Exit and voice: a game-theoretic analysis of customer complaint management

Liang, Pinghan

Research Institute of Economics and Management,Southwestern University of Finance and Economics

2013

Exit and Voice: A Game-theoretic Analysis of Customer Complaint Management[1]

Pinghan LIANG[2]
Southwestern University of Finance and Economics

February 21, 2013

[1]I am grateful to Sjaak Hurkens for his insightful guildence and valuable suggestions. I benefit much from the detailed comments from Joel Sobel and anonymous referees. The helpful comments from Salvador Barbera, Ken Corte, John Geanakoplos, Georg Kirchsteiger, Ines Macho, Eric Maskin, Jordi Masso, Andrea Mattozzi, David Perez, Yuliy Sannikov, Karl Schlag, and Jorgen Weibull at various stages of this work, as well as the attendants in the workshops in UAB, Konstanz, SSE, Toulouse, and UCSD, SAE 2008, APET 2009 and JEI 2009 are appreciated. Financial support from Generalitat Catalunya (Catalonia Government), and Spain Ministry of Science and Innovation under ECO2008-04756 is gratefully acknowledged. The usual waiver of liability applies.
[2]SWUFE, 55 Guanghuacun Street, Chengdu, China, 610072. Email: liangph@swufe.edu.cn

Abstract

We develop a multi-agent communication model with participation decisions to address the customer complaining behavior and the corresponding management policy. Privately informed customers choose among costly complain, keep silence, and exit, and a firm decides complaining barriers and whether to undertake a corrective action. It is shown that customers truthfully complain only under a moderate complaining barrier. The observed low complaint/dissatisfaction ratio and costly complaint arise as one equilibrium outcome. Customers' expectations, the precision of signals, and the temptation of outside options are identified as the determinants of complaint management policy. Firms are likely to set socially excessive complaining barriers.

Key Words: Customer complaint management, Communication, Exit

JEL Classification: D82, L15, L51, M31

1 Introduction

Customers usually hold soft information valuable to companies, which are often willing to hear the voice of clients to improve the quality of their products. Therefore, complaining from dissatisfied consumers is an indispensable tool for companies to acquire information and retain the valuable customer base.[1] However, in practice it is observed that different levels of complaining barriers are set by different companies. A concrete example might illustrate this point. Ryanair, a highly successful low-cost airline in Europe, is notorious in handling customer complaints: the only available complaining channel is to write or fax to Ryanair's headquarter in Dublin, Ireland.[2] However, the leader in the North America low-cost airlines market, Southwest Airlines, actively elicits feedbacks from customers[3] to satisfy them.

Although it is well recognized that complaints provide company with real-time monitoring,[4] customer complaints are inherently private, hence, subjective. This feature might make the acquisition and use of this information costly for the firm. For instance, some factors leading to dissatisfaction may hardly be the company's responsibilities, e.g., bad climate or traffic jam, or misperception among customers. Thus, a firm usually needs "sufficient" information to justify costly corrective actions. Low complaining barriers might invite customers' exaggeration of dissatisfaction, but high complaining barriers reduce the incentive to report to the firm. Similarly, passive attitudes to the voice of customers might lead to failing to invest in the corrective action, consequently the loss of customers. But it would turn out to be much about nothing when the firm is very reactive to complaints but the problem is minor.[5] Hence, the firm has to balance the gain from retaining customer base and the cost of corrective action.

In this paper, we formulate this tradeoff based on the insight of Hirschman's (1970) Exit-Voice theory. We develop a model of multi-person communication game that captures the salient features of complaining behavior, to understand these different complaints handling processes. In our model, there

[1] See Crask et al (1995), Barlow and Moller (2008).

[2] See http://www.ryanair.com/en/questions/contacting-customer-service

[3] Southwest has a well-designed online form to learn customers' feedbacks (https://www.southwest.com/cgi-bin/feedbackEntry), and provides postal address and phone number for customers to express voices.

[4] For example, Crask et al (1995) summarize that the substantial variability and nondurability of service quality make the feedback from customers almost the only criterion to assess service quality. Fornell (2007) addresses the role of complaint in the customer-company relationship.

[5] In terms of statistical decision theory, it is the type I versus type II error.

is a firm who serves two customers.[6] The firm ("she") announces a responsive mechanism consisting of a decision rule specifying when to undertake a corrective action as the response to customers' actions, and a complaining barrier. Each customer ("he") observes a private informative signal about the true quality of the service, and independently chooses exit, complaining or keeping silence. Quitters suffer from an exogenous outside option that is worse than the *ex ante* expected payoff from staying with the firm, complainers need to overcome the complaining barrier, but it is costless to keep silence. The non-exit customers become *attached* to the firm. After observing customers' actions, the firm could invest in a corrective action to ensure high quality. Then the attached customers perfectly observe the true quality. They would be *lock-in* if the quality turns out to be good, and exit otherwise.

We first analyze the mechanisms differing only in decision rules. We focus on two deterministic mechanisms[7] which exhibit the features of the real-world procedures: the *passive* and the *reactive* responsive mechanism, respectively. While the former specifies that the investment is undertaken only when both customers complain, the latter prescribes that even a single complaint suffices to convince the firm to undertake corrective actions. Depend on which mechanism is adopted, the nature of interaction among customers varies from a coordination game (under passive mechanism) to an anti-coordination game (under reactive mechanism).

Because customers might misreport their feelings, a modest complaining barrier is essential for extracting truthful report. It is shown that the firm's optimality can only be attained by one equilibrium in the passive responsive mechanism. However, due to the problem of multiple equilibrium in the coordination game, it is possible that the firm adopts a suboptimal reactive responsive mechanism. Under this mechanism, it is optimal for the firm to set a higher complaining barrier; and the dissatisfied customers would complain with some probabilities. This outcome is close to the real-world observation that most dissatisfied consumers never complain to the business.

We further demonstrate that compared with the socially optimal complaint management mechanism, firms are likely to set an excessive complaining barrier. Moreover, we relate the firms' choices of responsive mechanism

[6] It also could be considered as two groups of isolated customers, like the passengers in the bussiness class and those in the economy class. As regard to landing, flight time, etc., they get almost the same services. The key assumption is that there is no collective action problem within each group, and no communication between groups is feasible.

[7] Two reasons stimulate us to focus on deterministic mechanism: first, firms may not be able to commit to a lottery over actions since the *ex post* optimal decision rule (when the firm knows the action profile of customers) is deterministic. Second, in practice it is difficult to observe a random customer complaint management policy.

to the customers' prior expectation, the precision of signals, and the competition pressure. For instance, in standardized industries, customers have more precise signals about the true quality and the other customer's signal, this facilitates coordination between customers. Consequently, the firm will reduce the complaining barrier and be passive to the voice of customers. Under the severe competition, the firm is more likely to be reactive to the voice of customers, but sets the higher complaining barrier, since the competitive pressure increases the risk of losing the customer base.

Industrial Organization literature usually assumes that firms have private information about the quality of products/services, and persuade customers to buy. In practice, especially after purchase, the clients usually hold information about the real-time performance of products/services. Our work takes this alternative direction and investigates the information flow from customers to firms, consequently contributes to understanding the information transmission within customer-company relationships. For the marketing research, this work contributes by addressing some salient features of customer complaints with a game-theoretic model, thus provides a strategic foundation for the complaining behavior and management policy.

This paper is structured as the follows: Section 2 briefly describes some salient features of customer complaint behavior in real world, and reviews the related literature. Section 3 lays out our model, and explores the benchmark case that the firm is not responsive at all. Section 4 investigates the equilibrium properties under the reactive and the passive responsive mechanism, respectively. In Section 5 we compare the welfare under these two responsive mechanisms, highlight some comparative statics, and discuss the robustness of our results. Section 6 concludes and suggests the future research.

2 Background

In this section we first present some salient features of complaint management addressed by marketing researchers. These features to a large extent are incorporated into our model. Then, we review the related literature in economics, in particular, the works addressing strategic information transmission.

2.1 Features of complaint management

As Fornell and Wernerfelt (1988) suggest, complaint management policies typically apply to all customers, rather than a subset of clients; and they are closely related to the firm's efforts on quality improvement. In other words, the outcome of corrective actions, like the system upgrade, the reliability improvement, reducing waiting time, and a better service attitude, is a public good.[8] Moreover, "effort to facilitate voicing of complaints" is a crucial part of the complaint management. It is widely recognized that the complaining behavior is mainly driven by failing expectations, thus both expectations and the realized quality are essential. These features motivate the basic ingredients of our model, such as the corrective action as a public good, and the strategic choice of complaining barriers.

The following salient facts about the complaining behavior are highlighted in our work.

First, it is well-established that only a minority of dissatisfied customers complain directly to the business, though the percentage varies by industries and the type of problems (Best and Andreasen, 1977, TARP, 1986, Huppert, 2007). The classical marketing textbook by Kotler et al (1999) even asserts that as much as 95% of dissatisfied customers never tell the company their problems. This stylized fact suggests that keeping silence is more likely the customer's rational choice, rather than an abnormal action.

Second, since most customer complaints are unsolicited (Richins and Verhage, 1985) and inherently subjective, the self-selection problem prevails. Snellman and Vihtkari (2003) illustrate that the most frequent complainers are those considering themselves guilty for the outcome. Doerpinghaus (1991) suggests that the disappointed expectation, rather than the poor service quality, results in complaints. It is also recognized that the complaint frequency is not significantly related to the dissatisfaction (Andreasen, 1977; Bearden and Teel, 1983). Even worse, Halstead et al (1996) find out that the poor performance in one service area may predispose the complainers to negatively evaluate and complain about other service areas or attributes.

