What do we pay for asymmetric information? The evolution of mechanisms in online markets

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What Do We Pay for Asymmetric Information?

The Evolution of Mechanisms in Online Markets

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Abstract

The appearance of the Internet reduces transaction costs greatly, and brings the boom of online markets. While we are trying to regard it as the most realistic approximation of perfect competition market, the asymmetric information and a series of problems caused by it stop us from dreaming. As the old saying goes, there is no free lunch. This summer witnessed the collapse of the reputation system in Taobao, the biggest online transaction website in China. In fact, during the evolution of mechanisms in online markets, reputation, punishment and barriers to entry have been established in turn. What do we pay for maintaining these mechanisms? In which circumstance will they be effective?

In this paper I try to build a series of models within the principal-agent framework and repeated games to explain why and what we should pay for asymmetric information while enjoying shopping online. Specifically, these mechanisms are considered step by step and their boundary validation conditions are discussed. Finally, as the conclusion indicates, the more range that a mechanism is effective, the more opportunity cost should be paid as a rent for information.

1 Introduction

Nowadays in China, more and more consumers are fond of shopping online, which has obviously been the most popular and active form of electronic commerce. At the same time, this frictionless and competitive environment is the most realistic approximation of perfect competition market, the economist's ideal model. In fact, I couldn't find a better field to examine the effectiveness of related theories.

Its contribution to China's economy cannot be overlooked. In spite of the influence from financial crisis and earthquake, the total volume of online sales was nearly 130 billion RMB (about $19 billion) in 2008, which occupied 1.2% of social retails, and it has successfully been the most vibrant role in domestic economy at the growth speed of 128.5%, compared to the previous year. Furthermore, the low barriers to entry in online markets enable numerous individuals to own a shop online, thereby creating a large amount of new jobs. For instance, Taobao.com, the biggest online auction website in China, has successfully created about 690,000 jobs, which equals duodecimal nationwide number. Up to present, there are more than 100 billion registered users in Taobao, and a large proportion of them are able to live independently, with online sales as the only source of income.

However, unlike the perfection on the surface, the natural asymmetric information causes several problems. A good example is the reputation crisis happened in the summer of 2009, which leaded to the temporary breakdown of the whole market. Why doesn't the mechanism of reputation work as well as designed? Why is Taobao encouraging its old sellers to transfer to the new Shopping Mall, which requires higher entry cost?

What is interesting is that the online website for C2C transactions in China has a unique pattern of pricing. Different from online auction websites in the U.S. or U.K., almost every transactions in Taobao is completed in the form called "Buy now price" (the seller offers the price directly and the buyer chooses the goods labeled with pre-determined price), which is quite distinct from those in EBay. Therefore, instead of paying attention to the mechanism design of auction or psychological analysis of both sides' behaviors, we need to focus more on the effectiveness of the mechanisms designed to solve the troubles originated from moral hazard.

If we search for the development history of Taobao, it can be found easily that the mechanism of reputation, punishment and barrier to entry are established in turn. Thus, the first aim of this paper is to find out why the mechanism evolution in online markets happens. I will use the boundary conditions of validation, which are obtained from a series of economic models, to explain how the truth violates these conditions.

In addition, I also care about the situation of consumer's and social surplus under every mechanism. The change, especially the decrease, in their surplus can be regarded as the opportunity costs of establishing these mechanisms.

A lot of previous papers have discussed the asymmetric information problem in online markets, as well as more empirical researches. [Limited to the length of this writing sample, this information is omitted. You may see the reference list instead.]

The following part of this paper is arranged as below: in the second section the initial market is considered and the reason why it is not effective is discussed; in third section, the mechanisms of reputation, punishment and barrier to entry are taken into account step by step, and the boundary conditions are provided; in the fourth section the historical evidence from traditional markets is displayed in order to make a comparison; in the fifth section the empirical results from Taobao are used to test the theoretical models; the conclusion is at last.

2 The Initial Market

The initial market is the one without any interference from outside mechanisms (i.e. there is no reputation, punishment mechanism or barriers to entry). Then consider this process of online transactions:

$t = 0$	$t = 1$	$t = 2$	$t = 3$
the buyer offers a contact with price p	the seller accepts or refuses it	the seller provides high or low quality goods	the buyer receives the goods [end]

Model Design   Within the principal-agent framework from Laffont & Martimort (2002), these assumptions are made:

1. There are only two kinds of goods in the market: High-quality goods $\bar{q}$ and Low-quality goods $\underline{q}$. The buyer's utility function is $u(q)$, where $u' > 0$ and $u'' < 0$.

