Collective Reputation in Online Platforms and Private Quality Standards[1]

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Abstract

This article provides a conceptual framework to understand benefits and costs of private minimum quality standards, increasing seller reputation or warranties when there is a collective reputation for online platforms. Our framework uses a dual reputation model where consumers have a quality expectation based on the reputation of the platform and the reputation of the seller. We also analyze the benefits and costs of various types of fees associated with online platforms. We find that the optimal fee structure may depend upon weighing quality concerns with market power concerns. The optimal quality standard may also depend upon the fee structure, as well as the level of compliance to that standard.

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JEL classification: Q18, D43

1 Introduction

Online platforms have become an increasingly popular and a convenient method of purchasing goods and services. While these platforms allow for convenience, the downside is that consumers do not always know the exact characteristics of the good or service they are purchasing. While experience goods have long been an issue, online platforms exacerbate this problem since consumers cannot physically examine the product as they can with traditional brick and mortar stores. While this issue may be mitigated for homogeneous products, quality assurances are often critical with food purchases. Our model examines various seller fees and potential solutions to the incentive problem that arises with quality regarding online platforms and food purchases. We find that optimal solutions may depend upon the balance of quality issues and market power, as well as the compliance to particular policies.

Because of this experiential nature of food, counterfeit and low quality food continues to be a problem. As of 2015, quality control companies reported that 47% of Chinese food processors meet international standards.[1] This is not only low quality food, but much of it is counterfeit with ingredients that are mislabeled.[2] This behavior can potentially lead to safety issues for consumers and a decrease in profits for legitimate food businesses.[3] While these issues are important for all food producers, online platforms might find an additional challenge since consumers cannot inspect the food purchase beforehand. Furthermore, the online platforms may also distort quality and quantity incentives by how they charge individual sellers for their services.

[1] http://www.cnn.com/2015/01/16/world/china-food-safety/?iid=EL

[2] http://money.cnn.com/2017/01/18/news/china-fake-food-seasoning-factories/

[3] https://www.cnbc.com/2016/07/08/amazons-chinese-counterfeit-problem-is-getting-worse.html

The discussion of online grocery sales in the United States has increased recently with Amazon purchasing Whole Foods, but online food sales has already been underway in China with Alibaba selling on a large scale. While a majority of groceries are still bought in physical stores, some experts argue that this will not be the case in the coming years. One important impediment to the growth of online food shopping is that it is difficult to ascertain the quality of the good prior to delivery of the food. Therefore, online platforms must rely on their reputation or the reputation of the individual seller. In light of this, Alibaba has taken steps to ensure the quality of their food. Given that they have had non-food product counterfeited, they have teamed with a third party to track the food they sell via a third party firm.[4]

These stories illustrate the fact that online platforms have a collective reputation, which creates an incentive to free ride on that reputation. In other words, individual sellers do not fully benefit from a high quality product if consumers build a reputation based on the average quality of all sellers on the platform. Furthermore, online platforms use a variety of fees for sellers. For example, Alibaba charges a annual seller fee as well as a commission of the sale. So, sellers are not charged based on how many units are sold, but instead are charged a fixed fee and a percentage of revenue, which reduces the incentive to invest in quality even further. While Ebay is not primarily known for selling food, they do in fact sell food on their website, but they have a different fee system from Alibaba. Their fees are dependent upon the type of good sold, but they also charge a percentage of the revenue. However, the percentage decreases as the value of the sale increases. The types of fees can also change the incentives for quality and possibly exacerbate the collective reputation incentive problem. When sellers do not receive the full value of the quality of their product, because of either collective reputation or seller fees,

[4]https://www.techinasia.com/alibaba-fake-food-detection-blockchain

there is an incentive to reduce quality.

This article examines firms' incentives when there is a dual reputation structure in the context of online markets. Our model shows that if quality is a higher concern than market power, then large fixed fees for sellers may be the best solution. However, this prescription also reduces the number of firms and if market power is a greater concern, then the optimal type of fee is ambiguous. This paper also analyzes potential solutions to this problem. There are many potential solutions to the free riding problem including minimum quality standards, shifting the reputation from the platform to the seller, and warranties. We discuss the benefit and costs of these policies.

2 Literature Review

Nelson (1970) first described experience goods where consumers do not know the quality of a product before purchase. He contrasts experience goods with search goods where consumers can inspect the good before purchase. With experience goods, he states that consumers will rely on the recommendations of other consumers. Similarly, Akerlof (1970) models product quality and asymmetric information. He models an exogenous quality and argues that warranties or some type of guarantee will help alleviate the asymmetric information problem. (Shapiro, 1982) models a situation where firms can choose their quality level, but consumers expect a level of quality based on quality in previous periods. In this situation, a firm may under produce quality and make short term gains at the expense of consumers, so a minimum quality standard might increase social welfare.

