

# The Impact of Quality Uncertainty Risk on Shared Platform Decision

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## Abstract

Considering the uncertainty risk of the quality of shared goods, analyze the optimal quality and pricing decisions of the platform under the condition of avoiding the risks of the shared platform at this time, and the impact of quality uncertainty on the shared platform and consumers. Research shows that: (1) the risk sensitivity of the sharing platform has a negative effect on the product price and product quality decisions of the sharing platform; (2) the impact of the risk sensitivity of the sharing platform on consumer surplus depends on the sensitivity of consumer quality and the quality of shared goods Improve the cost factor. When  $k > g^2$ , the risk sensitivity of the shared platform has a positive effect on consumer surplus; when  $k < g^2$ , the risk sensitivity of the shared platform has a negative effect on consumer surplus; (3) When the risk sensitivity of the shared platform was not considered, the consumer quality sensitivity had a positive effect on the shared platform Decisions are all positive effects, and consumers should be encouraged to actively participate in product quality feedback. When considering the risk sensitivity of the sharing platform, consumer quality sensitivity has a negative effect on the sharing platform decision and should be discarded.

## Keywords

Sharing economy; Uncertain quality; Risk Aversion; Quality feedback.

## 1. INTRODUCTION

The rapid development of Internet communication and big data technology has laid the foundation for the rise of the sharing economy. (Ganapati S, 2018) pointed out that the sharing economy enables consumers to obtain the right to use goods when they do not own the ownership of the goods, and improve the efficiency of the use of resources in the entire society. The "Report on China's Sharing Economy Development (2020)" issued by the National Information Center pointed out that the share economy market transaction volume in 2019 was 3282.8 billion yuan, an increase of 11.6% over the previous year. During the COVID-19 pandemic in 2020, despite the pressure on the overall employment situation in society, the number of jobs in the sharing economy still maintained a growth rate of 4.2%. The sharing economy has played an important role in increasing employment, optimizing the structure of the service industry, and promoting the transformation of consumption patterns. With the rapid development of domestic mobile payment, the sharing economy has been deeply integrated into our daily life scenes.

(Chen, 2019) believes that the development of the sharing economy is facing various challenges such as a crisis of trust and unstable product quality, which greatly restricts the healthy development of the sharing economy. In the sharing economy, goods are held by consumers and shared platforms during the use and maintenance stages. For example, shared

bicycles are usually near commuter entrances and exits of subways and bus stations and bicycle parking spaces in various communities. When consumers have short-distance travel needs, pass The mobile phone scan code payment can easily obtain the shared bicycle use rights, and consumers can ride the shared bicycle to any area within the designated area. In the process of consumer use, there are often acts of deliberate destruction of shared bicycles and carts. The sharing platform cannot effectively monitor the shared products, and some shared bicycles are naturally aging after the wind and sun. The quality of related shared products is not up to standard. It is very common for the next user to use it. (Benjaafa, 2020) found that the instability of the quality of shared goods has caused a serious negative impact on consumers participating in the sharing economy. The quality control and quality improvement of the sharing platform is essential to the sharing economy. (Jiang, 2016) Studies have shown that in the sharing economy, the strategic improvement of the quality of goods by the sharing platform can effectively increase the revenue of the sharing platform. This study analyzes the response strategies of shared platforms under different risk preferences under quality uncertainty, and proposes that continuous improvement of product quality is not always beneficial when the cost of improvement of shared platforms is high.

In order to solve the problem of instability in the quality of shared products and reduce the difficulty of improving the quality of shared products, sharing economy platforms such as Harrow Bikes and Street Power encourage consumers to submit product use quality reports after using shared products in the form of reward points. Shared bicycles can set up electronic fences through APP positioning, stipulate the scope of use of consumers and regulate parking (Leung X Y, 2019). The quality feedback report helps the sharing economy sharing platform to find weaknesses in product quality and design defects, and to repair damaged products in a timely manner. The direct factor that attracts consumers to participate in the sharing economy is the price advantage of shared goods (Kang S, 2019), which is also the competitive advantage of the sharing economy model compared to other economic models. For example, when Didi Dache initially opened up the market, it used subsidies to attract passengers to participate in the sharing economy. Even if the incentives decrease, Didi Dache still has an obvious price advantage per unit mileage compared with taxis. This is also Didi Dache competition. The strength lies in Didi Taxi's main goal of "Fair and Safe Travel". Improving product quality can effectively increase the revenue of the shared platform. This research analyzes the pricing strategy of shared platforms under different risk preferences under quality uncertainty.