2. The seller's cost of providing High-quality goods is $\bar{c}$ and Low-quality goods is $\underline{c}$, where $\bar{c} > \underline{c}$. Here we can simply ignore the logistic costs, or it can be calculated in to the total cost directly since there is no significant difference between these two kinds of goods.

3. The supply is inelastic while the demand is elastic, so the price is determined by the buyer's willingness to pay.

Therefore, for every individual seller in the market, given the price p, their participation constraints must thus be satisfied:
$$p \geq \bar{c} \geq \underline{c} \tag{1}$$

Meanwhile, their incentive compatibility constraint (which enables the seller to provide high-quality goods) must satisfy:
$$p - \bar{c} \geq p - \underline{c} \tag{2}$$

However, according to our assumptions, (2) will be definitely violated. This result indicates that according to the asymmetric information existing in the market, the seller is more willing to provide Low-quality goods, which is called "moral hazard", the same as the traditional "lemon market" analyzed by Akerlof (1970).

3   The Evolution of Mechanisms

3.1   The Reputation Mechanism

In the early phase of development, because of the absence of third-part agency and the lack of feasible technique, the only mechanism available in online markets was the reputation. It indicates that, at that time, the only signal could be observed by the buyers before the transaction was the number of positive feedback (reputation rankings).

Now the process (mechanism before transaction) is:

$t = 0$	$t = 1$	$t = 2$	$t = 3$	$t = 5$
the seller choose the effort level, and obtained a signal	the buyer offers a contract with price $\bar{p}$ or $\underline{p}$	the seller accepts or refuses it	the seller provides high or low quality goods	the buyer receives the goods [end]

Model Design   Following the Informativeness of Signals model (Laffont & Martimort, 2002), these additional assumptions are made:

1. For every individual seller, their efforts are normalized respectively as a zero level ($e = 0$) and a positive level of one ($e = 1$). It also implies that the seller must pay a cost $\Psi(e)$ for exerting effort, and $\Psi(0) = 0$, $\Psi(1) = \Psi$.

2. The seller's utility function is $B(p, e) = p - \Psi(e)$, where $p \in \{\bar{p}, \underline{p}\}$ (i.e. the representative buyer's willingness to pay for High-Reputation seller is $\bar{p}$, and $\underline{p}$ for Low-Reputation seller).

3. Only two signals can be observed, σ_1 for High-Reputation seller, and σ_0 for Low-Reputation seller (i.e. the signals are belonging to a binary set $\Sigma = \{\sigma_0, \sigma_1\}$). Furthermore, assume that the signal sent by the seller is only directly depended on their effort level $e \in \{0, 1\}$.

4. To avoid the assumption of homogeneous buyers, we can instead use the average level – the probability of sending a particular type of signal based on the effort:

	$e = 0$	$e = 1$
σ_1	v_0	v_1
σ_0	$1 - v_0$	$1 - v_1$

   Here it can be assumed that $v_1 \geq v_0$, which implies that in order to send a High-Reputation signal, the seller must choose a higher effort level. Especially, when $v_1 = 1$ and $v_0 = 0$, the seller must make higher effort to obtain the High-Reputation signal, and this signal is publicly recognized by every member in the market.

5. When the seller choose $e = 1$, the probability of them to provide High-quality goods P equals $P\{\tilde{q} = \bar{q}|e = 1\} = \pi_1$, and $1 - \pi_1$ for Low-quality goods; the probability of a seller with $e = 0$ to provide High-quality goods $P\{\tilde{q} = \bar{q}|e = 1\} = \pi_0$ and $1 - \pi_0$ for Low-quality goods.