This asymmetric information problem for consumers has been extended to a collective reputation problem where individual sellers share a reputation and therefore do not receive the full benefit of investments into quality. If the quality of the good is endogenous in this setting, producers will under-invest in quality. This has been shown in an industrial organization setting (Winfree and McCluskey, 2005) as well as international trade (Donnenfeld and Mayer, 1987; Chiang and Masson, 1988; McQuade, Salant, and Winfree, 2016).

With the advent of Ebay, researchers in economics have been able to empirically analyze the effects of the individual seller's reputation on online sales. Ebay has long used ratings from buyers to quantify the quality of the seller and their products. Melnik and Alm (2002) show a small, but positive impact on price from a seller's reputation on Ebay. Livingston (2005) shows that positive online ratings are most important for newer sellers with fewer ratings. Resnick et al. (2006) found that experienced sellers fared better than inexperienced sellers, but when comparing new sellers, one or two negative comments did not have an adverse effect when compared with zero negative comments. Houser and Wooders (2006) similarly found that the reputation of the seller did increase the selling prices, but the reputation of the buyer had no impact.

The literature has suggested many solutions to the asymmetric information problem, but all solutions also have potential problems. For example, food quality standards have long been discussed in the literature (Gardner, 2003; Saitone and Sexton, 2010; Swinnen and Vandemoortele, 2011; Bovay and Sumner, 2017). While there certainly could be benefits from a standard, a quality standard cannot always be implemented perfectly, especially with food where the quality of the food can change quickly over time or it could also be counterfeited. Another solution is to inform the consumers about the individual seller's quality and create more traceability throughout the supply chain. While traceability might alleviate the collective reputation problem, it can also be costly to producers (Pouliot and Sumner, 2008; Souza-Monteiro and Caswell, 2010). A warranty could potentially be a better solution, but it could rely upon the honesty of the consumer. Other solutions such as punishments may not be feasible either in many cases.

3 Model

We model a market with one online platform and risk-neutral sellers. There are N firms with no entry. Each firm chooses a quantity (q) and quality (k) and pays fees to the online platform. One unit of production costs k^2. Firms sell their products to consumers who base their expected quality on a reputation that is a mixture of the firm's quality and the weighted average quality sold on the platform. Reputation for firm i is given by,

$$R_i = \gamma k_i + (1-\gamma) \frac{\sum_{j=1}^{N} q_j k_j}{Q} \tag{1}$$

where $Q = \sum_{j=1}^{N} q_j$ and $0 \leq \gamma \leq 1$.[5] If $\gamma = 1$, then the firm's reputation is completely determined by the firm and there is no collective reputation incentive problem. However, in the other extreme, $\gamma = 0$, then the firm's reputation is completely determined collectively. Demand for firm i is then given by,

$$p_i = a + \theta R_i - bQ \tag{2}$$

where a, θ and b are fixed constants. Also, each firm must pay a fee to the online platform, $F(q, p)$, which may be a function of quantity or revenue. We assume that the online platform incurs zero marginal costs and is therefore trying to maximize revenues. Therefore, each firm's objective function is given by,

[5]There may be a dynamic element to how the reputation is formed, which is not modeled here. For an example of how the reputation is formed in sequential waves, see McQuade, Salant, and Winfree (2016). Quality incentives may be distorted further if the firm is in the last wave.

$$\pi_i = q_i \left(a + \theta R_i - bQ - k_i^2\right) - F(q_i, p_i) \tag{3}$$

If all of the benefits to consumers and costs to firm's are taken into account, then $k^\dagger = \frac{\theta}{2}$, which gives us the socially optimal quality level. Furthermore, if prices are equal to marginal costs for this quality level, $q^\dagger = \frac{4a+\theta^2}{4Nb}$. However, incentives arising from collective reputation and market power will create lower levels of quality and quantity that are socially optimal.