## 2. PROBLEM DESCRIPTION

The sharing platform occupies a pivotal position in the operation of the sharing economy. There are many factors that affect the smooth and healthy operation of the sharing economy (Constantiou ID, 2017) (such as consumer trust (Mair J, 2017), asymmetry of supply and demand information, uncertainty in product quality, Costs, etc.). The sharing economy model is quite different from other economic models. On the one hand, the sharing economy enables consumers to obtain the right to use goods in a short period of time without owning the ownership of the goods, reducing social operating costs, and improving the overall resource utilization efficiency of the society. On the other hand, the sharing economy poses a huge test for the entire social credit (Zhang T, 2018) and supply chain quality monitoring system. The rapid development of mobile payment and Internet communication technology has laid the technical foundation for the development of the sharing economy, but the wanton destruction of shared goods during the rental period (Munoz P, 2017) is a huge test currently facing the sharing economy sharing platform. How to improve the quality of shared goods And design to improve the quality stability of shared goods in the operation process (Roma P, 2019). What impact does the sharing economy sharing platform's different attitudes towards risks have on the quality and pricing of shared goods? Based on the uncertainty of shared commodity quality,

this paper analyzes the commodity quality decision and pricing decision of the shared platform in the two situations of risk neutrality and risk aversion, and compares and analyzes the related decisions of the shared platform in the case of risk neutrality and risk aversion, as well as different decision pairs. Share the important impact of platform revenue and consumer surplus.

### 3. MODEL

This article takes the sharing platform in the sharing economy as the research object. The production of the sharing platform determines the quality and pricing of shared commodities, and analyzes the commodity quality decision  $q^*$  and pricing decision  $p^*$  of the sharing platform in the two situations of risk neutrality and risk aversion. Assuming that the consumer utility  $v$  is a uniform distribution that obeys  $v \in U[0,1]$ ,  $H(v)$  represents the consumer utility function, and  $h(v)$  represents the consumer utility density function. See Table 1 for the explanation of the decision variables and parameter symbols in the article.

**Table 1.** Symbols and descriptions of decision variables and model parameters

decision variables	variable description
$p$	shared commodity prices, $p < 1$
$q$	shared commodity quality, $q \in G(\bar{q}, \sigma^2)$
$E(\bar{R}_q)$	share platform revenue expectations
$S^2(\bar{R}_q)$	shared platform revenue variance
$H(v)$	consumer utility function
model parameter	parameter description
$v$	consumers estimate value, $v \in U[0,1]$
$c$	the unit cost of a shared good, $c < p$
$h(v)$	consumer utility density function
$\bar{q}$	average quality of goods, $\bar{q} > 0$
$g$	the consumer's sensitivity to the quality of goods, $g > 0$
$k$	shared commodity quality improvement cost coefficient
$\lambda$	shared platform risk sensitivity, $\lambda \in [0,1]$
$u$	consumer effectiveness, $u > 0$
$\sigma$	standard deviation of quality of shared goods, $\sigma > 0$

The improvement of the quality of shared goods has a positive effect on the consumer experience. Use  $(q \in G(\bar{q}, \sigma^2), \sigma > 0)$  to represent the quality of shared products. Consumer utility is related to product quality. Use  $u = v + gq - p$  to represent consumers' sensitivity to product quality. When  $v > p - gq$ , consumers rent Consumers who share goods and have consumption intentions are:

$$N_q(p, g) = \int_{p-gq}^1 h(v)dv = \int_0^1 h(v)dv - \int_0^{p-gq} h(v)dv = (1 - H(p - gq))$$

The improvement of product quality on shared platforms will incur corresponding costs, and the difficulty of product quality improvement will gradually increase. Use  $k\bar{q}^2/2$  to represent the cost of shared product quality improvement, and  $k$  to represent the cost coefficient of shared platform quality improvement. Different shared platforms vary according to different production processes. The value of different quality improvement stages is also different, the

price of the improved shared goods increases, and  $R_q(p, q)$  represents the revenue of the shared platform.

$$R_q(p, q) = (p - c)N_q(p, g) - k\bar{q}^{-2} / 2 = (p - c)(1 - H(p)) - k\bar{q}^{-2} / 2 \tag{1}$$

The revenue expectation of the shared platform is:

$$E(\bar{R}_q) = (p - c)(1 + g\bar{q} - p) - k\bar{q}^{-2} / 2$$

### 3.1. Risk Aversion

When the shared platform risk aversion, the shared platform revenue is:

$$\Pi = E(\bar{R}_q) - \lambda S^2(\bar{R}_q) \tag{2}$$

The risk sensitivity of shared platform  $\lambda$  measures the degree to which the shared platform avoids risks. An increase in  $\lambda$  indicates that decision-makers tend to avoid risks. The benefits of the shared platform are:

$$\Pi(\bar{R}_q)_1 = (p_1 - c)(1 + gq_1 - p_1) - k\bar{q}_1^{-2} / 2 - \lambda(p_1 - c)^2 g^2 \sigma^2$$