At this time, the buyer, as the principal, can divide the sellers into 4 groups:

state	description	probability when $e = 0$	probability when $e = 1$
$y_1 = \{\bar{q}, \sigma_1\}$	High-Reputation seller provides High-quality goods	$\pi_{10} = \pi_0 v_0$	$\pi_{11} = \pi_1 v_1$
$y_2 = \{\bar{q}, \sigma_0\}$	Low-Reputation seller provides High-quality goods	$\pi_{20} = \pi_0(1 - v_0)$	$\pi_{21} = \pi_1(1 - v_1)$
$y_3 = \{\underline{q}, \sigma_1\}$	High-Reputation seller provides Low-quality goods	$\pi_{30} = (1 - \pi_0)v_0$	$\pi_{31} = (1 - \pi_1)v_1$
$y_4 = \{\underline{q}, \sigma_0\}$	Low-Reputation seller provides Low-quality goods	$\pi_{40} = (1 - \pi_0)(1 - v_0)$	$\pi_{41} = (1 - \pi_1)(1 - v_1)$

Therefore, the participation constraint is:

$$\sum_{i=1}^{4} \pi_{i1} B(p_i, e_i) \geq 0 \tag{3}$$

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Meanwhile, their incentive compatibility constraint must satisfy:

$$\sum_{i=1}^{4} \pi_{i1} B(p_i, e_i) \geq \sum_{i=1}^{4} \pi_{i0} B(p_i, e_i) \tag{4}$$

Now writes the buyer's program as:

$$\max_{\{\bar{p}, \underline{p}\}} u = \sum_{i=1}^{4} (\pi_{i1} + \pi_{i0})(u(q_i) - p_i) \tag{5}$$

$$s.t. \ (3) \sim (4) \tag{6}$$

Solve this optimal program and discuss its first-order Kuhn-Tucker conditions (see the appendix), we can obtain these conclusions:

- (Only) When $v_1 = v_0$ (i.e. σ is not informative on the seller's effort), the seller is not willing to make any effort to send a positive signal.

- When $v_1 > v_0$, there must be $\underline{p} = 0$, which indicates that the buyer will pay nothing for a Low-Reputation seller. Hence, any seller in the market will make an effort to pursue the High-Reputation signal; otherwise they will be driven out from the market.

- Under this mechanism, there is no incentive for the sellers to improve there quality of service or probability of providing High-quality goods, since π_1 and π_0 are not existing in the first-order conditions. However, these probabilities are positive correlated with the buyer's utility.

Dynamic Analysis of Reputation Mechanism

Although the analysis above indicates the equilibrium result, there is still a condition left to make the mechanism effective. That is the seller's participation constraint (3). To have a better understanding of why they will actually participate in the competitive market, a repeated game model will be more persuasive.

Generally, the rule of the game can be interpreted as: if a seller provides High-quality goods at time $t-1$ with the effort $e = 1$, in the next period t, the probabilities of sending a signal increase, where $v_{1,t} \geq v_{1,t-1}$ and $v_{0,t-1} \geq v_{0,t}$; On the contrary, if he provides Low-quality goods, in the next period, $v_{1,t} \leq v_{1,t-1}$ and $v_{0,t-1} \leq v_{0,t}$. Let $\triangle v_{1,t} = v_{1,t} - v_{1,t-1}$ and $\triangle v_{0,t} = v_{0,t} - v_{0,t-1}$. The discount factor is δ.

Particularly, when the buyer follows the trigger strategy[1]:

- The seller is only able to send σ_0 during the first $N-1$ periods of the game. i.e. $v_{0,t} = v_{1,t} = 0$ $(1 \leq t \leq N-1)$ and $\triangle v_{1,t} = \triangle v_{0,t} = 0$ $(2 \leq t \leq N-1)$.

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[1]It not only makes the game simple but is also realistic, according to the common reactions of the consumers in the real world.

- If a seller provides High-quality goods during all $N-1$ periods (i.e. $e = 1$), then he can obtain σ_1 in the Nth period. i.e. $v_{1,N} = v_{0,N} = 1$ and $\triangle v_{1,N} = \triangle v_{0,N} = 1$. However, if he provides Low-quality goods once, he will be driven out from the market and the game is over.

- If the seller High-quality goods in the Nth period, he can continue to send σ_1 in the $N+1$ period. Otherwise, he will be driven out.

To make the model simpler, consider that if there are only one periods before N (i.e. $N = 2$). Now there are several feasible strategies for the sellers: (1) Provide High-quality goods in the first $N-1$ periods to obtain the High-Reputation signal in the Nth period. (2) Always provide Low-quality goods.