Finally, clients might incur substantive costs to make formal complaints. TARP (1979) identifies the time and effort involved, the ignorance about how to complain, and the uncertainty about redress after complaints as the primary sources of complaining costs. Moreover, the complaining behavior and management policy vary considerably across countries, industries, and companies. Many survey studies since Richins and Verhage (1985) have established that the culture matters in customers' willingness to complain. TARP (1986) demonstrates that the complaint/dissatisfaction ratio varies significantly across industries, where tourists and luxury products have a

[8] According to the monthly report from U.S. Department of Transportation, the most common complaint problems are flight problems, boarding, customer services. The most common complaints to Dell call centers are the long waiting time (Fornell, 2007).

higher ratio, and consumer products have the lowest one. Fornell (2007) identifies hospitals, life insurances, airlines and health insurances as the worst industries in handling complaints, while supermarkets and automobiles work pretty well. And as our motivating example about Ryanair and Southwest Airlines demonstrates, even the companies within the similar industry might have quite different complaint handling procedures.

2.2 Related literature

Fornell and Wernerfelt (1987, 1988) provide a theory about the customer complaining behavior on the basis of Exit-Voice paradigm *a la* Albert Hirschman (1970). However, by assuming that a fixed ratio of consumers will complain, they preclude the strategic behavior of any individual client. There is a large gap between economic theory and marketing research on the complaint management. To the best of our knowledge, Prendergast (2002) is the only game-theoretic work on customer complaining behavior. He considers the complaint as a way to solve the agency problem, since the clients could figure out the mistakes in the agent's decision. Hence, the customer serves as a monitor in the principal-agent relationship. His focus is on the possible collusion between the self-interested customer and the agent. In this paper, we take the divergence of interest between the customers and the firm as given, and analyze the acquisition and use of information of firms.

Our paper links to the large body of research on strategic information transmission originating from the seminal work by Crawford and Sobel (1982), in which an informed strategic player wants to convince a decision maker by sending costless messages. Kartik et al (2007) suggest that a sender would exaggerate the true state to lie a naive decision maker. Two recent papers exemplify the exaggeration incentive and the consequence in the context of multiple senders. Morgan and Stoken (2008) study the information aggregation problem in the circumstance of poll. They show that the fully-revealing equilibrium is impossible when the number of agents becomes large, since the individual incentive to exaggerate also increases, and the decision maker could not commit to a policy. Kawamura (2011) shows the impossibility of fully-revealing equilibrium due to exaggeration incentives, and gives credit to the binary message as a robust communication mode. Customer complaints differ from the objects in these studies in that the action of customers, e.g., whether to continue buying, really affects the firm's payoff even when the communication is costless. Besides, we take the voluntary participation problem into account, which distinguishes our work from all previous works, with the possible exception of Ambrus and Egorov (2012). Moreover, in our model the communication cost is also a decision variable chosenby the firm.

3 Model

In this section, we first describe the environment of our model, then we turn to the definition of equilibrium, and impose several assumptions on parameters to restrict our attentions to the cases of the most interests. Finally, we investigate the benchmark case in which the firm entirely ignores the customers' actions.

3.1 Model environment

There are one firm and two *ex ante* identical customers.[9] There are two periods $t = 1, 2$, the possible quality of the service (true state) in each period is $\theta_t \in \{B, G\}$, where G stands for the good and B denotes the bad. In the first period, each customer observes a private signal $s_i \in S = \{B, G\}$ $(i = 1; 2)$ regarding θ_1. With a little abuse of terminology, $s_i = B$ refers a bad signal, while $s_i = G$ represents a good signal. The signal is imperfectly informative in the sense that $\Pr(s_i = k \,|\theta_1 = k) = q > \frac{1}{2}, k \in \{G, B\}$. We refer the customer who get the signal G (B) as *satisfied (dissatisfied)* customer.[10] Therefore, the signal space includes four possible events $\{BB, BG, GB, GG\}$, corresponding to both get bad signals, one bad and one good signal, and two good signals, respectively. Figure 1 summarizes the time structure.

[Insert Figure 1 here]

The timing of this game is as the follows: On the outset of the game the firm announces a deterministic responsive rule g associating whether to invest with the action profile of the customers, and a communication cost $D \geq 0$ imposed on every complainer. In period 1, Nature chooses the true state θ_1, each customer observes the signal s_i, chooses action from $A = \{E, C, K\}$ independently, where E, C, K denote exit, complain, and keep silence, respectively. The non-exit customers become *attached* to the firm and defer the realization of his payoff to the second period. Then the firm observes the action of customers, and decides whether to invest in the corrective action. At period 2 the true state is known to everyone, and the attached customer chooses to be *lock-in* or exit.

In the first period, complaint incurs the communication cost D. If the customer exits in the first period, he will get an outside option with payoff

[9] In Section 5 we would discuss the consequence of asymmetric customers, e.g., value customer v.s. new customer.

[10] As long as the firm is not perfectly informed about the true state, the value of complaints from customers would not disappear.

$\omega \in (0,1)$, if he exits in the second period, the value of outside option shrinks to zero.[11] In the second period, all attached customers observe the true state θ_2 perfectly. If $\theta_2 = G$, attached customers stay, realize payoff 1, and become *lock-in*. Otherwise they exit and get 0.

All players share the common prior about the initial state of the world $\Pr(\theta_1 = G) = 1 - p$, which has the natural interpretation as customer expectations or firm's reputations. The firm could not observe the true state as well as the signals of the customers. After observing the customers' actions, she could invest F to undertake a corrective action to ensure that the true state is good, i.e., $\Pr(\theta_2 = G\,|F) = 1$. If no corrective action is undertaken, the *status quo* remains and $\theta_2 = \theta_1$. To concentrate on the issue of interest, it is assumed that the firm's revenue relies exclusively on the value of lock-in customer, V. Thus, maintaining *customer base* is crucial to profit-maximization.[12] Alternatively, the first period could be interpreted as the introductory phase, which generates negligible profits compared with the revenue from consumers' future purchase behavior.

We could concentrate on the first period in which the customers strategically use their information. We denote $\gamma_{s_{-i},s_i} = \Pr\left(s_{-i}\,|s_i\right)$ as customer i's perceived probability that the opponent receives s_{-i}, conditional on his own signal s_i. For instance, γ_{GB} stands for a dissatisfied customer's estimating probability that the other customer is satisfied. From now on we will use the following notations to simplify our analysis. For a dissatisfied customer, he prescribes $\underline{u} = \Pr\left(\theta_1 = G\,|s_i = s_{-i} = B\right) = \frac{(1-p)(1-q)^2}{pq^2+(1-p)(1-q)^2}$ if the event BB occurs, and $u = \Pr\left(\theta_1 = G\,|s_i \neq s_{-i}\right) = 1-p$ if the event GB happens. A satisfied customer expects $\overline{u} = \Pr\left(\theta_1 = G\,|s_i = s_{-i} = G\right) = \frac{(1-p)q^2}{(1-p)q^2+p(1-q)^2}$ in the event GG, and u in the event BG. Obviously, $\overline{u} > u > \underline{u}$, and the magnitude of this conditional probability is common knowledge among customers and the firm. However, a customer has to infer both the likelihood of the true state and the signal of the other side exclusively based on his own signal.

[11] This assumption reflects the customers' switching cost: the longer a customer being attached to a firm, the higher the switching cost entails if he leaves (Klemperer, 1995; Farrell and Klemperer, 2007). This is made without loss of generality. We defer the discussion about this assumption in Section 5.

[12] It's well-recognized among marketing researchers that keeping a current customer is much cheaper, thus much more profitable, than obtaining a new customer. According to a official report issued by U. S. government, the profit/cost ratio on average is as large as 5 to 1 (TARP, 1979).

3.2 Decision rule and the equilibrium

The firm doesn't want to undertake too frequent investment in corrective actions, so she has to make decisions based on customers' actions. On the other hand, her decision rule affects customers' incentive to report. To avoid credibility problem, we impose the following condition about the corrective cost to ensure that upon observing customers' actions, the firm has incentives to fulfill her promise on the outset of the game.

To guarantee that the information of complaints is useful, we need to impose several restrictions on the parameters. First, the valuable information implies that *ex ante*, for the firm doing nothing dominates investment in corrective actions, e.g., $2(1-p)V \geq 2V - F$. Second, the value of information requires that the firm has some incentives to undertake corrective actions. For instance, if she could perfectly observe the signals, then at least in the worst event BB she would like to carry out the investment, e.g., $2\underline{u}V \leq 2V - F$. Thus, we get the following condition:

Condition 1 $2pV \leq F \leq 2(1-\underline{u})V$

A further implication of these conditions is that if the firm could perfectly observe the customers' signals, her optimal investment policy is to invest only in the event BB. However, since the firm could not observe the customer's private signals, she has to provide proper incentives to acquire information from customers.

We restrict attentions to the monotonic decision rule g in the sense that if the firm commits to invest upon a certain number of complaints, she has to invest when more complaints are received. In literal words, if a single voice convinces the firm to change, so do two voices or one voice plus one exit.

This rule also implies anonymity, i.e., the firm could not discriminate among customers.[13] If the participation constraint is satisfied under the policy g, i.e., no customer exits, then the firm's profit could be expressed as

$$\pi_g = [1 - \Pr(\theta_2 = B)] * 2V - \Pr(\text{corrective action}) F \tag{1}$$

The firm aims to maximize the above profit function, subject to incentive compatibility constraints and participation constraints of customers.

We further impose the following assumptions on the value of outside options to make complaining behavior possible.

[13] If we allow the possibility of asymmetric customers, the basic result won't change since the investment is a public good and every customer has only one piece of signal.