The two complementary slackness conditions for each firm are given by,

$$q_i \geq 0, a + \theta R - (N+1)bq - \frac{k_i^2}{2} + q_i\theta(1-\gamma)\frac{Qk_i - \sum_{j=1}^{N} q_j k_j}{Q^2} - \frac{\partial F}{\partial q_i} \leq 0 \tag{4}$$

and

$$k_i \geq 0, q_i[\theta(\gamma + (1-\gamma)\frac{q_i}{Q}) - k_i] \leq 0 \tag{5}$$

With symmetry of firms, $\frac{Qk_i - \sum_{j=1}^{N} q_j k_j}{Q^2} = 0$ and $\frac{q_i}{Q} = \frac{1}{N}$. The equilibrium quantity is given by,

$$q^* = \frac{a + \theta k - k^2 - \frac{\partial F}{\partial q_i}}{b(N+1)} \tag{6}$$

and the equilibrium quality is then given by,

$$k^* = \frac{\theta}{2}\left(\gamma + \frac{1-\gamma}{N}\right) - \frac{\frac{\partial F}{\partial k_i}}{2q} \tag{7}$$

Equation (6) shows that the quantity produced by each firm will be below the socially optimal level due to market power and potentially because of decreased levels of quality. For example, if $k^* < \frac{\theta}{2}$, then quantity will be reduced even further than a market that does not have a collective reputation. Equation (7) shows that firms will produce a lower quality if γ is low and if quality influences the fees.

3.1 Fixed fees

This section analyzes the scenario where the online platform charges firms a fixed fee to use their service. This fee would not be based on quantity or revenue of the firm, but rather we simply define it as a constant F. In this case,

$$k^* = \frac{\theta}{2}\left(\gamma + \frac{1-\gamma}{N}\right) \tag{8}$$

and

$$q^* = \frac{a + \frac{\theta^2}{2}\left(\gamma + \frac{1-\gamma}{N}\right) - \frac{\theta^2}{4}\left(\gamma + \frac{1-\gamma}{N}\right)^2}{b(N+1)} \tag{9}$$

In this case the online platform maximizes the sum of the fixed fees, NF. Presumably the online platform could charge up to the profit level of the firms. If the fee is larger than the firm's profit, then firms will exit the market. Fewer firms will mean that the remaining firms will reduce production and increase the profits that can be taken by the online platform with the fee. Thus, the online platform can maximize their revenue if they charge a fee high enough that only one firm remains and they extract profits from a monopolist. If $N = 1$, there is no collective reputation incentive problem, and the firm would produce the quantity that maximizes industry profits.

It certainly may be the case that it is not feasible to reduce the number of firms to one. However, this is similar to the vertically integrated case of Amazon and Whole Foods. If an online platform such as Amazon sells food online via one firm, Whole Foods, they have eliminated any collective reputation problem. While it could be the case that there would be quality issues upstream of Whole Foods, in this case Whole Foods should have the correct quality incentives.

3.2 Per unit fee

If the online platform charges a fee for each unit sold such that $F = fq$, where f is a constant, then the optimal quality levels for firms will be the same as in the fixed fee example since $\frac{\partial F}{\partial k_i} = 0$. This type of fee will change quantity levels and the optimal quantity is given by $q^* = \frac{a+\frac{\theta^2}{2}\left(\gamma+\frac{1-\gamma}{N}\right)-\frac{\theta^2}{4}\left(\gamma+\frac{1-\gamma}{N}\right)^2-f}{b(N+1)}$.

The objective function of the online platform is then given by,

$$\pi^p = Nf\frac{a+\frac{\theta^2}{2}\left(\gamma+\frac{1-\gamma}{N}\right)-\frac{\theta^2}{4}\left(\gamma+\frac{1-\gamma}{N}\right)^2-f}{b(N+1)} \tag{10}$$

and the online platform's revenue is maximized when

$$f^* = \frac{1}{2}\left[a+\frac{\theta^2}{2}\left(\gamma+\frac{1-\gamma}{N}\right)-\frac{\theta^2}{4}\left(\gamma+\frac{1-\gamma}{N}\right)^2\right] \tag{11}$$

and output is cut in half for sellers when compared to the fixed fee so that $q^* = \frac{a+\frac{\theta^2}{2}\left(\gamma+\frac{1-\gamma}{N}\right)-\frac{\theta^2}{4}\left(\gamma+\frac{1-\gamma}{N}\right)^2}{2b(N+1)}$. As with the fixed fee case, while this does not alleviate quality concerns, it does not exacerbate them either. Also similarly to the fixed fee case, production does decrease and prices will increase.

3.3 Fee as a percentage of revenue

This section assumes that the online platform charges a commission that is a percentage of revenue. In this scenario, $F = \phi qp$. In this case, the seller's optimal quality is given by $k^* = (1-\phi)\frac{\theta}{2}\left(\gamma+\frac{1-\gamma}{N}\right)$ and the optimal quantity is given by $q* = \frac{a+(1-\phi)\left[\frac{\theta^2}{2}\left(\gamma+\frac{1-\gamma}{N}\right)-\frac{\theta^2}{4}\left(\gamma+\frac{1-\gamma}{N}\right)^2\right]}{b(N+1)}$. The percentage of revenue fee decreases the quality that firms produce, which makes intuitive sense since firms new receive less of a return on their investment in quality.