Now the payoff matrix is

	$t=1$		$t = 2,3,\ldots$	
	High-quality	Low-quality	High-quality	Low-quality
High Price $\overline{p}$	-	-	$(u(\overline{q}) - \overline{p},\ \overline{p} - \overline{c})$	$(u(\underline{q}) - \overline{p},\ \overline{p} - \underline{c})$
Low Price $\underline{p}$	$(u(\overline{q}) - \underline{p},\ \underline{p} - \overline{c})$	$(u(\underline{q}) - \underline{p},\ \underline{p} - \underline{c})$	-	-

Therefore, if the game continues, the sellers will choose strategy (1), which is their strictly dominated strategy, to reach the Nash equilibrium in each stage and finally arrive at the sub-game-perfect outcome, if

$$\frac{-\underline{c}}{1-\delta} \leq -\overline{c} + (\overline{p} - \overline{c})\frac{\delta}{1-\delta} \tag{7}$$

or

$$\delta \geq \frac{\overline{c} - \underline{c}}{\overline{p}} \tag{8}$$

And the equilibrium result is: the buyers pay high price and the sellers provide High-quality goods, which is the goal of an effective mechanism.

Since now we can define the seller's cost Ψ as $\Psi = \sum_{t=1}^{N-1}(\overline{c} - \underline{c})(1 + r)^t$, where $r = \frac{1-\beta}{\beta}$. Then the seller's participation constraint (3) can be rewritten as

$$v_1\overline{p} \geq \sum_{t=1}^{N-1}(\overline{c} - \underline{c})(1 + r)^t \tag{9}$$

With these analysis above we can finally obtain (see appendix for proofs):

Proposition 1. *The reputation mechanism will function well if the market satisfies the seller's participation constraint (9) and the assumption above that $v_1 > v_0$.*

Then the outcome is that the buyers pay high price and the sellers provide High-quality goods.

Proposition 2. *If the reputation mechanism functions well, then the equilibrium price for High-quality goods is*
$$p_1^* = [\sum_{t=1}^{N-1}(\overline{c} - \underline{c})(1 + r)^t]/v_1$$

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Why is the reputation not reliable? The truth is not as ideal as the imagination from these models above. In contrast, the reputation crisis happened in Taobao in the summer of 2009, as some news reported[2]. But the reason is so simple that may be beyond economist's expectation. The only cause is that the sellers can get a high level reputation easily by creating fraudulent transaction records with the help of their friends or some professional companies with a every low cost. Therefore, the real situation violates the assumption that "the signal sent by the seller only directly depends on their effort level" (i.e. now $v_1 \leq v_0$).

3.2 The Punishment Mechanism

Having seen the poor situation in the real market, we have to pay attention to another mechanism: punishment, which is defined as if the buyers verify that they have received Low-quality goods, they can apply for "treble-price compensation" (i.e. the sellers will pay three times as a punishment).

Now the process (mechanism after transaction) is:

$t = 0$	$t = 1$	$t = 2$	$t = 3$	$t = 5$
the buyer offers a contract with price p	the seller accepts or refuses it	the seller provides high or low quality goods	the buyer makes an effort to identify the quality of the goods	the seller pay treble-price as a punishment

Model Design Consider this situation: the buyer must pay for identifying whether the quality is high or low. Specifically, assume:

1. The buyers cannot observe any signal before transactions (or they do not believe the reputation), and they offer a price p to buy the goods.

2. The buyers believe that a seller would provide High-quality goods with the probability π, and Low-quality with $1 - \pi$.

3. The buyers can successfully verify that the goods are Low-quality ones with the probability ρ. But they must pay $d(\rho)$ for this action, and $d'(\rho) > 0$, $d''(\rho) > 0$.

