. [13] explore the implications of the two-sided competition on the actions and source of profits of media firms, which competed in content and advertising two connected markets. Halaburda and Yaron [14] study how extant uncertainty and ex-post asymmetric information concerning the value of a new technology affect the strategies of the platforms and the market outcome and find that the incumbent dominates the market by setting the welfare-maximizing level of trade when the difference in the degree of asymmetric information between buyers and sellers is significant. Hagiu and Jullien [15] study search diversion on competing platform and find that competition between platforms leads to lower equilibrium levels of search diversion relative to a monopoly platform when the intensity of competition is high.

Another novelty in our paper is to connect heterogeneities of platform's quality assurance and sellers' product quality to the platform's strategies. In fact, the discussion on quality in the context of platform is increasingly fruitful. Casadesus-Masanell and Lianes [16] study incentives to invest in platform quality in open-source and proprietary two-sided platforms. They find that investment incentives depend on the access policies in place and are stronger in a proprietary platform for a given level of user and developer access, but an open platform may still lead to higher investment when some

conditions are met. Kim et al. [17] illustrate the importance of accounting for variation in software quality when conducting this measurement and provide the conditions under which not doing so results in over- or underestimation of the actual indirect network effect. Gabszewicz and Wauthy [18] model platform competition in a market where products are characterized by cross network externalities and quality differentiation. They show that platform competition induces a vertical differentiation structure that allows for the coexistence of asymmetric platforms in equilibrium. Zenny [19] investigates the competition between vertically differentiated platforms in two-sided markets. He finds that, despite the existence of quality differences, the decisions by the platforms about royalty rates are symmetric and only hardware pricing is asymmetric.

In the majority of the previous researches on platforms, platform's competitive strategies depend on agents' pricing. Few literature studied B2C platform competitive strategies by the quality way. To investigate two-sided markets trade-off where consumers' marginal utilities are affected by quality assurance and pricing, we develop a Hotelling B2C platform model in the monopoly and competitive two-sided markets. This leads to equilibrium where agents that join the quality assurance exert more network effects and get more profits. This differs from much of the previous literature yet it closely resembles what is seen in reality.

## 3. Monopoly Platform Model

Consider two groups of agents who benefit from B2C platform but are unable to do so without a platform. The utility of one group depends on the number of agents of the other group and quality assurance level that are available. The B2C platform charges agents in each group for entry fee to participate in the platform and thus brings these groups together.

*3.1. Base Model.* Agents on both sides of the B2C platform are described by continuous variables. Agents on side 1, buyers or the consumers are denoted by  $b$ , and the number of buyers that join the B2C platform is denoted by  $n_b$ , and the utility for a buyer is given by

$$u_b = \theta_b v + \lambda_b n_s + a\beta. \quad (1)$$

Here, the term  $v$  is the membership value that every buyer receives from joining the platform. This is the stand-alone utility depending on the platform information service level. The term  $\theta_b$  measures the buyer's perception of the platform service level. When  $\theta_b = 1$ , the buyer's satisfaction of the platform service is very high, and the utility of seller is also very high. When  $\theta_b = 0$ , it means that buyers are not satisfied with the platform service. The network effect to a buyer for an additional seller on the platform is given by  $\lambda_b$ . The number of sellers that join the platform is given by  $n_s$ . In the B2C model, the price or entry fee that buyers pay the platform is always free, such as the Tmall platform in the Alibaba group.

The term  $\beta$  captures the level of quality assurance that the platform or the seller provides to promote sales. We assume

$0 \leq \beta \leq 1$ , where  $\beta = 0$ ; it means that the platform and the seller do not offer quality assurance policy. If there exists  $\beta = 1$ , the level of quality assurance is the highest among its industry. The variable  $a$  measures the impact of  $\beta$  on the buyer's utility.

On the other side of the platform, side 2 is the sellers, which are denoted by  $s$ . The sellers' utilities are given by

$$u_s = \theta_s v + \lambda_s n_b - p_s. \quad (2)$$

Here  $\theta_s$  is similar to  $\theta_b$  and measures the seller's perception of the platform service level. The term  $\lambda_s$  is a network effect parameter and captures the marginal benefit of sellers that receive from an additional buyer on the platform. The number of the buyers is given by  $n_b$ , and the entry fee that sellers pay to the platform is given by  $p_s$ . To simplify calculations, we assume that the total size of buyers and sellers is normalized to one (as noted by Armstrong (2006), these assumptions are not extremely critical in the analysis and they make computations simple).