In the case of shared platform risk aversion, when  $2k(1 + \lambda g^2 \sigma^2) > g^2$  is satisfied,  $\Pi(\bar{R}_q)_1$ 's strict pseudo-concave with respect to  $(p_1, q_1)$ , based on which the optimal product quality  $q_1^*$  and the optimal price  $p_1^*$  for maximizing the revenue of the sharing platform are obtained.

$$q_1^* = \frac{g(1 - c)}{2k(1 + \lambda g^2 \sigma^2) - g^2}$$

$$p_1^* = \frac{k(1 - c)}{2k(1 + \lambda g^2 \sigma^2) - g^2} + c$$

Proposition 1 The sharing platform tends to avoid risks, the lower the rental price of shared goods, the lower the quality of shared goods

Focs:

$$\frac{\partial q_1^*}{\partial \lambda} = \frac{-2kg^3 \sigma^2 (1 - c)}{(2k(1 + \lambda g^2 \sigma^2) - g^2)^2}, \quad \frac{\partial p_1^*}{\partial \lambda} = \frac{-2k^2 g^2 \sigma^2 (1 - c)}{(2k(1 + \lambda g^2 \sigma^2) - g^2)^2}$$

$$\frac{\partial q_1^*}{\partial \lambda} < 0, \quad \frac{\partial p_1^*}{\partial \lambda} < 0$$

For consumers participating in the sharing economy, the uncertainty of shared product quality directly affects the consumer experience. The greater the risk of shared product quality uncertainty, the worse the consumer experience. For example, the common phenomenon of shared bicycle seats is destroyed, brake failure and other phenomena have greatly affected consumers' experience of participating in the sharing economy, thereby reducing consumers' demand for shared goods. For the sharing platform, its goal is to avoid risks to the greatest extent and increase revenue. In order to cope with the reduction in demand caused by the uncertainty of the quality of shared goods, the sharing platform chooses to set a lower rental price for shared goods to reduce consumers The threshold for participating in the sharing economy will attract more consumers to participate in the sharing economy. At the same time,

due to the choice of lower shared commodity leasing pricing decisions, the sharing platform chooses to formulate lower commodity quality to meet the profit demand of the sharing platform. At the same time, the lower quality of shared commodities has a relatively small quality improvement cost coefficient, which is as follows One step to improve the quality of the sharing platform provides room for improvement.

Take GoFun, the leading domestic shared electric car, as an example. Its first product to enter the shared car field is the relatively compact and lightweight Chery Ant model. It is battery-driven and can only be used by two people. Compared with other domestic auto brands, the quality of Chery's small Ant models is relatively low, but its lower rental pricing reduces the threshold for consumers to participate in shared cars, and at the same time quickly occupy the market. Follow-up GoFun in order to deal with the lack of battery life of Chery's small Ant models. Stability and other uncertain risks, GoFun launched Chery Arrizo e5 model to further improve the quality of related products.

Proposition 2 The impact of the risk sensitivity of shared platforms on consumer surplus depends on the sensitivity of consumers' quality and the coefficient of improvement of the quality of shared goods. When  $k > g^2$ , the risk sensitivity of the shared platform has a positive effect on consumer surplus; when  $k < g^2$ , the risk sensitivity of the shared platform has a negative effect on consumer surplus.

Consumer surplus is:

$$CS_q^*(p, q)_1 = \frac{(1 + gq_1^* - p_1^*)^2}{2} \quad (3)$$

$$CS_q^*(p, q)_1 = \frac{k^2(1-c)^2(1+2\lambda g^2\sigma^2)^2}{2(2k(1+\lambda g^2\sigma^2)-g^2)^2}$$

$$\frac{\partial CS_q^*(p, q)_1}{\partial \lambda} = \frac{4g^2(1-c)^2\left(\lambda g^2\sigma^2 + \frac{1}{2}\right)\sigma^2 k^2(k-g^2)}{(2k(1+\lambda g^2\sigma^2)-g^2)^3}$$

The quality of shared goods directly determines the consumer experience. When  $g^2 < k$ , it is more costly for the shared platform to improve the quality of shared goods, and consumers pay less attention to the quality of shared goods. In order to avoid the uncertain risk of shared goods, the shared platform Choose to increase consumer demand by lowering the pricing of shared commodities, transfer part of the income to consumers, and promote consumer surplus. When  $g^2 > k$ , the cost of improving the quality of shared goods on the public platform is relatively small. In order to avoid the uncertainty of the quality of shared goods, the sharing platform reduces the risk of quality uncertainty by choosing ways to improve the quality of the goods. The degree of attention is relatively high. The measures taken by the sharing platform to improve the quality of shared goods have enabled consumers to obtain a better consumption experience, stimulate consumers' enthusiasm for participating in the sharing economy, increase the revenue of the sharing platform, and reduce consumer surplus accordingly.