4. When the goods is verified as a Low-quality one, the seller must pay treble price $3p$ to the buyers.

Therefore, the participation constraint is:

$$p - \bar{c} \geq 0 \tag{10}$$

Meanwhile, their incentive compatibility constraint must satisfy:

$$p - \bar{c} \geq \rho(p - \underline{c} - 3p) + (1 - \rho)(p - \underline{c}) \tag{11}$$

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[2]see: http://news.xinhuanet.com/tech/2009-08/04/content_11824446.htm

Now the buyer's program writes now as:

$$\max_{p,\rho} \ u = \pi u(\overline{q}) + (1 - \pi)(u(\underline{q}) + \rho \cdot 3p + (1 - \rho) \cdot 0) - p - d(\rho) \qquad (12)$$

$$s.t. \ (10) \sim (11)$$

To solve (12), we can obtain these results (see appendix for proofs):

Proposition 3. *The boundary validation condition for the punishment mechanism is that* $\rho \geq \frac{\overline{c} - \underline{c}}{3\overline{c}} > 0$.

Meanwhile, since $\frac{\partial d(\rho)}{\partial \pi} = -3p\rho < 0$, for a given level of ρ, the buyers pay less when the probability π increases.

Proposition 4. *If the punishment mechanism is effective, the equilibrium price for High-quality goods is* $p_2^* = \overline{c}$, *which is the same as symmetric information.*

However, although here the equilibrium price p_2^* is obviously lower than p_1^*, it doesn't necessarily mean that the buyer's welfare is better, since they must pay for identifying the quality.

What is the limitation of the punishment?   From the analysis above, it can be easily seen that the effectiveness of punishment mechanism heavily depends on the probability of successful identification π and the cost for identifying. Thus, for some kinds of goods, such as a book or a VIP card, they can be easily identified. In contrast, for those goods like cosmetic or digital equipments, the buyers must pay a very high cost to identify.

In conclusion, the punishment mechanism is limited to the categories of goods, which is not applicable to the entire market.

3.3 The Barriers to Entry Mechanism

Although we hope that the reputation and punishment mechanisms will have a significantly positive influence on the seller's behaviors, the fact shatters our dream. Due to the unreliable reputation records and the high costs of identifying, these mechanisms are not strong enough to protect the buyer's rights perfectly. As a result, other mechanisms are designed as substitutions, such as barriers to entry and trader's coalition. Here we only consider the former one, since the latter one has already been discussed by numerous researchers like Greif (1993) in a historical approach.

The "Taobao Mall" is a new website for B2C transactions, which was built in 2008. As its objection described, B2C transactions are different from traditional C2C ones in a large extent. The most significant characteristic is that it has a much stricter requirement of the sellers. Every shop owners in Taobao Mall must be certificated by national institutions, and at least they should provide a business license, which is issued by law. Moreover, the transactions are supervised by the website with punishment rules. All these requirements can be simply regarded as barriers to entry, and the seller's cost includes the effort to get a license and the obligation of punishment rules. Hence, the analysis of barriers to

entry includes both the mechanism of reputation and punishment, but not the same as analyzed in the former section.

Now the process (mixed mechanism) is:

$t = 0$	$t = 1$	$t = 2$	$t = 3$	$t = 5$	$t = 6$
the seller decides whether to enter the mall with an effort	the buyer offers a contract with price $\overline{p}$ or $\underline{p}$	the seller accepts or refuses it	the seller provides high or low quality goods	the buyer makes an effort to identify the quality of the goods	the seller pay treble-price as a punishment

Model Design   Assume that the seller must make an effort Ψ to enter the mall to send a High-Reputation signal, and others who fail to entering can only send a Low-Reputation signal (i.e. $v_1 = 1$ and $v_0 = 0$). Here I also assume that there is only one punishment[3] – treble price– to make the model concise.

Now the signals observed are simplified to:

state	description	probability
$y_1 = \{\overline{q}, \sigma_1\}$	seller in the mall provides High-quality goods	π_1
$y_2 = \{\overline{q}, \sigma_0\}$	seller out of the mall provides High-quality goods	π_0
$y_3 = \{\underline{q}, \sigma_1\}$	seller in the mall provides Low-quality goods	$1 - \pi_1$
$y_4 = \{\underline{q}, \sigma_0\}$	seller out of the mall provides Low-quality goods	$1 - \pi_0$

Therefore, the participation constraint on entering the mall is:

$$\overline{p} - \overline{c} - \Psi \geq 0 \tag{13}$$

Meanwhile, their incentive compatibility constraint must satisfy:

$$\overline{p} - \overline{c} - \Psi \geq \rho(-\underline{c} - 2\overline{p}) + (1 - \rho)(\overline{p} - \underline{c}) - \Psi \tag{14}$$

