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Liability and reputation in credence goods markets

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HIGHLIGHTS

- We study the impact of liability on a credence-good seller's incentives to maintain a good reputation.
- Credence-good markets are characterized by information asymmetry about the value of sellers' services to consumers.
- Liability refers to the legal environment in which the seller is liable for fixing consumers' problems after charging them the price for his treatment.
- When the seller is short-lived, liability mitigates information asymmetry and facilitates trade.
- Nevertheless, liability may undermine a long-lived seller's incentive to maintain a good reputation and reduces market efficiency.

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ABSTRACT

This paper studies the impact of liability on a credence-good seller's incentives to maintain a good reputation. Credence-good markets are characterized by information asymmetry about the value of sellers' services to consumers who must rely on sellers for diagnosis and treatment provision. Liability refers to the legal environment in which the seller is liable for fixing consumers' problems after charging them the price for his treatment. When the seller is short-lived, liability mitigates information asymmetry and facilitates trade. Nevertheless, liability may undermine a long-lived seller's incentive to maintain a good reputation and reduces market efficiency.

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1. Introduction

We investigate the impact of liability on credence-good sellers' incentives to maintain a good reputation. In markets for credence goods, sellers diagnose consumers' problems and also provide treatment. Examples include health care, consulting and various repair services. The information asymmetry about the value of sellers' services exposes consumers to the risk of seller fraud which is widely documented in various markets.[1] The existing literature (see Dulleck and Kerschbamer, 2006 for a comprehensive review) has shown that when sellers are liable for solving consumers' problems (Liability), trade takes place in the static setting.[2] Although Liability mitigates information asymmetry and facilitates trade in the one-shot game, it is unclear how it affects sellers' incentives to maintain a good reputation in a setting of infinitely repeated game.[3]

We study the role of Liability in a credence-good market in a repeated game. Contrary to the conventional wisdom, we find a seller may have the strongest incentive to provide the appropriate treatment and implement the first best outcome when there is no Liability. This suggests that legal protections for consumers

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1 "Patients give horror stories as cancer doctor gets in prison", CNN, July 11, 2015. Auto repair scam is consistently listed as the number one of the top consumer complaints in the U.S. according to "Nation's Top Ten Consumer Complaints", Consumer Federation of America.
Balafoutas et al. (2013) and Liu et al. (2017) find evidence of seller fraud in taxi ride markets.

2 Pitchik and Schotter (1987), Wolinsky (1993), Fong (2005), Liu (2011), Fong et al. (2014) and Taylor (1995) .

3 Dulleck et al. (2011) investigated the impact of reputation on expert fraud with and without Liability in a lab experiment. In their experiment, the game is repeated finitely many times and consumers learn from their own experience. We study infinitely repeated game and allow a consumer to learn from others' experiences.

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in credence-good markets may undermine experts' incentives to maintain a good reputation, hence reducing the efficiency of the market.

The most closely related paper is Chen et al. (2017). Chen, et al. study optimal liability policy in a one-shot game. In their model, the expert needs to perform a costly and unobservable diagnosis to become informed. So, the optimal liability policy must solve both the adverse selection and the moral hazard problems. Our paper complements Chen, et al. in that we focus on the impact of Liability on the expert's incentives to maintain a good reputation in a repeated game and we do not consider the moral hazard problem. Also in a one-shot game, but with a different focus, Fong et al. (2014) compare the market outcomes under the liability and verifiability assumptions.

In a dynamic setting, Fong et al. (2017) studies credence-good sellers' trust building mechanism in monopoly and competitive markets. They assume throughout that the expert is liable for the treatment outcome and consider the case in which it is efficient to repair the serious problem but inefficient to repair the minor problem. By contrast, our study compares the legal environments with and without liability, and we consider the case when it is efficient to repair both the minor and serious problems.

2. Model

A risk neutral, long-lived expert interacts with an infinite sequence of risk neutral, short-lived consumers. Each period one consumer arrives with a problem which is either serious (s) or minor (m). Denote by l_i, $i = m, s$, the loss from problem i and assume $0 < l_m < l_s$. It is common knowledge that the problem is serious with probability $\alpha \in (0, 1)$. The consumer does not know the nature of the problem and consults the expert who can perfectly diagnose the consumer's problem at zero cost. The expert can fully prevent the loss l_i after incurring a treatment cost r_i, $i = m, s$, with $r_m < r_s$. We assume $r_i \leq l_i$, $\forall i$. So, it is efficient to fix both types of problems. Furthermore, we assume $E(l) \equiv \alpha l_s + (1-\alpha) l_m < r_s$,[4] which imposes an upper bound $\overline{\alpha} \equiv \frac{r_s - l_m}{l_s - l_m}$ on α.

A consumer maximizes her expected payoff. She receives utility $u = -l_i$, $i = m, s$, if problem i is left untreated and $u = -p$ if her problem is fixed at price p. Denote by $\delta \in (0, 1]$ the expert's discount factor. The expert maximizes the discounted expected life-time profit.