Condition 2 *The value of outside option ω satisfies the following assumptions:*

1. $\omega \geq \underline{u}$
2. $\omega \leq u$
3. $\omega \leq 1 - D$

The first part implies that if the firm never responds and a customer could observe all signals, he would quit if two bad signals occur. The second part is the ex-ante participation constraint, which implies that if the prior sustains, attached to the firm is a dominant strategy. The third part means that if the customer expects that his complaint certainly induces a corrective action, complaining dominates exit.[14]

The mechanism consists of a deterministic action rule $g \in \{R, P\}$[15] and a communication cost (complaining barrier) $D \in [0, 1]$. R stands for the reactive responsive mechanism, which specifies that the firm undertakes a corrective action even only one complaint is received. P stands for the passive responsive mechanism, in which two complaints or one exit are needed to convince the firm to invest.[16]

Once the mechanism is announced and signals are drawn, the game between those two customers starts. A strategy used by the customer observing signal s is $\sigma : S \to \Delta(A)$, which is a function mapping private signals into the set of probability distribution over the action set A. The equilibrium is formally defined as:

Definition 1 *The Bayesian-Nash Equilibrium is a triple $\{(g^*, D^*), \sigma^*\}$ such that*

1. *Given the customers' strategy under any signal $\sigma_i(s_i)$, the decision rule and the communication cost (g^*, D^*) maximizes the firm's ex-ante expected profit in (1).*

[14] This is quite analogous with the insights on network competition with quality differences. The key point there and here is similar: the formation of consumers' expectations about the true state. "(T)his logic making expectations stubbornly unresponsive to price or performance) would focus expectations on a firm that plainly could dramatically improve its product if necessary- even if it never actually does so" (Farrell and Klemperer, 2007, P.2042)

[15] We have investigated other deterministic action rules and find out either the games between customers under these mechanisms can be generalized into these two rules, or they are payoff dominated by these two.

[16] We may think that there may be randomly coming new customers in the second period, thus the exit of old customer would not affect the firm's incentive to undertake corrective actions.

2. *Given the responsive mechanism* (g^*, D^*), *for each player* i *and every possible signal* s_i, *the behavioral strategy* $\sigma^*(s_i)$ *maximizes customer* i'*s expected payoff, that is,* $Eu_i(\sigma_i^*, \sigma_{-i}^* | s_i) \geq Eu_i(\sigma_i', \sigma_{-i}^* | s_i), \forall i \in \{1,2\}, \forall \sigma_i'$.

3. *The customers' belief about other's signal* (γ_{s_{-i},s_i}) *is updated according to the Bayes' rule.*

Since the firm chooses the decision rule before customers acting, her belief after observing customers' actions would not affect any outcomes. A customer's action only depends on his own private signal, so we could confine attentions to characterize the symmetric Bayesian-Nash equilibrium. We say that when σ is a one-to-one mapping from signals to actions, then it is a *separating equilibrium.* The customers adopts a *pooling strategy* if all signals induce the same action. An equilibrium is called *partially revealing* if in equilibrium upon receiving at least one signal, the customer undertakes mixed strategy, i.e., $\sigma(s_i) = (\sigma_C, \sigma_K, \sigma_E)$ where $\sigma_a \geq 0$ specifies the probability to take at least two actions $a \in A$.

Here we briefly outline the approach. We first propose the alternatives of decision rules, then for a given decision rule, we examine the equilibrium strategies of customers under different communication costs, and calculate the profit of firms under each mechanism. Finally, we compare these mechanisms.

3.3 Benchmark case: No response

In this subsection, we analyze the benchmark case in which an obtuse firm doesn't respond to the action of the customers at all. Thus, the status-quo quality always sustains. We formally state the equilibrium in the following proposition:

Proposition 1 *If the firm never responds to the action of customers, then* C *is unused in any equilibrium, and the equilibrium outcome depends on the value of outside option.*

1. *If* $\omega \leq \frac{1}{1-\frac{p}{1-p}\frac{q}{1-q}}$, *then the pooling equilibrium emerges, every customer keeps silence in the first period, and the expected profit is:*

$$\pi^{Pooling} = 2(1-p)V \tag{2}$$

2. *If* $\omega > \frac{1}{1-\frac{p}{1-p}\frac{q}{1-q}}$*, then in equilibrium the satisfied customer keeps quiet and the dissatisfied one exits, the expected profit is:*

$$\pi^{Fully-revealing} = \left[p\left(1-q\right)^2 + \left(1-p\right)q^2\right] 2\overline{u}V + 2q\left(1-q\right)\left(1-p\right)V = 2\left(1-p\right)qV \tag{3}$$

Proof. *See the Appendix.* ■

In Part 2 of this proposition, since the firm won't respond to the action of customer, a dissatisfied customer would not bother to complain, and he leaves directly. Hence, her profit only depends on her expectation about the events. The first term in (3) represents the expected profit in the event GG, which occurs with probability $p\left(1-q\right)^2 + \left(1-p\right)q^2$; the second term is the expected profit in the event GB or BG, where only one customer becomes lock-in.

Under the pooling equilibrium in Part 1, both customers choose to be attached regardless of the private signal. Hence, the firm could not acquire any information from customers. In the second period, both customers choose to be lock-in if observing a good true state, and exit otherwise.

The result is consistent with the classic insight about market competition: the more severe the competition (higher ω), the lower the profit. Thus, (2) generalizes the expected profit under the pooling equilibrium..

4 Equilibrium Analysis

In this section, we investigate the equilibrium under two specific responsive mechanisms. By Condition 1, we know that the optimality of the firm is attained by carrying out investment only when two bad signals occur. Hence, only the passive responsive mechanism with proper incentive compatibility constraints could implement this. However, we show that this mechanism fails to fully implement the optimal rule in that many undesirable equilibria outcome might arise. Then, we move to investigate the reactive responsive mechanism. We show that even though it could not implement the optimality, it always has a unique (symmetric) equilibrium, and the worst outcome is avoided. Furthermore, for the firm it is optimal to induce the equilibrium in which the dissatisfied customer randomizes between complaining and keeping silence. This equilibrium outcome resembles the observation of the low complaint/dissatisfaction ratio and the costly complaint. Finally, we analyze the choice of responsive mechanism under the endogenous outside option, in which the complaint management policy serves as a competitive device to attract new customers and retain old customers. We find out that the suboptimal reactive responsive mechanism still emerges as one equilibrium outcome.

4.1 Passive responsive mechanism (P): coordination game

We first investigate the passive responsive decision rule, which implies that the firm responds to either two voices or one exit or both.[17] Under this rule customer complaints are complementaries. If the dissatisfied customer is pessimistic about the other's action, he may exit rather than complain.

The firm's optimality is undertaking the corrective action only when BB occurs. The *informative separating equilibrium* CK, which prescribes action C upon a bad signal and action K conditional on a good signal, could implement this outcome. If the outside option is low, this equilibrium could be attained by setting an intermediate level of communication cost under the mechanism P.

This informative separating equilibrium requires that truth-telling is the mutual best response. But since the passive responsive mechanism creates a coordination problem between customers, multiplicity of equilibria arises and many undesirable equilibrium outcome might emerge.

The minimal possible payoff to the action K is the expectation of the good state if the firm does nothing: $\Pr(\theta = G \,|s_i = B) = \gamma_{BB}\underline{u} + \gamma_{GB}u = \frac{(1-p)(1-q)}{(1-p)(1-q)+pq}$. Depending on the value of outside option, e.g., whether the participation constraint in the first period also holds, we could divide the results of multiple equilibrium into two cases. Here we just present the main results in the following proposition.

Proposition 2 *Under the passive responsive mechanism, the equilibrium varies with the level of communication cost and the outside option, for instance:*

1. *If the outside option* $\omega < \frac{(1-p)(1-q)}{(1-p)(1-q)+pq}$, *we have*

[17] The response to exit may violate the interim incentive compatibility condition for the firm, i.e., the firm may find it is not optimal to invest if one customer has already quit. However, adding this consideration would not alter our result significantly, since it further reduces the attractiveness of passive responsive mechanism in that the Pareto-inferior equilibrium outcome becomes even worse.

(a) *If* $D \in \left[\frac{pq(1-q)}{(1-p)q+p(1-q)}, \frac{pq^2}{(1-p)(1-q)+pq}\right]$, *then* CK *would be an equilibrium, and the firm's expected profit would be the highest,*[18] π_P^*:

$$\pi_P^* = \pi_P^{FR} = 2V\left[1 - p\left(1-q^2\right)\right] - \left[(1-p)(1-q)^2 + pq^2\right]F \quad (4)$$

(b) *The pooling equilibrium* KK*, in which the customer always keeps silence regardless of his own signal, is an equilibrium for any value of* D*. And it is the unique equilibrium if* $D \in \left[\frac{pq^2}{(1-p)(1-q)+pq}, 1-\omega\right]$*. And the firm's profit is the same as (2).*

(c) *If* $D \in \left[0, \frac{p(1-q)}{(1-p)q+p(1-q)}\right]$*, the babbling equilibrium in which customers always complain regardless of his own signal exists if The firm's profit becomes*

$$\pi_P^b = 2V - F \quad (5)$$

(d) *There is a mixed strategy equilibrium, in which a satisfied customer keeps silence, and a dissatisfied customer randomizes between* C *and* K*.*

2. *If the outside option* $\omega \geq \frac{(1-p)(1-q)}{(1-p)(1-q)+pq}$*, we have*

(a) *If* $D \in \left[0, \frac{p(1-q)}{(1-p)q+p(1-q)}\right]$*, there is an babbling equilibrium* CC *in which customers always complain, and the firm's profit is (5).*

(b) *If* $D \geq \max\{\frac{p(1-q)}{(1-p)q+p(1-q)}, \frac{pq^2}{(1-p)(1-q)+pq}\}$*, the unique equilibrium is a mixed-strategy equilibrium, in which a satisfied customer keeps silence, and a dissatisfied customer randomizes between* C *and* E*.*

(c) *If* $D \in \left[\frac{p(1-q)}{(1-p)q+p(1-q)}, \min\{\frac{(1-p)(1-q)+pq^2}{(1-p)(1-q)+pq} - \omega, \frac{pq^2}{(1-p)(1-q)+pq}\}\right]$*, there exists an informative separating equilibrium* CK*, and the firm's profit is (4).*

(d) *If* $D \in \left[\frac{p(1-q)}{(1-p)q+p(1-q)}, \frac{pq^2}{(1-p)(1-q)+pq}\right]$*, there exists an equilibrium in which a dissatisfied customer complains with the probability* σ_C*, exits with the probability* σ_E*, and keeps silence with the complementary probability.*

Proof. *see the Appendix.* ■

[18] In this equilibrium, dissatisfied customers always complain, and satisfied customers always keep silence. Therefore, the firm undertakes corrective actions only when two complaints are received, e.g., customer's signals are both bad. This is actually the firm's best outcome. Hence, π_P^* is the highest among all possible mechanisms.