Lastly, we introduce the B2C platform. The platform's profits are shown by

$$\pi = p_s n_s - c\beta^2. \quad (3)$$

We assume that the platform faces no fixed costs and the marginal costs. A cost  $c\beta^2$  is incurred to provide this level of quality assurance by the platform or by the seller. The platform is an entry fee setter so it maximizes profits with respect to  $p_s$  and  $\beta$ .

**3.2. Strategy on Monopoly Model.** In this section, we assume that there exists a B2C platform. We solve the platform's problem and compare the platform's quality assurance with the sellers'. When the seller provides the quality assurance policy, the utility of the sellers changes from (2) to

$$u_s = \theta_s v + \lambda_s n_b - p_s - c\beta^2. \quad (4)$$

**Lemma 1.** *Under the B2C monopoly market, the platform and the seller have no intention to improve the level of quality assurance.*

*Proof.* Since the inequalities  $u_b > 0$  and  $u_s > 0$  are satisfied, the buyer and the seller would join the platform. Using (1) and (2), the number of the buyers and the sellers considering the platform that provides the quality assurance policy is  $n_b = 1 + (\lambda_b n_s + a\beta)/v$  and  $n_s = 1 + (\lambda_s n_b - p_s)/v$ , respectively. By substituting these into (3), the optimal entry fee and quality assurance level can be given by  $p_s^* = (1/2)(v + \lambda_s n_b)$  and  $\beta^* = 0$ . When the seller offers quality assurance policy, the result of optimal entry fee and quality assurance level is the same to the platform providing it.

In the monopoly markets, the trade-off of the B2C platform is very straightforward in this framework. The quality assurance policy does not rain influence on the network effects of platform and the entry fee of seller. So the platform and the seller have no incentive to hold and improve quality assurance policy. With the framework developed in this section we extend the model to allow for platform competition.  $\square$

## 4. Competitive Platform Model

Assume that there exists two B2C platforms, 1 and 2, that play a static strategy. With multiple platforms buyers and sellers can either join a single platform or join multiple platforms. In the B2C markets, buyers' entry fee is free and buyers are always multihoming. Without loss of generality we only study two platform markets; one is buyers who multihome and sellers who single-home; the other is all buyers and sellers who multihome. We assume that two B2C platforms are homogeneous. The network effects of platforms 1 and 2 are the same; that is,  $\lambda_{b1} = \lambda_{b2} = \lambda_b$  and  $\lambda_{s1} = \lambda_{s2} = \lambda_s$ .

**4.1. Buyers Multihome and Sellers Single-Home Model.** In these B2C markets, platforms 1 and 2 provide quality assurance polices and pay their costs. Sellers that single-home on platforms 1 and 2 have the same utility as in the model:

$$\begin{aligned} u_{s1} &= \theta_{s1} v + \lambda_s n_{b1} - p_{s1}, \\ u_{s2} &= \theta_{s2} v + \lambda_s n_{b2} - p_{s2}. \end{aligned} \quad (5)$$

With multihoming these changes, a buyer that multihomes has utility:

$$\begin{aligned} u_{b1} &= \theta_{b1} v + \lambda_b n_{s1} + a\beta_1, \\ u_{b2} &= \theta_{b2} v + \lambda_b n_{s2} + a\beta_2. \end{aligned} \quad (6)$$

When buyers single-home on platform 1 or platform 2, it means that  $n_{s1} + n_{s2} = 1$ . If  $u_{b1} > u_{b2} > 0$  and  $u_{s1} > u_{s2} > 0$ , buyers and sellers will join on platform 1; otherwise they join on platform 2. If  $u_{b1} = u_{b2} > 0$  and  $u_{s1} = u_{s2} > 0$ , buyers and sellers will join on platform 1 or platform 2.

**Lemma 2.** *When  $v > \lambda_b$  and  $v > \lambda_s$ , if  $\beta_1 < \beta_2$ , then  $p_{s1}^* > p_{s2}^*$ ,  $n_{s1}^* < n_{s2}^*$ ,  $n_{b1}^* < n_{b2}^*$ , and  $\pi_1^* < \pi_2^*$ ; and if  $\beta_1 > \beta_2$ , then  $p_{s1}^* < p_{s2}^*$ ,  $n_{s1}^* > n_{s2}^*$ ,  $n_{b1}^* > n_{b2}^*$ , and  $\pi_1^* > \pi_2^*$ .*