We summarize our model by describing the timeline of events. At the beginning of each period $t = 1, 2, \ldots$, the expert posts a price list (p_{mt}, p_{st}), with $p_{mt} \leq p_{st}$, where p_{it}, $i = m, s$, is the quoted price for fixing problem i. Then, nature draws the loss of the consumer's problem. The consumer observes the price list and decides whether to consult the expert. If the consumer consults the expert, the expert perfectly diagnoses her problem. Then, the expert either proposes to fix the problem at one of the quoted prices or refuses to treat the consumer. Upon a treatment recommendation, the consumer decides whether or not to accept it.

Denote by $R_t \in \{p_{mt}, p_{st}, N\}$ the recommendation made by the expert, where N denotes refusal to treat the consumer. The expert's recommendation policy is $(\beta_{it}, \rho_{it}) \in [0, 1]^2$, $i = m, s$, where β_{it} is the probability that the expert recommends the expensive treatment (p_{st}) to problem i and ρ_{it} is the probability that the expert refuses to treat problem i. Denote by $\tau_{it} \in \{r_m, r_s\}$ the expert's treatment decision if a consumer accepts his recommendation. Let $a_t \in \{0, 1\}$ denote the consumer's acceptance decision, where 0 indicates rejection and 1 indicates acceptance. Finally, let $\gamma_{it} \in [0, 1]$, $i = m, s$, denote the probability that the consumer accepts price p_{it}. At the end of each period, the prices charged by the expert, his recommendation, the consumer's acceptance decision as well as her utility become public information.[5] Formally, we denote $h_t = \{p_{mt}, p_{st}, R_t, a_t, u_t\}$ as the public events that happen in period t and $h^t = \{h_n\}_{n=1}^{t-1}$ as a public history path at the beginning of the period, with $h^1 = \emptyset$. Let $H^t = \{h^t\}$ be the set of public history paths till time t. A public strategy of the expert is a sequence of functions $\{P_t, \beta_{mt}, \beta_{st}, \rho_{mt}, \rho_{st}, \tau_{it}\}_{t=1}^{\infty}$, where the pricing strategy P_t is a mapping from H^t to $\mathbb{R}_+^2$, and $(\beta_{mt}, \beta_{st}, \rho_{mt}, \rho_{st}, \tau_{it}) : H^t \cup \mathbb{R}_+^2 \cup \{m, s\} \to [0, 1]^5$. A public strategy of the consumer is $(\gamma_{mt}, \gamma_{st}) : H^t \cup R_t \to [0, 1]^2$.

We focus on *Stationary Perfect Public Equilibria* in which strategies are stationary and players use public strategies which constitute a Nash equilibrium following every public history.

3. Equilibrium

To investigate how liability affects the expert's incentives to maintain a good reputation and the implementation of the first-best outcome, we explicitly distinguish the following two legal environments:

Liability: *The expert must fix the consumer's problem if the consumer accepts his treatment recommendation and pays for it.*

No-Liability: *The expert must provide services to the consumer after she pays for the treatment but is not liable for fixing the consumer's problem.*[6]

When the expert is liable for the treatment outcome, he must provide the appropriate treatment for each type of problem. We can think of the expert's payoff being $-\infty$ when he fails to fix a problem he is paid to treat. In contrast, in the No-Liability environment, the expert is not liable to provide the appropriate treatment but needs to at least provide the minor treatment. His flow payoff is simply $p_i - r_j$ when he charges p_i and provides treatment j, irrespective of the actual problem.

3.1. Liability

Stage-Game Equilibrium and the Punishment Path Fong (2005) shows that in the one-shot game, there is a unique subgame perfect Nash equilibrium in which the expert sets $(p_m, p_s) = (l_m, l_s)$. In the recommendation subgame, the expert always truthfully reveals the nature of the problem ($\beta_m = 0, \beta_s = 1$) and never refuses to provide treatment ($\rho_m = \rho_s = 0$). The customer accepts a treatment at price p_m with probability $\gamma_m = 1$, and at price p_s with probability $\gamma_s = (p_m - r_m)/(p_s - r_m) = (l_m - r_m)/(l_s - r_m)$. In equilibrium, the expert earns a profit of

$$\pi_S^L \equiv \alpha\,(l_s - r_s)\,\frac{l_m - r_m}{l_s - r_m} + (1-\alpha)\,(l_m - r_m)\,. \tag{1}$$

Please refer to Proposition 1 in Fong (2005) for detailed discussion of the stage game Nash equilibrium.

We assume that if the punishment phase is triggered in the repeated game, players revert to the stage game Nash equilibrium perpetually.

Repeated game Define $\pi^{FB} := \alpha(l_s - r_s) + (1-\alpha)(l_m - r_m)$ and $\underline{\delta}^L := \frac{r_s - E(l)}{r_s - E(l) + \pi^{FB} - \pi_S^L}$.

[4] The case of $E(l) \geq r_s$ is trivial since there exists an equilibrium in which the expert charges $E(r)$ for both repairs and always fix the problem even in a static model.

[5] This assumption is motivated by the flourishing of websites like Angie's list, Yelp, and RateMDs on which consumers actively post and share reviews on experts' services.

[6] We thank the anonymous referee for the suggestions on the No-Liability legal environment.