If there is an interior solution, meaning $k^* > 0$, $q^* > 0$ and $0 \leq \phi^* \leq 1$, then the optimal fee will satisfy the following quadratic equation,

$$\phi^{*2}\left[3\xi_1\xi_2 - \frac{3N\xi_2^2}{N+1}\right] + \phi^*\left[(a+2\xi_2)(\frac{2n\xi_2}{N+1} - 2\xi_1) - \frac{2a\xi_2}{N+1}\right] + \left[(a+\xi_2)(\frac{a-N\xi_2}{N+1} + \xi_1)\right] = 0 \tag{12}$$

where $\xi_1 = \frac{\theta^2}{2}\left(\gamma + \frac{1-\gamma}{N}\right)$ and $\xi_2 = \frac{\theta^2}{2}\left(\gamma + \frac{1-\gamma}{N}\right) - \frac{\theta^2}{4}\left(\gamma + \frac{1-\gamma}{N}\right)^2$. However, it is important to note that in this case, a corner solution may be reached where, for example, the optimal quality level for the firm is euqal to zero.

4 Policies

4.1 Minimum quality standards

We first examine the benefits and costs of implementing a minimum quality standard. If an online platform can effectively issue a standard, then this can alleviate the collective reputation problem. If the online platform sets the standard at $\bar{k}$, then equation (6) can we written as $q^* = \frac{a+\theta\bar{k}-\bar{k}^2-\frac{\partial F}{\partial q_i}}{b(N+1)}$. If there is a fixed fee, or a per unit fee, the impact of a marginal increase in the standard on output is given by, $\frac{\partial q^*}{\partial \bar{k}} = \frac{\theta-2\bar{k}}{b(N+1)}$. This is positive as long as the standard is not above the socially optimal standard of $\frac{\theta}{2}$, which it presumably would be since neither the sellers nor the online platform would want a standard higher than the socially optimal standard. At least in the case of full compliance of the standard, both the online platform and the sellers would want to set the standard so that $\bar{k} = \frac{\theta}{2}$.

If, however, there is a fee that is a percentage of revenue, then there is disagreement between the online platform and sellers on what the standard should be. Under that scenario, the impact of the standard on output is given by $\frac{\partial q^*}{\partial \bar{k}} = \frac{(1-\phi)\theta - 2\bar{k}}{(1-\phi)b(N+1)}$, which is positive if and only if $\bar{k} < \frac{(1-\phi)\theta}{2}$. The sellers would prefer if $\bar{k} = \frac{(1-\phi)\theta}{2}$ since this standard eliminates the free riding on quality due to collective reputation. But, at that quality level an increase in the quality standard increases quality, and therefore prices, and has no impact on quantities. Given that the online platform's objective in this case is to maximize revenues, they will want a standard above $\frac{(1-\phi)\theta}{2}$ since at that point $\frac{\partial q^*}{\partial \bar{k}} = 0$ and $\frac{\partial p}{\partial \bar{k}} > 0$. In this case, the online platform prefers a higher quality standard than sellers.

Other possible problems arise from quality standards as well. For example, it may be difficult for the online platform to enforce the standards, in which case the standard may do more harm than good. There needs to be a certain level of compliance in order for the quality standard to increase profits for the complying sellers, similar to Winfree (2016). In other words, if a quality standard increases cheating, then compliant firms may be harmed by the standard. As in the case of Alibaba, outside firms may be hired to increase compliance of food standards and authenticity. However, the impact of this is difficult to ascertain given the complex nature of compliance and profitability.

4.2 Increasing reputation to the individual seller

Perhaps the online platform can marginally shift the reputation from the platform to the individual seller. It may be able to do this through seller ratings or other means. The impact would be an increase in quality,

$$\frac{\partial k^*}{\partial \gamma} = \frac{\theta(N-1)}{2N} > 0 \tag{13}$$

If the reputation can be shifted so the $\gamma = 1$, then the incentive problem derived from collective reputation is eliminated. However, at times this can be costly and not feasible. As Resnick et al. (2006) showed, it can be difficult for new firms to generate a meaningful reputation. Furthermore, as Shapiro (1982) points out, there may be an incentive to mine this reputation for older firms that have built a good reputation.