If $\frac{(1-p)(1-q)}{(1-p)(1-q)+pq} > \omega$, e.g., the dissatisfied customer still maintains sufficient confidence about the other's signal (high q), or the outside option is not too attractive (low ω), E is strictly dominated by K. Then, only K and C are involved in any equilibrium. It could be shown that the pooling equilibrium KK always exists, since keeping silence is a mutual best response of dissatisfied customers. If D is low, then in addition to the informative separating equilibrium CK and the pooling equilibrium KK, the babbling equilibrium CC also exists. This implies that if the communication cost is low, customers might always complain regardless of his own signal. Besides, there is a mixed-strategy equilibrium which specifies that satisfied customers keep silence and dissatisfied customers randomize between complaining and exit. The probability of complain, however, is increasing with respect to the communication cost D.

Scholars may suggest to use the more sophisticate equilibrium selection criterion to choose the plausible equilibrium. In this case, since exit becomes the dominated strategy, the underlying game turns out to be a 2×2 coordination game, we might use risk-dominance criterion (Harsanyi and Selten, 1987) to define the cost interval where the separating equilibrium CK is a more plausible prediction. However, when exit becomes possible, this equilibrium selection criterion fails.

If $\frac{(1-p)(1-q)}{(1-p)(1-q)+pq} \leq \omega$, the participation constraint fails in the first period. Thus, a customer could review the outside opportunity after observing his private signal. In this case, the babbling equilibrium CC still exists as long as the communication cost D is low. Otherwise, a satisfied customer doesn't bother to complain. However, if the communication cost is too high, or the posterior is pessimistic, a dissatisfied customer may prefer exit to complain. The mixed-strategy equilibrium in which he randomizes between exit and keep silence hence becomes the unique equilibrium.

On the other hand, if D is not so high, then the situation becomes more complicate. The informative separating strategy CK might exist for the intermediate range of communication costs. However, there also exists another

mixed-strategy Nash equilibrium which is particularly bad for the firm: a dissatisfied customer completely randomize over E, K, C. In this equilibrium, as the outside option becomes more appealing, a dissatisfied customer is more likely to choose exit.

However, comparative statics exercises on complaining behavior ((13) and (16)) demonstrate that the inclination of complaining increases with respect to the complaining barrier (D), which is highly implausible, though understoodable in terms of our model. Therefore, though the low complaint/dissatisfaction ratio can arise under the passive responsive mechanism as an undesirable equilibrium, the direction of change would be opposite to our observations. Hence, it's difficult to reconcile that this mechanism with the management policy at work.

In summary, though the passive responsive mechanism with a moderate communication cost could implement the firm's best outcome, it suffers from two drawbacks which may seriously limit its practical value. First, due to the nature of coordination game between customers, the inevitable multiplicity of equilibria arises, the undesirable equilibrium outcome may emerge. Second and perhaps more important, when the outside option becomes appealing, after receiving signals the customer's participation constraint differs from the ex-ante one, thus it is more difficult to retain customers.

4.2 Reactive responsive mechanism (R): one complaint suffices

The reactive responsive mechanism is characterized by that the voice of any single consumer suffices to convince the firm to invest. Under this mechanism, the firm would commit to some *ex post* inefficient action, e.g., invest when only one complaint is received, even though her prior sustains. However, this mechanism also has two appealing properties compared with the mechanism P. Since $u(E) = \omega < 1 - D = u(C)$, exit is strictly dominated in the first period. Hence, the participation constraint always holds. Besides, this mechanism ensures a unique symmetric Nash equilibrium for any communication cost. Thus, this mechanism could fully implement this action rule.

The point is that since one complaint certainly leads to a corrective action, complainers substitute to each other. They have the incentive to free ride the other's complaining behavior. Thus, if they have full information about signals and it turns out that the event BB occurs, the game between two customers becomes a Chicken game, in which the only symmetric equilibrium is a mixed-strategy equilibrium.

In the first place, we explore the informative separating equilibrium. The result is presented in the following lemma.

Lemma 1 *Under the mechanism R, CK is the unique informative separating equilibrium if and only if*

$$\frac{p(1-q)^2}{p(1-q)+(1-p)q} \leq D \leq \frac{pq(1-q)}{(1-p)(1-q)+pq} \tag{6}$$

Proof. *see the Appendix.* ■

It is straightforward to calculate the expected profit to the firm

$$\pi_R^{FR} = 2V\left[1 - p(1-q)^2\right] - \left[1 - p(1-q)^2 - (1-p)q^2\right]F \qquad (7)$$

In this equilibrium, the firm loses the customer base if the true state is bad but both customers get good signals (type I error). This probability is $p(1-q)^2$. Since a bad signal leads to complaints, consequently a corrective action, the probability to invest is the same as the complaining rate (the probability for the firm to receive a complaint), which is captured by the bracket of the second term of (7).

By Condition 1, since the firm has to invest in the event GB and BG, this fully revealing equilibrium under the mechanism R is not in the firm's best interest. Thus, we need to examine other equilibria under this responsive rule. We characterize all symmetric equilibrium in the following proposition.

Proposition 3 *Under the mechanism R, the equilibrium varies with respect to the communication cost D.*

1. *If* $D \geq \frac{1}{\frac{1-p}{p}\frac{1-q}{q}+1}$, *the unique symmetric equilibrium is the pooling equilibrium* KK. *The expected profit is the same as (2).*

2. *If* $D \in \left[\frac{1-q}{\frac{1-p}{p}\frac{1-q}{q}+1}, \frac{1}{\frac{1-p}{p}\frac{1-q}{q}+1}\right]$, *then in the unique symmetric equilibrium a satisfied customer keeps silence, while a dissatisfied customer complain with the probability*

$$\sigma_C = \frac{(1-D)\left[(1-p)(1-q)+pq\right]-(1-p)(1-q)}{pq^2}$$

   And the firm's expected profit is

$$\pi_R^{PR} = [1-p(1-q\sigma_C)^2]2V - \{\left[(1-p)(1-q)^2 + pq^2\right]\sigma_C(2-\sigma_C) + 2q(1-q)\sigma_C\}F \qquad (8)$$

3. *If* $D \in [\frac{1-q}{\frac{1-p}{p}\frac{q}{1-q}+1}, \frac{1-q}{\frac{1-p}{p}\frac{1-q}{q}+1}]$, *then the unique symmetric equilibrium is the fully-revealing equilibrium in which a satisfied customer keeps silence, and a dissatisfied one complains. The expected profit equals to (7).*

4. *If* $D \in (0, \frac{1-q}{\frac{1-p}{p}\frac{q}{1-q}+1}]$*, the unique symmetric equilibrium is that a dissatisfied customer complains, and a satisfied customer randomizes between complaining and keeping silence.*

5. *If* $D = 0$*, the babbling equilibrium where everyone complains emerges as the unique symmetric equilibrium, and the expected profit is the same as (5).*

Proof. *see the Appendix.* ■

It is noteworthy that the probability to complain, σ_C, in Part 2 of this proposition has the natural correspondence as the complaint/dissatisfaction ratio in the business. The higher the complaining barrier, the lower this ratio.

A surprising result is that provided with the reactive responsive mechanism, the profit-maximization firm always has the incentive to raise the communication cost to induce the mixed strategy equilibrium described in Part 2 of Proposition 3. This result is stated formally in the following proposition.

Proposition 4 *Given the reactive decision rule, the profit-maximization firm will set the communication cost at* D_R^* *to induce the partially revealing equilibrium, in which a dissatisfied customer randomizes between complaining and keeping silence. In which*

$$D_R^* = \min\{1-\omega, \frac{pq}{(1-p)(1-q)+pq}\frac{(1-q)\left[(1-p)(1-q)^2+pq^2-q^2\right]F}{\left[(1-p)(1-q)^2+pq^2\right]F-2pq^2V}\} \tag{9}$$

Proof. *see the Appendix.* ■

Under the mechanism R, the firm in effect commits to invest upon events BB, BG and GB. But in the latter two events, the investment is inefficient in that firm's belief concerning the true state remains the same. Therefore, the firm would increase the complaining barrier to reduce the probability of inefficient investment. Though under this mixed-strategy equilibrium the firm might sometimes miss the real bad event BB which necessitates a corrective action, this loss is compensated by lower wasteful investment in events BG and BG (type II error). This could explain the well-established empirical fact in marketing research that many dissatisfied clients never complain to companies (TARP 1986, Kotler et al 1999). Our explanation is that the observed low complaining tendency among dissatisfied consumers, and the stubborn complaint management policy like that in Ryanair, could be the firm's deliberate choice.

In summary, there are two perfect Bayesian equilibrium. One is that the firm chooses the reactive responsive mechanism, and dissatisfied customers play a mixed strategy. Alternatively, the firm chooses the passive responsive mechanism, and the fully-revealing equilibrium among customers emerges. Though the firm's optimality can only be attained in the latter one, the former is more stable in the sense that the game between customers admits a unique symmetric equilibrium. Thus, if a firm has pessimistic perception about the coordination between customers, i.e., fears of losing customer base, it is quite reasonable that she adopts the reactive mechanism. A firm has to weigh the risk of losing customer base against the cost to incur inefficient corrective actions. Moreover, the mechanism R could provide a more plausible description of the observed low complaint/dissatisfaction ratio, hence it is more likely to capture the management policy at work.