The participation constraint of other sellers to remain in the market is:

$$\underline{p} - \underline{c} \geq 0 \tag{15}$$

And also the incentive compatibility constraint of them is:

$$\underline{p} - \overline{c} \geq \underline{p} - \underline{c} \tag{16}$$

Now the buyer's program writes now as:

$$\max_{\overline{p}, \underline{p}, \rho} u = \pi_1(u(\overline{q}) - \overline{p}) + \pi_0(u(\overline{q}) - \underline{p}) + (1 - \pi_1)(u(\underline{q}) - (1 - \rho)\overline{p} + \rho \cdot 2\overline{p}) + (1 - \pi_0)(u(\underline{q}) - \underline{p}) - d(\rho) \tag{17}$$

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[3]In fact, considering the whole brand influence, the real punishment will be much heavier.

$$s.t. \ (13) \sim (16)$$

Similarly, the participation constraint (13) is not easy to be satisfied without dynamic analysis.

Dynamic Analysis Here we continue to use the repeated game model. However, there are slight differences in the strategies:

- Period 1: The sellers decide whether to enter the mall with an effort Ψ or remain outside of the mall.

- Period 2 and then on: The buyers pay a high price $\bar{p}$ for in-mall sellers, and a low one $\underline{p}$ for others.

Then the payoff matrix after stage 2 is:

	$t = 2, 3, \ldots$	
	High-quality	Low-quality
High Price $\bar{p}$	$(u(\bar{q}) - \bar{p}, \ \bar{p} - c)$	$(u(\underline{q}) - \bar{p}, \ \bar{p} - c)$
Low Price $\underline{p}$	$(u(\bar{q}) - \underline{p}, \ \underline{p} - c)$	$(u(\underline{q}) - \underline{p}, \ \underline{p} - c)$

Compare two strategies available for the seller[4]:

1. To enter the mall and provide High-quality goods, their expectation of payoff is $B_1 = (\bar{p} - \bar{c})(\delta + \delta^2 + \cdots + \delta^n) - \Psi$.

2. To stay outside of the mall, their expectation is $B_2 = (\underline{p} - \underline{c})(\delta + \delta^2 + \cdots + \delta^n)$

Similarly, these propositions can be obtained (see appendix for proofs):

Proposition 5. *The boundary validation conditions for the barriers to entry mechanism are $\rho \geq \frac{\bar{c} - \underline{c}}{3(\bar{c} + \Psi)}$ and $\delta > \frac{\Psi}{(\bar{p} - \underline{p}) - (\bar{c} - \underline{c}) - \Psi}$.*

Then the Nash equilibrium outcome is: the sellers in the mall provide High-quality goods, and other sellers are driven out of the market. Now it can be seen clearly that the buyers pay less for identifying under this mixed mechanism. If the equilibrium is reached, the price is also determined.

Proposition 6. *Given a discount factor δ, the equilibrium price $p_3^* = \Psi \frac{\delta}{1 - \delta} + \bar{c}$.*

Therefore, p_3^* is larger than p_2^*, and is likely to be higher than p_1^*, which implies that the buyer's welfare are worse compared with these two situations above. So this mechanism is the last choice. If we consider the possibility of monopoly, the price may be even higher.

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[4]Because of the trigger strategy, they will not choose to provide Low-quality goods after entering the market.

4 Comparison to Traditional Markets: A Historical Approach

The nature of online markets is similar to the traditional ones except the way and speed of transiting information, and the reason why I am interested in online markets is that it is an approximation of perfect competition markets existing in the real world. In this case, a comparison to the evolution history of traditional market may be revealing. As Greif (1993) indicates, the change in contract forms will have a remarkable influence on economic development.