*Proof.* According to the Hotelling theory, we define that the utility of both sides on platforms 1 and 2 is zero, and the equation group can be shown by

$$\begin{aligned} \theta_1 v + \lambda_b n_{s2} + a\beta_2 &= 0, \\ \theta_2 v + \lambda_b n_{s1} + a\beta_1 &= 0, \\ \theta_3 v + \lambda_s n_{b2} - p_{s2} &= 0, \\ \theta_4 v + \lambda_s n_{b1} - p_{s1} &= 0. \end{aligned} \quad (7)$$

When  $n_{s1} + n_{s2} = 1$ , we can get  $\theta_3 + \theta_4 = 1$ . From (7), the number of buyers and sellers who join on platforms 1 and 2 is  $n_{b1} = 1 - \theta_2$ ,  $n_{b2} = 1 - \theta_1$ ,  $n_{s1} = 1 - \theta_4$ , and  $n_{s2} = 1 - \theta_3$ , respectively. By substituting these into the profits of platforms 1 and 2, which is  $\pi_i = p_{si} n_{si} - c\beta_i^2$  ( $i = 1, 2$ ). The first order of platform profits can obtain the optimal entry fee, which gives a certain quality assurance level. So when  $v > \lambda_b$  and  $v > \lambda_s$ ,  $p_{s1}^* = (3v^2 - 3\lambda_b \lambda_s + \lambda_s a(\beta_2 - \beta_1))/3v$ , and  $p_{s2}^* = (3v^2 - 3\lambda_b \lambda_s + \lambda_s a(\beta_1 - \beta_2))/3v$ , then  $p_{s1}^* - p_{s2}^* = -2\lambda_s a(\beta_1 - \beta_2)/3v$ . By substituting these into equations of buyers and sellers, the

optimal number of buyers and sellers who join on platforms 1 and 2 can be given by  $n_{s1}^* - n_{s2}^* = \lambda_s a(\beta_1 - \beta_2)/3(v^2 - \lambda_b \lambda_s)$  and  $n_{b1}^* - n_{b2}^* = a(\beta_1 - \beta_2)(3v^2 - 2\lambda_b \lambda_s)/3v(v^2 - \lambda_b \lambda_s)$ , and the difference between optimal profit of platforms 1 and 2 is shown by  $\pi_1^* - \pi_2^* = (\beta_1 - \beta_2)(3vc\beta_1 + 2\lambda_s a + 3vc\beta_2)/3v$ . Then the result of Lemma 2 can be easy to see.

When sellers provide quality assurance policies, buyers and sellers have utility:

$$\begin{aligned} u_{s1} &= \theta_{s1}v + \lambda_s n_{b1} - p_{s1} - c\beta_1^2, \\ u_{s2} &= \theta_{s2}v + \lambda_s n_{b2} - p_{s2} - c\beta_2^2. \end{aligned} \quad (8)$$

The profit of platform is  $\pi_i = p_{si}n_{si}$  ( $i = 1, 2$ ). With these changes, the optimal entry fee is given by  $p_{s1}^{*'} = (-3v^2 - 3\lambda_b \lambda_s + c\beta_2^2 v - c\beta_1^2 v + \lambda_s a\beta_1 - \lambda_s a\beta_2)/3v$  and  $p_{s2}^{*'} = -(3v^2 + 3\lambda_b \lambda_s + c\beta_2^2 v - c\beta_1^2 v + \lambda_s a\beta_1 - \lambda_s a\beta_2)/3v$ . Then  $p_{s1}^{*'} - p_{s2}^{*'}$  =  $-2(\beta_1 - \beta_2)(-vc\beta_1 + \lambda_s a - vc\beta_2)/3v$ . Also we can get the optimal number of buyers and sellers and optimal platform profit is shown by

$$\begin{aligned} n_{b1}^{*'} - n_{b2}^{*' } &= \frac{(\beta_1 - \beta_2)(v\lambda_b c\beta_1 + 2\lambda_b \lambda_s a + 3v^2 a + v\lambda_b c\beta_2)}{3v(v^2 + \lambda_b \lambda_s)}, \\ n_{s1}^{*'} - n_{s2}^{*' } &= -\frac{(\beta_1 - \beta_2)(-vc\beta_1 + \lambda_s a - vc\beta_2)}{3(v^2 + \lambda_b \lambda_s)}, \\ \pi_1^{*'} - \pi_2^{*' } &= \frac{2(\beta_1 - \beta_2)(-vc\beta_1 + \lambda_s a - vc\beta_2)}{3v}. \end{aligned} \quad (9)$$