Figure 2 illustrates this comparison. For the sake of simplicity, we just draw the pure strategy equilibrium under the mechanism P as the dash line.[19] We could see that the pooling equilibrium (2) and the babbling equilibrium (5) generate much lower profits, while the Pareto-optimal outcome is better than the best outcome attainable in the mechanism R.[20] In contrast, the mechanism R always has a unique equilibrium. In practice, directly exit is still rare as the initial response among dissatisfied customers,[21] it again might suggest that the mechanism R is in wide use in the real world.

[Insert Figure 2 here]

Outside options might be another reason justifying the use of the mechanism R. If the outside option is relatively high, there are equilibria in which dissatisfied customers are very likely to quit. Thus, the firm may be inclined to overreact and set higher complaining barriers. This suggests that the difference in the low-cost airlines market structure between Europe and North America[22] might contribute to the different complaint handling policies of Ryanair and Southwest.

[19] The profit under the mixed-strategy equilibrium, by definition, will lie within the region prescribed by pure strategy equilibria.

[20] By comparing (4) and (8), it is straightforward to show that when customers' expectations become high and signals become more precise, i.e., $p \to 0$ and $q \to 1$, the profit difference between these two outcomes vanishes.

[21] Voorhees et al (2006) found that among those consumers who did not complain, only 6.12% explicitly mention brand switching as his action as the response to dissatisfaction.

[22] There are only nine low-cost airlines in USA market (http://www.discountairfares.com/lcostusa.htm). On the other

To gain more impression on the relative performance of these two mechanisms, we construct the following numerical example:

Example 1 *Let $p = 0.5, q = 0.8, V = 1, F = 1.1, \omega \leq 0.5$. It's easy to check that these parameters satisfy condition 1 and 2. Then, under the mechanism R, the optimal communication cost is set at $D_R^* = 0.198$, the complaint/dissatisfaction ratio would be $\sigma_C^* = 0.94$, and the profit is $\pi_R^* = 1.235$. The possible scenarios under the mechanism P is more complicate, and we address only the best equilibrium and the worst equilibrium. The best equilibrium is the informative separating equilibrium where dissatisfied customers always complain, which requires $D \in [0.16, 0.64]$ and generates a slightly higher profit $\pi_P^* = 1.266$.(2.5% higher than π_R^*)*
In the worst equilibrium, a dissatisfied customer randomizes among all actions. Within the exactly same communication cost interval $D \in [0.16, 0.64]$, if $\omega < 0.2$, then no exit occurs, but the dissatisfied one complains with $\sigma_C \in [0.25, 1]$. If $\omega \in [0.2, 0.5]$, then exit is possible, and in equilibrium $\sigma_C \in [0.25, 1]$, while $\sigma_E \in [0, 0.43]$. Obviously, the profit loss for the firm is substantive under this worst equilibrium.

5 Implications

In this section we first undertake the comparative statics to derive the testable predictions about the complaint management policy in practice, then we address the social welfare issue. Finally, we discuss the plausibility of our assumptions.

5.1 Testable Predictions

Our model assumes a corrective action as a public good, treats dissatisfaction as a unverifiable variable, and concentrates on the case of two customers. Therefore, it could not accommodate some other features of complaint management, including private compensation for the customer's loss. However, this model still could make some testable predictions about the complaint management policy. Our model suggests that the observed difference of customer complaint management policy is driven by the multiplicity of equilibria. If we interpret customers' expectations p as a firm-specific characteristic,

hand, over 100 low-fare airlines operate across Europe continent (http://www.attitudetravel.com/lowcostairlines/europe/), and Ryanair faces the challenges from the leading competitors such as Easyjet and Vueling. It may not be coincidence that it is also difficult to find out how to complain on both Easyjet and Vueling website.

e.g., firm's reputation of delivering high quality product/service, and the precision of signals q as an industry-specific characteristic, e.g., the variation in quality, and the outside option ω as an indicator of market competition, then we can shed lights on the choice of complaint handling procedures in the real world.

Though carrying out comparative statics is risky when there are multiple equilibria, we still could address some cases where one mechanism is more plausible to be chosen, e.g., the limit case of parameters.

5.1.1 Standardized product industry

q, the precision of signals, is usually higher (resp, lower) in standardized product industries (resp, service industries). Therefore, we could examine the limit case that $q \to 1$ to account for standardized products. In this situation, the merits of the reactive responsive mechanism almost disappear. However, the drawbacks of the passive responsive mechanism vanish. Therefore, the mechanism P is favored by the firms.

On the one hand, the communication cost interval to have a fully-revealing equilibrium under the mechanism P, (**??**), expands to $(0, 1)$. On the other hand, under the mechanism R, the interval for the existence of a fully-revealing equilibrium would disappear, and the mixed-strategy equilibrium could occur for any $D \in (0, 1)$. That's because in the first period, a client observing his private signal is almost sure about the true state, as well as the other's signal, the probability weight attached to the events of BG and GB thus vanishes. Because under the mechanism R there is strategic substitution among customers, in the unique symmetric Nash equilibrium a dissatisfied customer would still randomize between complain and keep silence. Under the mechanism P, however, there is strategic complementarity among customers. If ω is not too large, as the literature in global games[23] suggests, precise signals lead to vanishing strategic uncertainties, consequently facilitate coordination among dissatisfied customers. Hence, within standardized products industries, if the competition is not too severe, firms would like to choose the passive responsive mechanism. Hence, a testable prediction is that in the industries of standardized products, if a firm also has some extent of monopoly power (lower outside option), the complaining barrier would be lower, and the complaint/dissatisfaction ratio would be higher.

[23] See Carlsson and van Damme (1993) and Morris and Shin (2003) for references.

5.1.2 Customer expectations

Because D_R^* in (9) might lie in the interval of D that also admits the fully revealing equilibrium under the mechanism P, it is difficult to infer the mechanism choice by only observing the magnitude of complaining barriers. However, taking derivatives of D with respect to p reveals that the optimal D under two mechanisms would move to different directions as a response to the changes in customer expectations.

First, observe that D_R^* is decreasing as long as customer expectations decline. When a firm is more vulnerable to the loss of customer base, information from clients becomes more valuable. However, under the mechanism P, as (**??**) shows, the lower and upper bounds of D to guarantee the existence of truthful equilibrium, decrease by different speeds whenever customer expectations raise, and coincide when $p \to 0$ (thus the fully-revealing equilibrium disappears). This suggests that, other things being equal, the complaining barrier among those firms with high customers expectations might be clustered on two extremes. Some firms may be trapped into the partially revealing equilibrium under the reactive responsive mechanism, while the others may successfully induce customers coordination, and obtain the fully-revealing equilibrium with the high complaint/dissatisfaction ratio and the low complaining barrier.

The contrast between Ryanair and Southwest in handling customers complaints exemplifies the predicted divergence. Among all low fair airlines in Europe, Ryanair has the reputation of on-time delivery due to her deliberate selection of destination airports. Southwest also enjoy the reputation of on-time delivery and high satisfaction among customers in North America market. However, Ryanair sets very a high complaining barrier while Southwest is keen to the voices of clients.

5.2 Social welfare

Though we have demonstrated that undertaking a corrective action only in signal event BB attains the firm's optimality, a welfare-maximization regulator may have a different view. The distinction comes from two sources: first, since a firm could not entirely exploit the surplus, customers and firms may have different valuation about values of customer base; second, firms fail to internalize the complaining expenditure she imposes on the customers, so this communication cost is a socially pure waste. Since the informative separating equilibrium is more socially desirable, the maximum social welfare under the mechanism P is:

$$W_P' = 2\left[1 - p\left(1 - q^2\right)\right] - \left[(1-p)(1-q)^2 + pq^2\right] F - 2\left[q(1-q) + (1-p)(1-q)^2 + pq^2\right] D_P'$$

where $D_P' = \frac{pq(1-q)}{(1-p)q+p(1-q)}$ is the minimal communication cost to implement the fully-revealing equilibrium.

On the other hand, the maximum welfare under the mechanism R is:

$$\begin{aligned} W_R' &= 2\left[1 - p(1-q)^2\right] - \left[1 - p(1-q)^2 - (1-p)q^2\right] F \\ &\quad -2\left[q(1-q) + (1-p)(1-q)^2 + pq^2\right] D_R' \end{aligned}$$

$D_R' = \frac{1-q}{\frac{1-p}{p}\frac{q}{1-q}+1}$ has the similar interpretation as D_P'.

In both W_P' and W_R', the first term is the customers' expected payoff, the second term represents the firm's expected investment, and the third term measures the customers' expected spending on complaining. We ignore the firm's profit since we think the value of customer would not disappear if customers quit from a specific firm. Instead, it just transfers to another firm.[24] Moreover, most debates about the consumer policy focus on consumer welfare and ignore firms' profits.

We compare the welfare under these two mechanisms and find out that the welfare ranking actually depends on customer expectations p.

Proposition 5 *There exists a threshold value of expectations p^* such that the welfare-maximization regulator should assign the mechanism R to the firm with $p > p^*$, and the mechanism P to the firm with $p \leq p^*$.*

Proof. *The difference in welfare could be written as the following:*

$$\triangle W = W_R' - W_P' = 2q(1-q)(2p-F) - 2\left[q(1-q) + (1-p)(1-q)^2 + pq^2\right]\left(D_R' - D_P'\right) \tag{10}$$

Since $q > \frac{1}{2}$, $D_R' - D_P' = \frac{p(1-q)(1-2q)}{p(1-q)+(1-p)q} < 0$ always holds. Thus, the second term of $\triangle W$ is always negative. As $p \to 0$, $\triangle W \to -2q(1-q)F < 0$, and as $p \to 1$, $\triangle W \to 2q(1-q)(2-F) - 2q(1-2q) > 0$ by deduce Condition 1 to the limit case. Since $\triangle W$ is continuous with respect to p, by the Intermediate Value Theorem, there is a p^* such that $\triangle W(p^*) = 0$. ■

[24] Taking into account the firm's profit, however, won't alter our basic result on welfare comparison.