### 3.2. Risk Neutral

When the shared platform is risk-neutral, the shared platform does not consider risk factors and builds a model 0:

$$E(\bar{R}_q)_0 = (p_0 - c)(1 + gq_0 - p_0) - kq_0^2 / 2$$

When the shared platform is risk-neutral, the relevant parameters satisfy  $2k > g^2$ , and  $B E(\bar{R}_q)_0$  is a strict concave function on  $(p_0, q_0)$ . Based on this, the shared product quality  $q_0^*$  and product price  $p_0^*$  are obtained when the shared platform's revenue is maximized.

$$q_0^* = \frac{g(1-c)}{2k-g^2}, \quad p_0^* = \frac{g(1-c)}{2k-g^2} + c$$

Consumer surplus is:

$$CS_q^*(p, q)_0 = \frac{(1 + gq_0^* - p_0^*)^2}{2} \tag{4}$$

$$CS_q^*(p, q)_0 = \frac{k^2(1-c)^2}{2(2k-g^2)^2}$$

### 3.3. Comparative Analysis

It is found by comparison that the cost coefficient of improving the quality of shared goods has similar impact on the decision-making of the shared platform under the two models. When the quality of the shared goods is easy to improve, the shared platform will attract consumers by improving the quality of the goods to increase revenue, and the improvement of the quality of goods will be the price of the goods. Improve provides space. When considering risk factors, the difficulty of improving product quality depends on consumers' sensitivity to product quality and the uncertainty of product quality. When consumers' sensitivity to product quality increases or the uncertainty of product quality decreases, sharing platforms tend to improve products Quality, but this improvement is not endless, depends on the cost of improving the quality of goods. The sharing platform will not infinitely improve the quality of goods regardless of cost. When the consumer's product quality sensitivity is at a small value, the sharing platform has a larger cost coefficient for improving the quality, and chooses to reduce the quality of the product and then participates in the competition by reducing the price.

$$q_1^* - q_0^* < 0$$

$$p_1^* - p_0^* < 0$$

$$\Pi(\bar{R}_q)_1 - E(\bar{R}_q)_0 < 0$$

$$CS_q^*(p, q)_1 - CS_q^*(p, q)_0 > 0 \quad (k > g^2)$$

$$CS_q^*(p, q)_1 - CS_q^*(p, q)_0 < 0 \quad (k < g^2)$$

When sharing platform risk aversion, choose to reduce the quality of goods and thus reduce the price of goods through competition, resulting in reduced profits. Whether consumer surplus is reduced depends on the consumer's sensitivity to product quality and the relationship between the cost coefficient of the sharing platform to improve product quality.

### 3.4. Sensitivity Analysis

For model 0, the sensitivity analysis is as follows:

**Table 2.** Sensitivity analysis of model 0 parameters

The optimal value	$\xi$	$k$
$q_0^*$	(+)	(-)
$p_0^*$	(+)	(-)
$E(\bar{R}_q)_0$	(+)	(-)
$CS_q^*(p, q)_0$	(+)	(-)

For Model 1, the risk appetite of the shared platform and the uncertainty of product quality have a significant impact on its quality decision and pricing decision. Under the risk aversion, the decision of the shared platform is more difficult. Table 3 shows the optimal decision under the risk aversion of the shared platform Parameter sensitivity analysis.

**Table 3.** Model 1 parameter sensitivity analysis table

The optimal value	$g$	$k$
$q_i^*$	(-)	(1) $k < \frac{1}{2\lambda\sigma^2}$ (+)
		(2) $k > \frac{1}{2\lambda\sigma^2}$ (-)
$p_i^*$	(-)	(1) $k < \frac{1}{2(\lambda g^2 \sigma^2 - 1)}$ (+)
		(2) $k > \frac{1}{2(\lambda g^2 \sigma^2 - 1)}$ (-)
$\Pi(\bar{R}_q)_1$	(-)	(1) $k > \frac{g^2(1+8k^2\lambda^2\sigma^4)}{2(3\lambda g^2\sigma^2+1)}$ (+)
		(2) $k < \frac{g^2(1+8k^2\lambda^2\sigma^4)}{2(3\lambda g^2\sigma^2+1)}$ (-)
$CS_q^*(p, q)_1$	(+)	(-)

Proposition 3 In the case of the sharing platform's risk neutrality, the sensitivity of consumers' product quality has a positive effect on the decision-making of the sharing platform, and it is necessary to encourage consumers to actively participate in product quality feedback reports.