This lemma holds that the policy of quality assurance has influence on the performance of competitive platform. When the service level of platform is up to certain condition, that is,  $v > \lambda_b$  and  $v > \lambda_s$ , the quality assurance policy can attract more sellers and buyers to participate in the transaction in this platform; this is because the quality assurance policy with the platform offered can strengthen consumers' trust in the B2C platform, and more sellers will trade on this platform, which is based on the network effect. Given these results, we have the following proposition.  $\square$

**Proposition 3.** When  $\beta_1 + \beta_2 < \lambda_s a/vc$ , if  $\beta_1 < \beta_2$ , then  $p_{s1}^{*'} > p_{s2}^{*'}$ ,  $n_{b1}^{*'} < n_{b2}^{*'}$ ,  $n_{s1}^{*'} > n_{s2}^{*'}$ , and  $\pi_1^{*'} < \pi_2^{*'}$ , and if  $\beta_1 > \beta_2$ ,  $p_{s1}^{*'} < p_{s2}^{*'}$ ,  $n_{b1}^{*'} > n_{b2}^{*'}$ ,  $n_{s1}^{*'} < n_{s2}^{*'}$ , and  $\pi_1^{*'} > \pi_2^{*'}$ .

**Proposition 4.** When  $v > \lambda_b$  and  $v > \lambda_s$ , if  $\beta_1 < \beta_2$ ,  $\pi_1^{*'} < \pi_2^{*'}$ .

These propositions hold that the platform with quality assurance policy always creates more profit than platform without quality assurance when all buyers multihome and all sellers single-home. And the higher the quality assurance level is, the more profits the platforms attain. When the service level of platform is more than the network effects, sellers who provide quality assurance policy and bear their costs create more welfare than platforms who offer it, and

this result contradicts what we usually see in Bertrand competition. Sellers usually join one platform and provide quality assurance policy to improve competitive advance. They will fully guarantee quality assurance because the marketing channel of product is the only one, and it can build consumers' confidence on the quality of product.

**4.2. Buyers Multihome and Sellers Multihome Model.** The utility of buyers and sellers is the same as formula (5) and (6) when all two sides multihome. For this market, the total number of sellers and buyers is denoted by  $n_{s1} + n_{s2} > 1$  and  $n_{b1} + n_{b2} > 1$ . When platforms offer quality assurance policy and pay its cost, platforms pursue their own profit maximization, that is,  $\max \pi_i = p_{si}n_{si} - c\beta_i^2$ . Then we have a striking result.

**Lemma 5.** When  $\beta_1 < \beta_2$ ,  $p_{s1}^M < p_{s2}^M$ ; if  $v > \lambda_b$  and  $v > \lambda_s$ , then  $n_{s1}^M < n_{s2}^M$  and  $n_{b1}^M < n_{b2}^M$ .

*Proof.* Clearly, given by (5) and (6), the optimal numbers of buyers and sellers can be calculated, which are denoted by  $n_{s1}^M, n_{s2}^M, n_{b1}^M$ , and  $n_{b2}^M$ . By substituting these into the formulas of platform profits and using two first-order conditions, the optimal entry fee of platforms 1 and 2 is given by  $p_{s1}^M = (v^2 + \lambda_s v + \lambda_s a\beta_1)/2v$  and  $p_{s2}^M = (v^2 + \lambda_s v + \lambda_s a\beta_2)/2v$ . Then when  $\beta_1 < \beta_2$ ,  $p_{s1}^M < p_{s2}^M$ . Because there are  $n_{s1}^M - n_{s2}^M = \lambda_s a(\beta_1 - \beta_2)/2(v^2 - \lambda_b \lambda_s)$  and  $n_{b1}^M - n_{b2}^M = a(\beta_1 - \beta_2)(2v^2 - \lambda_b \lambda_s)/2v(v^2 - \lambda_b \lambda_s)$ , if  $v > \lambda_b$  and  $v > \lambda_s$ , then  $n_{s1}^M - n_{s2}^M < 0$  and  $n_{b1}^M - n_{b2}^M < 0$ .

When platforms offer quality assurance policy and pay its cost, it is easily seen that an increase in the parameter ( $\beta_i$ ) will increase the optimal entry fee and the size of sellers and buyers. The quality assurance policy can obtain more benefits in the competitive platform.