There are two effects in welfare comparison. The first is the *surplus change effect*. Mechanism R specifies investment in the events BG and GB, which occur with the probability $2q(1-q)$, in addition to the event BB specified under mechanism P. Hence, the first term of (10) captures the expected welfare change due to the changing decision rule. The *complaining barrier reduction effect* is shown in the second term of (10). This is always non-positive since mechanism R could induce the fully-revealing equilibrium with a lower communication cost. When expectations about the quality are low (high p), the first effect would dominate since restoring customers' satisfaction is of priority, even at the expense of unnecessary investment. On the other hand, if customer expectations are quite high (low p), regulator doesn't need to request too frequent responses.[25]

This proposition suggests that from the view of social welfare, the regulation on customer complaint management also should vary across firms. Moreover, there are two instruments available to a regulator: assigning responsive rule and regulating complaining barriers. As Proposition 3 shows, firms won't choose the fully-revealing equilibrium given the mechanism R. Thus, if only the responsive rule is under the oversight of a regulator, the firm with low customer expectations would set an inefficiently high complaining barrier. Therefore, it is appropriate that the regulation intervention aims at reducing complaining barriers. Our analysis also suggests that such regulations are the most important in the context that customers don't have high expectations of the quality.

This sheds light on the practice of legal intervention in complaint handling procedures in Europe. Since 1990s, the legal development on customer complaints in European countries focuses mainly on transferring the burden of proof from complaining customers to the firm. The directive on product liability and safety issued around 1990 required the firm to use accepted means of defense to convince the court, otherwise she will be held liable (de Ruyter and Brack, 1993). This effort could be understood as effectively reducing the complaining cost on the customer side, which in general would enhance the welfare as our model suggests.

5.3 Discussion

In this subsection, we briefly discuss the robustness of our results. In other words, we want to discuss whether our results significantly change if we relax

[25] Our analysis ignores the possible implementation problem of the mechanism P. However, as Section 5.1.2 demonstrates, for the firms with high customer expectations, coordination are more likely to succeed under the mechanism P. Hence, it is also desirable to force firms to implement the passive responsive mechanism for these firms.

some assumptions.

We have assumed that the outside option shrinks from ω in the first period to zero in the second period. A more realistic formulation is setting $\omega' < \omega$ as the available outside option in the period 2. Hence, customers may compare ω' with the expected payoff to being attached. For instance, when the worst event BB occurs and both keep silence, the payoff to a dissatisfied customer would be $\max\{\omega', \underline{u}\}$. If $\omega' < \underline{u}$, this doesn't affect the equilibrium behavior. Otherwise, the action K becomes even more attractive since customers would lose little from waiting for the news and switching then. However, the basic characterization of equilibrium behavior under these two mechanisms won't change much.

It is presumed that a firm would commit to an announced responsive mechanism. This might look unrealistic in that we rarely observe a specified decision rule that automatically triggers a corrective action. If firms could not commit, both mechanisms suffer from the firm's incentives to overrule her promises. On the one hand, under the passive responsive mechanism the firm might not undertake investment if one customer exits, since retaining the remaining customer is not profitable. Then, there exist an additional pure strategy equilibrium in which dissatisfied customers exit for sure. On the other hand, the reactive responsive mechanism is also not self-enforcing, since investment is not the best response when only one customer complains. When the outside option becomes endogenous, the lack of commitment might further induce both firms to be reluctant to undertake corrective actions, since in equilibrium they indeed "exchange" customers: though customers flow from one to the other, the size of customer base for each firm remains.

Some readers may conjecture that the robustness of the reactive responsive mechanism is an artifact of our two-customer specification. In the real world, perhaps no firm would implement a global corrective action upon a single complaint. Thus, the coordination problem among consumers might always emerge. However, for the firm the basic trade-off between losing the customer base and the wasteful investment remains. An optimal decision rule may require a high cutoff level of complaints, which will affect an individual customer's incentive to report private signals. On the other hand, lowering this threshold level increases the customers' willingness to voice, consequently makes exit less appealing and the undesirable equilibrium outcome less likely, on the expense of too frequent corrective action.

We have restricted attentions to the symmetric equilibrium, which allows full implementation under the reactive responsive mechanism. If asymmetric equilibrium is also considered in the reactive responsive mechanism, then there are equilibria where one consumer may never complain, while the other always complains conditional on a bad signal. The firm thus can only extract information from one customer. The inefficient investment occurs only in either the event BG or GB, but not both. The profit thus exceeds that under the fully-revealing equilibrium, but whether it can attain π_R^* (19) depends on the subtlety of environment. There is no clear ranking between the outcomes of the possible asymmetric equilibria and the symmetric equilibrium. This story may apply for the complaint management with asymmetric customers, e.g., some customers are more valuable than the others, but it hardly works in our motivating example of low-cost airlines, in which customer loyalty programme is rarely used.

6 Conclusion

Despite the value of information in hands of customers, why firms in similar industries end up in setting quite different customers feedback (complaints) handling procedures? We use a game-theoretical model in which a firm needs to acquire and use the private information of customers to address this question. Our parsimonious model demonstrates the basic trade-off between customer base retention and unnecessary investment in corrective actions. The observed low complaint/dissatisfaction ratio, as well as the costly complaint, are shown as one equilibrium outcome. We assess the welfare implication and suggest that to restore efficiency, it is possible to use public intervention to lower complaining barriers. We demonstrate that the firm chooses complaining barriers and management policy as a response to customers expectations, the precision of signals, and competition pressures.

Broadly, our model studies the interpretation of statistical results from a sample consisting of strategically self-selected senders. One implication is that the meaning of messages is context-specific and depends on the subtlety about the incentive. For example, when complaining is too easy, like the internet poll or the feedback for the service of online sellers, our model predicts that the information content of these feedback diminishes, since the clients who dislike it most have the strongest incentive to express, and even exaggerate, their feelings.

The exogenous outside option plays an important role in determining the equilibrium outcome under a specific mechanism. The reader might wonder what will happen if the outside option is endogenously determined, e.g., from the perspective of customers, the product/service offered by a competitor might be viewed as the outside option. In the previous working paper version we have investigated the mechanism choice under duopoly competition. We find out that the main results and intuitions in the monopoly case sustains. The reactive responsive mechanism still emerges as the firm's choice under competition.

In practice, the customer may voice out his feeling through choices from multiple categories, like Very dissatisfied, Dissatisfied, Normal, Satisfied, Very satisfied. Allowing a finer partition of the message space to express the feeling would not significantly affect our results. Neither misreport problem nor free-rider problem would be eliminated by a finer partition, and the incentive to exaggerate remains. Kawamura (2011) provides a rationale of binary choice ("Yes" and "No") as a robust communication mode in a multiagent environment.

Most marketing research on complaining behavior highlights the case study. Our model contributes by providing a strategic interaction model to explain some salient features of customer complaints. It will be valuable to examine the predictions of our model with a large dataset. However, this is limited by the availability of reliable data. Though there are many attempts to measure the customers' satisfaction across countries, industries and firms, the measure about complaint resolve to a large extent is still in absence.

In the real world, complaints coexist with compliments, and a non-negligible part of customer feedback is praises. In our model, introducing compliment will not change the outcome, since it is predicted that a rational customer would never praise. In the real world, compliments might be possible due to at least two reasons. First, from the standpoint of consumers, the reciprocity concern may motivate customers to praise. Second, from the perspective of firms, in the context of sequential purchasing, she may strategically induce compliments from early buyers to influence later customers. In a word, the firm may have the incentive to manipulate the word-of-mouth among clients, especially in the internet community (Dellarocas, 2006). This interesting direction awaits for future research.

A Collection of Proofs

A.1 Proof of Proposition 1

First, since the firm is unresponsive to customers' actions, complaining is strictly dominated by keeping silence for any positive communication cost D, regardless of signals.

With Condition 2, we have that a satisfied customer attaches and keeps silence. Then, we turn to the dissatisfied customer, though he doesn't observe the event, he is sure that the other customer, if gets a good signal, would do nothing. Thus, if he chooses to exit, his payoff is a certain amount ω. If he decides to keep silence, then in the event BB he expects to get $\underline{u}$, and his payoff is u if the event GB occurs. His expected payoff from action K thus is

$$\gamma_{BB}\underline{u} + \gamma_{GB}u = \tfrac{(1-p)(1-q)}{(1-p)(1-q)+pq}$$

His best response to his own signal thus relies on the attractiveness of the outside option. A dissatisfied customer keeps silence if $\omega \leq \frac{(1-p)(1-q)}{(1-p)(1-q)+pq}$, and exits if $\omega \geq \frac{(1-p)(1-q)}{(1-p)(1-q)+pq}$.

A.2 Proof of Proposition 2

A.2.1 *Case I.* $\frac{(1-p)(1-q)}{(1-p)(1-q)+pq} > \omega$

This arises when the outside option is too low to attract dissatisfied customers even if the firm won't undertake investment, namely $\gamma_{BB}\underline{u}+\gamma_{GB}u > \omega$, then E is strictly dominated by K.

If sincerely reporting signals is an equilibrium, it has to be the mutual best response for each customer. Hence, we need $\gamma_{BG}u+\gamma_{GG}\overline{u} \geq \gamma_{BG}+\gamma_{GG}\overline{u}-D$ and $\gamma_{BB}\underline{u}+\gamma_{GB}u \leq \gamma_{BB}+\gamma_{GB}u-D$ as incentive compatibility constraints of the satisfied and dissatisfied customer, respectively. Namely, we must have

$$\frac{pq\,(1-q)}{(1-p)\,q+p\,(1-q)} \leq D \leq \frac{pq^2}{(1-p)\,(1-q)+pq}$$

Moreover, we also need the participation constraint holds after observing private signals. By Condition 2.1, $\omega \leq u$, thus exit is a strictly dominated strategy for satisfied customers. For dissatisfied customers, participation constraint requires that $\gamma_{BB} + \gamma_{GB}u - D \geq \omega$, which is equivalent to $\frac{(1-p)(1-q)}{(1-p)(1-q)+pq} > \omega$. The expected profit hence is (4). Since in the equilibrium the firm would invest only if two customers truthfully complain about the bad signal, her optimality is attained.