Parameter sensitivity analysis shows that when the shared platform is risk-neutral, continuous improvement of product quality leads to increased manufacturing costs. In order to avoid a large amount of cost improvement, the shared platform reduces quality improvement work, and the pricing of shared products decreases, and the corresponding equilibrium profit of the shared platform decreases. At this time, the key to increasing the balanced profit of the sharing platform is to increase consumers' sensitivity to product quality. This is achieved by consumers filling in feedback reports after the products are used. Filling in the consumer experience report increases consumers' awareness of their own consumption activities. A sense of participation and enhance the consumer experience. Through consumer feedback reports, the sharing platform can be urged to improve the quality of goods, increase the price of goods, and the sharing platform and consumers can achieve a win-win situation.

The sharing platform should encourage consumers to actively participate in providing feedback reports on product quality, and the feedback reports help the sharing platform reduce the cost of product quality improvement. When consumers are more sensitive to product quality, encourage consumers to actively participate in filling out product quality feedback reports. For

sharing platforms, it reduces the difficulty of product quality improvement, reduces the cost of quality improvement, and improves product quality. Significantly increase the revenue of the sharing platform and improve the quality of goods on the other hand to reduce the safety risks of consumers using shared goods Encouraging consumers to provide feedback reports on product quality is beneficial to consumers and sharing platforms.

Shared platform risk aversion and product quality uncertainty are both negative effects on the optimal decision-making of the shared platform. When the shared platform avoids risks and the quality of new products is determined, the shared platform generally reduces the risk of income uncertainty by lowering pricing Take the bicycle-sharing platform Mobike as an example. When Mobike-sharing bicycles were first launched, there was a greater risk of product quality uncertainty. Mobike used low prices to reduce the risk of uncertainty in future earnings. To some extent, this The risk of R&D costs is also transferred to manufacturing companies in the supply chain. This is also the reason why a large number of shared bicycle manufacturing companies closed down during the trough of the sharing economy in 2019. At this time, for the sharing platform, maintaining a relatively low level of product quality is crucial to seizing the market

In general, the risk aversion attitude of the sharing platform has a significant impact on its product quality and pricing decisions. The cost coefficient of improving the quality of shared products and the sensitivity of consumers' product quality are critical to the decision of the sharing platform. The sharing platform is in progress. Commodity quality and pricing decisions should not only consider the cost coefficient of shared product quality improvement, but also comprehensively consider consumers' sensitivity to product quality. Encouraging consumers to actively participate in the feedback of product quality under risk aversion is not good for sharing platforms and consumers.

#### 4. CONCLUSION

This article combines the uncertainty of the quality of shared commodities and risk factors to analyze the relevant decision-making under different risk attitudes of the shared platform in the sharing economy and the factors that affect the quality and pricing of the shared platform's commodities. First, when the shared platform is risk-neutral, the product quality and pricing decisions of the shared platform depend on the cost coefficient of the shared platform to improve product quality and the consumer's sensitivity to product quality. When the shared platform risk aversion, the optimal decision of the shared platform is still Need to consider the uncertainty of product quality and the risk sensitivity of the sharing platform (). Second, when sharing platform risk aversion, compared with risk neutrality, the sharing platform will choose to set lower commodity prices, and the quality of the products is also at a lower level. This is mainly due to the sharing platform's desire to maintain market scale through lower pricing. Reduce the uncertainty of benefits. Third, it is unwise for sharing platforms to continuously improve product quality when improving product quality. This conclusion is especially obvious when sharing platform risk aversion. When the cost coefficient of product quality improvement is much smaller than the consumer's sensitivity to product quality, the sharing platform chooses Improve product quality. Fourth, this article analyzes the necessity of encouraging consumers to actively participate in product quality feedback reports under risk-neutral conditions. Feedback reports can reduce the difficulty of product quality improvement. At this time, consumers' active participation in product quality feedback reports is a win-win for the sharing platform and consumers. . These suggestions provide important reference for the decision-making of the sharing economy sharing platform. For example, how the sharing platform makes product quality and pricing decisions in a risk-neutral and risk-averse attitude. The importance



of consumers' active participation in product quality feedback is important for the healthy development of the sharing economy. Important.

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