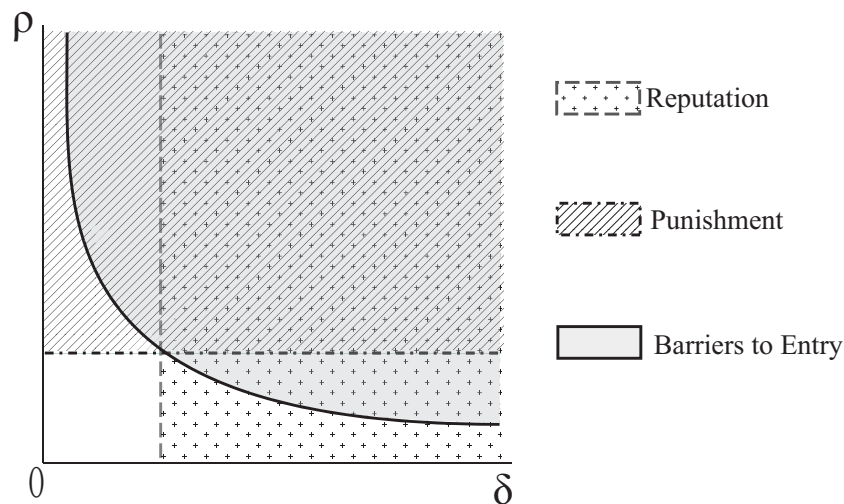[To be finished...]

5 Empirical Tests

5.1 The estimations of boundary conditions

5.2 The effectiveness of existing mechanisms

[To be finished...]

6 Conclusion

According to my theoretical models, all of these three mechanisms will be effective in particular environments. A stimulative result of valid areas is shown below:


The Valid Areas of Different Mechanisms

However, with the interruption of some "noise" or baleful actions, the mechanism of barriers to entry is the only left choice for market designers to use, because it reduces the level of competitiveness as well as consumer's welfare.

In addition, with the compassion to traditional markets.....the empirical results also....[To be finished...]

Furthermore, when paying attention to price-determine principles, the consumer should either pay premiums for High-Reputation sellers or make an effort to identify the quality, or even both. The situations of consumer's welfare (given a certain budget) are shown in the following figure (one shadow area represents one mechanisms).
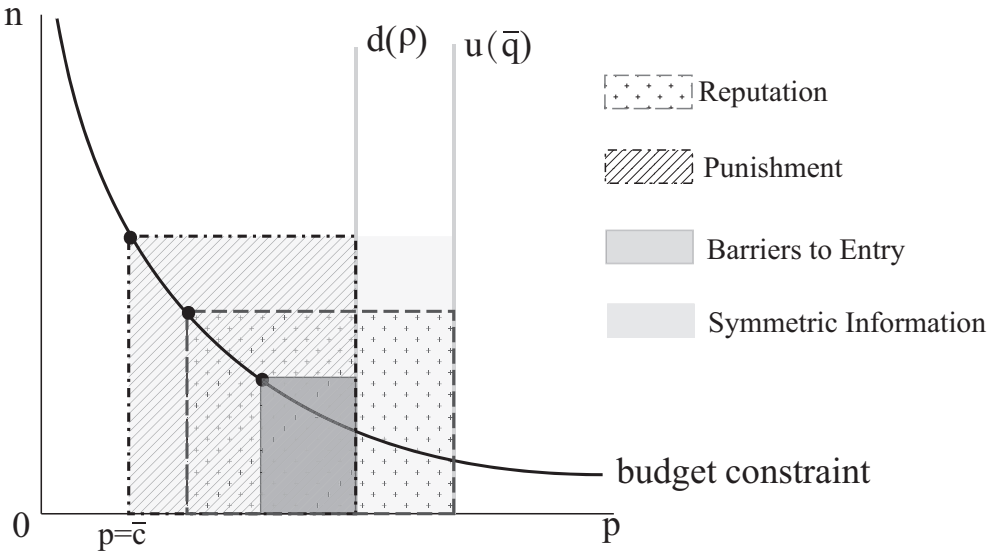
Consumer's Welfare Under Different Mechanisms

Therefore, the existing of these mechanisms that enables the normal order of the market has actually caused an opportunity cost. So the significance of mechanism design to economic activities can be interpreted clearly.

While the development of science and technology is making our everyday lives better with new innovative applications, it is necessary to find out how the information will influence microeconomic activities. Does it really reduce the level of asymmetric information? What is their influence on contracts and the determination of price? The online market is a ideal ground to test the effectiveness of different mechanisms and find out their opportunity costs. Thus, the combination of theoretical models and experimental applications is the direction of future research.

Appendix

Proofs for Proposition 1-6

In this sample only, the appendix is omitted. Briefly, the demonstration relays on the solving of the buyer's programs using Kuhn-Tucker conditions.

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