Then, if the communication cost D is so high that the payoff to K exceeds C, i.e. $\gamma_{BB}\underline{u} + \gamma_{GB}u \geq \gamma_{BB} + \gamma_{GB}u - D$, which turns out to be

$$D \geq \frac{pq^2}{(1-p)\,(1-q)+pq} \tag{11}$$

Then we have the pooling equilibrium KK. The expected profit is the same as (2). In effect, if the other dissatisfied customer always keeps silence, it is also the best response for a customer to keep silence when receiving a bad signal. Therefore, for any communication cost pooling could be one equilibrium.

If the communication cost is not high, in addition to the informative separating equilibrium CK and the pooling equilibrium KK, the babbling equilibrium CC is also an equilibrium whenever $\gamma_{BG}u + \gamma_{GG}\overline{u} \leq 1 - D$, namely the satisfied customer also prefer C to K. The condition turns out to be the follows:

$$D \leq \frac{p\,(1-q)}{(1-p)\,q + p\,(1-q)} \tag{12}$$

In effect, multiple pure strategy equilibria always exist for any communication cost. Besides, there is a mixed-strategy equilibrium which specifies that satisfied customers keep silence and dissatisfied customers complain with the probability σ_C. Since in this equilibrium a dissatisfied customer is indifferent between K and C, we have

$$\gamma_{BB}\,(\sigma_C + (1-\sigma_C)\,\underline{u}) + \gamma_{GB}u - D = \gamma_{BB}\underline{u} + \gamma_{GB}u$$

The left-hand term is the payoff to the action C. For a dissatisfied customer, corrective actions are expected to be undertaken only in the worst event BB and the other customer also complains, which occurs with probability $\gamma_{BB}\sigma_C$. Otherwise, in the event BB the dissatisfied customer gets $\underline{u}$, and in the event GB he gets u. The right-hand term is the payoff to the action K. Thus, we have

$$\sigma_C\,(B) = \frac{(1-p)\,(1-q) + pq}{pq^2}D \tag{13}$$

A.2.2 *Case II.* $\frac{(1-p)(1-q)}{(1-p)(1-q)+pq} \leq \omega$

Here the point is that the participation constraint fails in the first period, like Part 2 of Proposition 1. When a customer learns the private signal, he could review the outside opportunity. Note that by Condition 2.2 and 2.3, $\omega \leq \min\{u, 1-D\}$, so $D \leq \frac{1}{1+\frac{1-p}{p}\frac{1-q}{q}}$ should always hold.

First, we note that the babbling equilibrium CC still exists as long as (12) holds.

Second, if (12) is violated, a satisfied customer still keeps silence. Thus, we turn to dissatisfied customers. Intuitively, if the communication cost is high, or the updated belief about the true state is pessimistic, then a dissatisfied customer may prefer exit to complain. The mixed-strategy equilibrium in which he randomizes between exit and silence thus becomes the unique equilibrium. This situation happens if (11) still holds. To calculate the probability, we need

$$\gamma_{BB}\left(\sigma_E + \left(1-\sigma_E\right)\underline{u}\right) + \gamma_{GB} u = \omega$$

In the worst event BB, a corrective action is expected only if the other is also dissatisfied and quit. Hence, in this mixed-strategy equilibrium we will have $\sigma = \left(0, 1-\sigma_E, \sigma_E\right)$, where the exit probability is

$$\sigma_E = \frac{\omega\left[\left(1-p\right)\left(1-q\right) + pq\right] - \left(1-p\right)\left(1-q\right)}{pq^2} \tag{14}$$

Third, if (11) also fails, then the situation becomes more complicate. The informative separating strategy (CK) exists if $\gamma_{BB} + \gamma_{GB} u - D \geq \omega$ also holds, which means:

$$\frac{p\left(1-q\right)}{\left(1-p\right)q + p\left(1-q\right)} \leq D \leq \frac{\left(1-p\right)\left(1-q\right) + pq^2}{\left(1-p\right)\left(1-q\right) + pq} - \omega$$

However, this pure strategy equilibrium fails to be the unique one, and there exists another mixed-strategy equilibrium which is particularly bad for the firm: a dissatisfied customer completely randomizes over E, K, C if $\frac{p(1-q)}{(1-p)q+p(1-q)} \leq D \leq \frac{pq^2}{(1-p)(1-q)+pq}$. Tedious calculation shows that the equilibrium strategy thus is $\sigma^*\left(B\right) = \left(\sigma_C, \sigma_K, \sigma_E\right)$, where

$$\sigma_E = \frac{\omega\left[\left(1-p\right)\left(1-q\right) + pq\right] - \left(1-p\right)\left(1-q\right)}{pq^2} \tag{15}$$

$$\sigma_K = \frac{\left(1-p\right)\left(1-q\right) + pq^2 - \left(D+\omega\right)\left[\left(1-p\right)\left(1-q\right) + pq\right]}{pq^2} \tag{16}$$

Comparative statics regarding (14) and (15) show that whenever E is a part of mixed-strategy equilibrium, as ω becomes more appealing, dissatisfied customers are more likely to choose E.

A.3 Proof of Lemma 1

The informative separating strategy CK is an equilibrium strategy profile if the incentive compatibility constraint for a satisfied customer $\gamma_{BG} + \gamma_{GG}\overline{u} \geq 1 - D$ and that for a dissatisfied customer $\gamma_{BB} + \gamma_{GB}u \leq 1 - D$ are satisfied, which implies (6). The uniqueness is straightforward.

On the other hand, if the second inequality of (6) holds, then complaining becomes the dominated strategy for a dissatisfied customer since it induces corrective actions for sure. If the first inequality of (6) maintains, then a satisfied customer doesn't bother to exaggerate the problem. Thus, there exists a separating equilibrium of CK.

A.4 Proof of Proposition 3

When the incentive compatibility constraint for a dissatisfied customer to sincerely report, namely the second inequality of (6), fails, then though a satisfied customer still keeps silence, a dissatisfied one will randomize between action K and C. Hence, the equilibrium strategy is the mixed strategy that assigns positive probability on action profile KK and CK. The probability to complain whenever having a bad signal is calculated by equalizing the payoff to complain and that to keep silence:

$$\gamma_{BB}\left(\sigma_C + \left(1 - \sigma_C\right)\underline{u}\right) + \gamma_{GB}u = 1 - D$$

The left hand is the payoff to keep silence and believe in that the other customer, conditional on getting a bad signal, complain with the probability σ_C. The right hand is the sure payoff to complain. Thus, we have $\sigma_C = \frac{(1-D)[(1-p)(1-q)+pq]-(1-p)(1-q)}{pq^2}$. This implies a *partially revealing equilibrium.*

The event GG occurs with the probability $(1-p)\,q^2 + p\,(1-q)^2$, where no customer complains. On the other hand, in the event BB complaint occurs with the probability $1 - (1-\sigma_C)^2 = \sigma_C\,(2-\sigma_C)$, and in GB (or BG) it happens with the probability σ_C. The complaining rate thus is the weighted sum of these two events $\left[(1-p)\,(1-q)^2 + pq^2\right]\sigma_C\,(2-\sigma_C) + 2q\,(1-q)\,\sigma_C$.

Since the firm would invest based on a single complaint, the only possibility that both customers quit is that the true state is bad, but no customer complains, which happens with the probability

$$p\left[(1-q)^2 + q^2\,(1-\sigma_C)^2 + 2q\,(1-q)\,(1-\sigma_C)\right] = p\,(1-q\sigma_C)^2$$

The expected profit thus is

$$\pi_R^{PR} = [1 - p\,(1 - q\sigma_C)^2]2V - \{\left[(1-p)\,(1-q)^2 + pq^2\right]\sigma_C\,(2-\sigma_C) + 2q\,(1-q)\,\sigma_C\}F$$

Hence, we get Part 2 of this proposition.

In another extreme situation, if $\gamma_{BB}\underline{u} + \gamma_{1B}u \geq 1 - D$ holds, K will be the dominant strategy for a dissatisfied customer. Tedious algebra shows that this implies $D \geq \frac{pq}{(1-p)(1-q)+pq}$, where both customers keep silence. Thus, we get Part 1 of this proposition. We return to the pooling equilibrium in the benchmark case presented in Proposition 1, the expected profit thus is the same as (2).

Moreover, if the incentive compatibility condition for a satisfied customer to keep silence fails, namely the communication cost is so small that the first inequality of (6) fails. Then, the unique symmetric equilibrium is that a dissatisfied always complains, and a satisfied customer randomizes between C and K. The firm would be misled by complaints and incur inefficiently high expenditure on frequent corrective actions. We have Part 4 of this proposition. The expected profit thus is lower than that under the fully-revealing equilibrium.

A.5 Proof of Proposition 4

First, we need to show that the partially revealing equilibrium can induce the highest profit. Therefore, take derivative of (8) with respect to D, we need $\left.\frac{\partial \pi_R^{PR}}{\partial D}\right|_{D=\frac{1-q}{\frac{1-p}{p}\frac{1-q}{q}+1}} > 0$, which implies that increasing D above the threshold level between the fully-revealing equilibrium and the mixed-strategy equilibrium strictly raises profit. Note that $\frac{\partial \pi_R^{PR}}{\partial D} = \frac{\partial \pi_R^{PR}}{\partial \sigma_C}\frac{\partial \sigma_C}{\partial D}$, since $\frac{\partial \sigma_C}{\partial D} < 0$, $\frac{\partial \pi_R^{PR}}{\partial D} > 0$ if and only if $\frac{\partial \pi_R^{PR}}{\partial \sigma_C} < 0$. Because $\sigma_C \to 1$ whenever $D \to \frac{1-q}{\frac{1-p}{p}\frac{1-q}{q}+1}$, $\frac{\partial \pi_R^{PR}}{\partial \sigma_C}|_{\sigma_C=1} < 0 \Leftrightarrow 2pV < F$, which is exactly the statement in Condition 1.