Increasing the individual seller's reputation will also have an impact on quantity. Since quality would increase and therefore demand increases, output increases as well,

$$\frac{\partial q^*}{\partial \gamma} = \frac{\theta^2(N-1)(1-\gamma-\frac{1-\gamma}{N})}{4bN(N+1)} > 0 \tag{14}$$

If the reputation can shift from the online platform to the individual seller, both the online platform and seller are better off. Therefore, there is little downside to increasing the consumer's awareness of the individual seller. However, given the number of sellers on online platforms and imperfect seller ratings, it may not be feasible to entirely eradicate the importance of the reputation of the online platform.

4.3 Warranties

The individual seller, or the online platform, may decide to offer a warranty as in Akerlof (1970), but this may create a new set of incentive problems. In the same way the consumer may not be able to determine the quality before purchase, the consumer may have an incentive to argue that the food was of insufficient quality that they should be reimbursed.

Another potential issue with warranties is that it may not be a sufficient contract so that consumers are getting the *type* of quality they would prefer. In other words, there may be horizontal quality issues as well. In either case, it may be difficult to issue a warranty for food.

5 Example

In this section, we provide a numerical example where $N = a = \theta = b = 10$. Table 1 shows equilibrium qualities, quantities, prices and fees under different fee regimes and levels of collective reputation. The example shows that as consumers recognize the seller's quality instead of the online platform's quality (an increase in γ), qualities, quantities, and prices increase.

In the case of a fixed fee to the seller, the table assumes that the online platform charges exactly the revenues minus the costs of the firm. Therefore, each firm has a net profit of 0, but they do not leave the market. Under these parameter values, the online platform could charge a fixed fee of 30.625 and all firms would exit but one. Therefore, this would be highest level of profits the online platform could obtain. So, while Table 1 shows the online platform's profit is always higher using quantity based fees, if the online platform can reduce quantity by decreasing the number of firms through a fixed fee, then a fixed fee may be optimal for the online platform.

The example also illustrates that the quality is lowest with revenue based fees than compared with quantity based fees or fixed fees, but quantities are higher with revenue based fees than quantity based fees. While the online platform has higher profits with quantity based fees under this scenario, the preference of sellers depends upon the level of collective reputation.

6 Conclusion

We have highlighted the various quality and quantity incentives regarding food and online platforms. As news headlines suggest, when products are sold online with a very low quality, the reputation of the online platform suffers. This is because it is often impossible for consumers to distinguish between various sellers. Thus, bad quality incentives for the firms exist due to this collective reputation. This problem can also be exacerbated by the types of fees that online platforms charge their sellers for their services. If the online platform is charging a percentage of the sale price, sellers still incur all of the cost of quality investment, but receive even less of the revenue. Other types of fee structures, such as fixed fees or a per unit fee, do not change the quality incentive, but may cause lower output among sellers, so there may be a tension between quality and market power issues. Ideally, online platforms would take into account costs and charge a percentage of profits, but as they do not know the cost of the goods, this does not seem feasible.

Ways to alleviate quality concerns include setting a minimum quality standards, shifting the reputation to individual sellers, or offering a warranty. While any of these mechanisms have the potential to create optimal quality levels and increased quantity levels, they all have potential problems as well. Further, there is an interaction between the fee structure and the quality increasing policy. For example, the online platform would prefer a higher miinimum quality level than individual sellers if the online platform is receiving a percentage of revenues.

As online food sales increase on platforms such as Amazon or Alibaba, food quality and safety issues could be a growing concern. A major hurdle of online food sellers is the trust of the consumers. It seems likely that online food sellers and online platforms will continue to explore ways to ensure food quality through various mechanisms.

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Table 1: Numerical Example

	γ	k^*	q^*	p	f	ϕ	π	π^p
Fixed Fee[6]	0	0.5	0.134	1.591			0	1.798
	0.5	2.75	0.272	10.284			0	7.407
	1	5	0.318	28.182			0	10.124
Fee Per Unit	0	0.5	0.067	8.295	7.375		0.045	4.945
	0.5	2.75	0.136	23.892	14.969		0.185	20.369
	1	5	0.159	44.091	17.5		0.253	27.841
Perenct of Revenue Fee	0	0.060	0.096	0.991		0.879	0.011	0.838
	0.5	1.602	0.196	6.369		0.418	0.225	5.226
	1	3.040	0.229	17.492		0.392	0.319	15.707

[6] This assumes that the online platform will extract all profits from sellers through fees, but does not eliminate any firms by charging more than that. Under these parameter values, a monopolist seller could earn a profit of 30.625, which would be more profits the online platform could extract compared to the 1.798 per firm of the 10 firms.