In the B2C markets, we assume that sellers provide quality assurance polices and pay their costs and the level of  $\beta_1$  and  $\beta_2$  is exogenous. The optimal entry fee and optimal number of two sides are denoted by  $p_{s1}^{M'}, p_{s2}^{M'}, n_{s1}^{M'}, n_{s2}^{M'}, n_{b1}^{M'}$ , and  $n_{b2}^{M'}$ ; then we have the following lemma.  $\square$

**Lemma 6.** Consider the following:  $p_{s1}^{M'} < p_{s1}^M$ ,  $p_{s2}^{M'} < p_{s2}^M$ ,  $n_{s1}^{M'} < n_{s1}^M$ ,  $n_{s2}^{M'} < n_{s2}^M$ ,  $n_{b1}^{M'} < n_{b1}^M$ , and  $n_{b2}^{M'} < n_{b2}^M$ .

*Proof.* For this market, the utility of sellers is given by (8). Then the optimal entry fee of platforms 1 and 2 is obtained by  $p_{s1}^{M'} = (\lambda_s v + v^2 - vc\beta_1^2 + \lambda_s a\beta_1)/2v$  and  $p_{s2}^{M'} = (\lambda_s v + v^2 - vc\beta_2^2 + \lambda_s a\beta_2)/2v$ . Similarly, other results of Lemma 6 are obvious.  $\square$

These lemmas imply that platforms that provide quality assurance policy and pay its cost can lead to greater profits than sellers. We also find that as the level of quality assurance increases, the platform will increase the entry fee and the number of two sides will also increase, that is, to increase the network effects. This follows intuitively from our experiences that the platform focuses more on quality assurance policy and charges more on sellers in the multihoming competition

markets. For example, Tmall of Alibaba Group offers the policy of seven days with no reason return and increases the level of quality assurance increase in 2013. At the same time, JingDong Tmall that is the second B2C sales platform also provides the policy of 30 days with no reason returns for electrical products. This means that platform dominantly controls the rights of quality assurance which can increase welfare of consumers in the competition platform. The implications of these are meaningful regarding the design of the platform's quality model and fee structure. Understanding the quality variation of its sellers and platforms, the platform can more effectively allocate its marketing power and operating quality resource for a platform-focus or seller-focus strategy.

## 5. Conclusions

This paper examines a monopoly and competition B2C platform's two-sided quality assurance strategy problem, using an approach that endogenizes network effects with quality assurance level. We capture quality variation between platforms and sellers and derive the platform's optimal competitive strategies. We find that both the platform and the seller always have fewer incentives to improve the level of quality assurance under a monopoly B2C markets. In the competition markets, sellers provide quality assurance policy which can lead to greater profits than platforms when buyers multihome and sellers single-home. However, platforms hold quality assurance policy which can drive more profit than sellers when all buyers and sellers multihome.

We suggest several future research directions that are not addressed in the current work. One natural extension is to study competing platforms with an endogenous quality assurance strategy. Competing platforms may differ in their information technologies so that platforms design quality differentiation traded within their own markets and do not only depend on pricing strategy. Also, competing platforms have asymmetry information on product quality between two sides. The asymmetry can yield new insights into how platforms set control rights of quality strategy that depends on competitive market characteristics. Another extension is to study competitive quality assurance strategy with heterogeneous consumers. This could lead to many interesting results about quality and pricing strategy in two-sided markets.

## Conflict of Interests

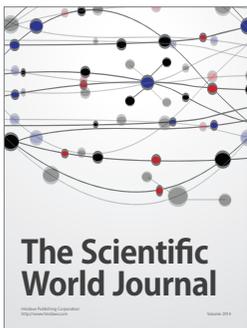
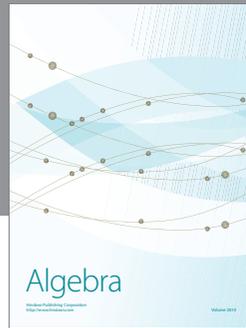
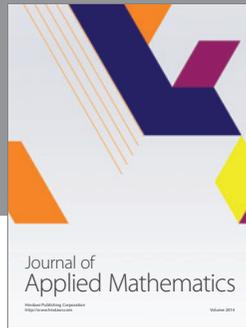
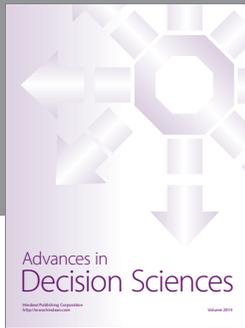
The authors declare that there is no conflict of interests regarding the publication of this paper.

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