Then we could derive the optimal level of communication cost D^* which maximizes the firm's profit. The firm's objective could be described as maximizing (8), subject to the constraint derived from Condition 2: $\sigma_C \geq \frac{\omega[(1-p)(1-q)+pq]-(1-p)(1-q)}{pq^2}$. We have

$$D_R^* = \min\{1-\omega, \frac{pq}{(1-p)\,(1-q)+pq}\frac{(1-q)\left[(1-p)\,(1-q)^2 + pq^2 - q^2\right]F}{\left[(1-p)\,(1-q)^2 + pq^2\right]F - 2pq^2V}\} \tag{17}$$

Consequently, the equilibrium complaint/dissatisfaction ratio is

$$\sigma_C^* = \min\left\{\begin{array}{c}\frac{\left[(1-p)(1-q)^2+pq^2+q(1-q)\right]F-2pqV}{\left[(1-p)(1-q)^2+pq^2\right]F-2pq^2V}, \\ \frac{\omega[(1-p)(1-q)+pq]-(1-p)(1-q)}{pq^2}\end{array}\right\} \tag{18}$$

and the profit is

$$\pi_R^* = [1-p\,(1-q\sigma_C^*)^2]2V - \left\{\left[(1-p)\,(1-q)^2 + pq^2\right]\sigma_C^*\,(2-\sigma_C^*) + 2q\,(1-q)\,\sigma_C^*\right\}F \tag{19}$$

References

[1] Ambrus, Attila and Georgey Egorov (2012) Delegation and Nonmonetary Incentives, Working Paper, Duke University.

[2] Andreason, Alan R (1977) A Taxonomy of Consumer Satisfaction/Dissatisfaction Measures, *Journal of Consumer Affairs*, 11, 11-24.

[3] Barlow, Janelle. and Claus Moller (2008) *A Complaint is a Gift: Recovering Customer Loyalty When Things Go Wrong*, San Francisco, CA: Barrett-Koehler Publishers.

[4] Bearden, William O. and Jesse E, Teel. (1983) Selected Determinants of Consumer Satisfaction and Complaint Reports, *Journal of Marketing Research*, 20, 21-28.

[5] Best, Arthur. and Alan R. Andreasen (1977) Consumer Response to Unsatisfactory Purchases: A Survey of Perceiving Defects, Voicing Complaints, and Obtaining Redress, *Law and Society Review*, 11, 701-742.

[6] Bougie, R.; R. Pieters. and M. Zeelenberg (2003) Angry Customers don't Come Back: They Get Back: The Experience and Behavioral Implications of Anger and Dissatisfaction in Services, *Journal of the Academy of Marketing Science*, 31, 377-393.

[7] Carlsson, Hans. and Eric van Damme (1993) Global Games and Equilibrium Selection, *Econometrica*, 61, 989-1018.

[8] Crask, Melvin.; Richard J. Fox. and Roy G. Stout (1995) *Marketing Research: Principles and Applications*, Englewood Cliffs, NJ: Prentice Hall.

[9] Crawford, Vincent. and Joel Sobel (1982) Strategic Information Transmission, *Econometrica*, 50, 1431-1451.

[10] de Ruyter, Ko. and Antoni Brack (1993) European Legal Developments in Product Safety and Liability: The Role of Customer Complaint Management as a Defensive Marketing tool, *International Journal of Research in Marketing*, 10, 153-164.

[11] Dellarocas, Chrysanthos (2006) Strategic Manipulation of Internet Opinion Forums: Implications for Consumers and Firms, *Management Science*, 52, 1577-1593.

[12] Doerpinghaus, Helen I. (1991) An Analysis of Complaint Data in the Automobile Insurance Industry, *Journal of Risk and Insurance*, 58, 120-127.

[13] Farrell Joseph. and Paul Klemperer (2007) Coordination and Lock-in: Competition with Switching Costs and Network Effects, in M. Armstrong and R. Porter (ed). *Handbook of Industrial Organization*, Vol. 3, North-Holland, 1967-2072.

[14] Fornell, Claes (2007) *The Satisfied Customer: Winners and Losers in the Battle for Buyer Preference*, New York, NY: Palgrave-McMillan.

[15] Fornell, Claes. and Birger Wernerfelt (1987) Defensive Marketing Strategy by Customer Complaint Management, *Journal of Marketing Research*, 34, 337-346.

[16] ——— (1988) A Model for Customer Complaint Management, *Marketing Science*, 7, 287-298.

[17] Halstead, Diane.; Edward A. Morash and John Ozment (1996) Comparing Objective Service Failures and Subjective Complaints: An Investigation of Domino and Halo Effects, *Journal of Business Research*, 36, 107-115.

[18] Harsanyi, J. C. and Reinhard Selten (1988) *A General Theory of Equilibrium Selection in Games*, Cambridge, MA: MIT Press.

[19] Hirschman, Albert O (1970) *Exit, Voice, and Loyalty: Responses to decline in firms, organizations and states*, Cambridge, MA: Harvard University Press.

[20] Huppertz, John W (2007) Firms' Complaint Handling Policies and Consumer Complaint Voicing, *Journal of Consumer Marketing*, 24, 428-437.

[21] Kartik, Navin.; Marco Ottaviani and Francesco Squintani (2007) Credulity, Lies, and Costly Talk, *Journal of Economic Theory*, 134, 93-116.

[22] Kawamura, Kohei (2011) A Model of Public Consultation: Why is Binary Communication So Common? *Economic Journal*, 121, 819-842.

[23] Klemperer, Paul (1995) Competition when Consumers have Switching Costs: An Overview with Applications to Industrial Organization, Macroeconomics, and International Trade, *Review of Economic Studies*, 62, 515-539.

[24] Kotler, Philip.; Gary Armstrong.; John Saunders. and Veronica Wong (1999) *Principles of Marketing*, London, UK: Prentice Hall Europe.

[25] Morgan, John. and Phillip C. Stocken (2007) Information Aggregation in Polls, *American Economic Review*, 98, 864-869.

[26] Morris, Stephen. and Hyun Song Shin (2003) Global Games: Theory and Applications, in *Advances in Economics and Econometrics (Proceedings of the Eighth World Congress of the Econometric Society)*, edited by M. Dewatripont, L. Hansen and S. Turnovsky; Cambridge University Press.

[27] Prendergast, Canice (2002) Consumers and Agency Problems, *Economic Journal*, 112, C34-C51.

[28] Richins, Marsha. and Bronislaw J. Verhage. (1985) Cross-Cultural Differences in Consumer Attitudes and their Implications for Complaint Management, *International Journal of Research in Marketing*, 2, 197-206.

[29] Singh, J (1988) Consumer Complaint Intentions and Behaviors: Definitional and Taxonomical Issues, *Journal of Marketing*, 52, 93-107.

[30] Snellman, K. and T. Vihtkari (2003) Customer Complaining Behavior in Technology-based Service Encounters, *International Journal of Service Industry Management*, 14, 217-231.

[31] TARP (Technical Assistance Research Program) (1979) Consumer Complaint Handling in America: An Update Study, Washington, DC: White House Office of Consumer Affairs.

[32] ——— (1986) *TARP's Approach to Customer Driven Quality: Moving from Measuring to Managing Customer Satisfaction*, Washington DC: White House Office of Consumer Affairs.

[33] Voorhees, Clay M.; Michael K. Brady. and David M. Horowitz (2006) A Voice from the Silent Masses: An Exploratory and Comparative Analysis of Noncomplainers, *Journal of the Academy of Marketing Science*, 34, 514-527.

Figure 1. Time structure of the game

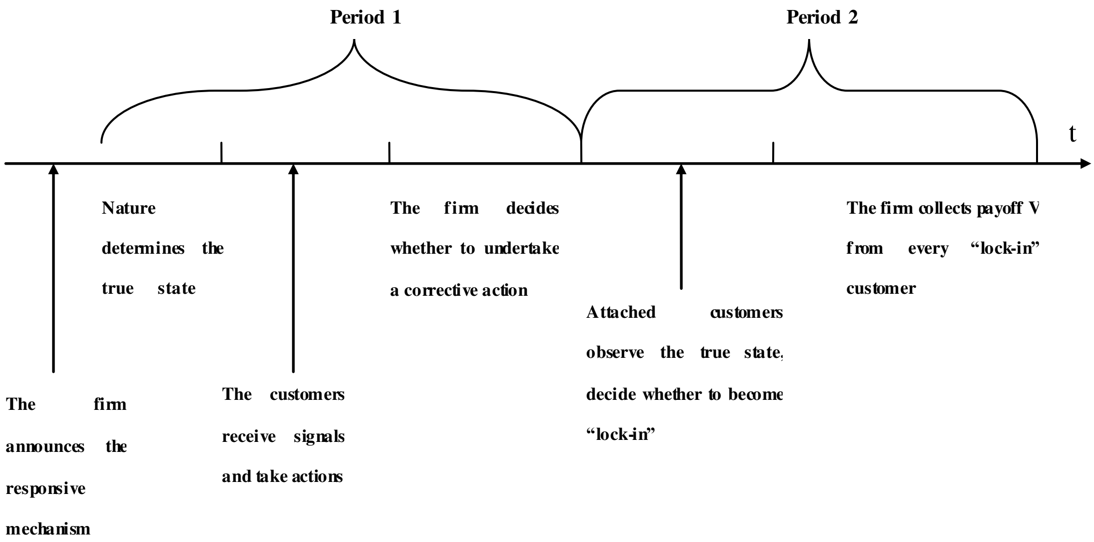

Figure 2 The comparison of profits between two mechanisms