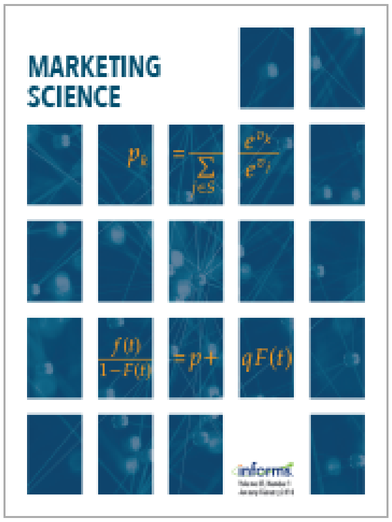

Marketing Science

Publication details, including instructions for authors and subscription information:
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informs
http://pubsonline.informs.org/journal/mksc/

MARKETING SCIENCE
Vol. 38, No. 3, May–June 2019, pp. 500–515
ISSN 0732-2399 (print), ISSN 1526-548X (online)

Why Customer Service Frustrates Consumers: Using a Tiered Organizational Structure to Exploit Hassle Costs

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Received: November 12, 2016
Revised: November 13, 2017; June 15, 2018; November 13, 2018
Accepted: December 5, 2018
Published Online in Articles in Advance: May 16, 2019

https://doi.org/10.1287/mksc.2019.1149

Abstract. Many customer service organizations (CSOs) reflect a tiered, or multilevel, organizational structure, which we argue imposes hassle costs for dissatisfied customers seeking high levels of redress. The tiered structure specifies that first-level CSO agents (e.g., call center operators) be restricted in their payout authority. Only by escalating a claim to a higher level (e.g., a manager), and incurring extra hassles, can a dissatisfied customer obtain more redress from the firm. We argue that the tiered structure helps the firm to control redress costs by (1) screening less severe claims so that such customers do not escalate their claims to a manager and (2) screening illegitimate claims. Our main result is that a firm can be more profitable if it uses a tiered CSO.

History: Ganesh Iyer served as the senior editor and Greg Shaffer served as associate editor for this article.
Funding: This work was supported by the Marketing Science Institute [Grant 4000166] and by a grant to Y. Zhu from the 3M Non-tenured Faculty Grant
Supplemental Material: The online appendix is available at https://doi.org/10.1287/mksc.2019.1149.

Keywords: hassle costs • consumer service organization • customer complaints • organizational structure • sequential search model

> The system is designed to frustrate customers … and United is very good at it.
> — Dave Carroll from *United Breaks Guitars*

1. Introduction

Any time a consumer purchases a product or service, the possibility of dissatisfaction exists. Regardless of the cause for dissatisfaction, the customer may want to contact the seller's customer service organization (CSO) to seek restitution. This organization can take the form of an online chatroom with a customer representative, a call center, or even a traditional service desk within the store. Many of these organizations, such as offshore call centers, are characterized by a *tiered* organizational structure. Call centers that serve Dell, for example, have a set of "Level 1" agents who take the initial call.[1] These agents are trained to provide standardized resolution options to the caller's problem and are limited in their authority to provide redress. If a caller's problem is not satisfactorily resolved, the caller can escalate her claim to a more senior agent, such as a CSO manager, who is authorized to provide larger compensation.

However, for many customers, dealing with a CSO is time consuming and frustrating. It has been reported that a U.S. consumer spends, on average, 13 hours per year in calling queues (Tuttle 2013), and de Véricourt and Zhou (2006) indicate that callers typically call multiple times about a single issue before they are either satisfied or give up.[2] The time and effort expended in this process mean that unsatisfied customers must incur *hassle costs* to claim redress. The hassle cost associated with the complaint process often leads to frustration, which is revealed in many measures of customer satisfaction.[3] Gerstner and Libai (2005) suggest that a level of frustration with customer service is persistent over time. Persistent customer frustration, however, seems at odds with the claims of many firms that they are committed to customer service.[4] This raises the following question: *Why do firms organize their CSOs in a way that consistently leads to customer frustration?* Resolving this question is the focus of this paper.

Hassle costs, and the inevitability of customer frustration with a CSO, are typically explained from an operations perspective. A large literature from operations research points out that, because of the volume of inbound calls and the randomness of their arrivals, eliminating all hassle costs would not justify the operational costs of sufficiently staffing call centers.[5] Acknowledging this explanation, our research reexamines the issue, but from a marketing perspective. Our results do not contradict the above-mentioned operations explanation, but they do suggest that there may be profitable advantages for the firm to induce customer hassles. We find that, by implementing a tiered CSO, the firm can avoid paying out too much in refunds; in particular, a firm may have no compelling incentive to fully eliminate customer hassle, even if it were operationally feasible to do so.

We study the microeconomic incentives of a dissatisfied customer seeking compensatory redress from a firm's CSO. Specifically, we develop a model of the complaint process in which customer claims are heard and evaluated by the CSO. In our model, the firm specifies only the limit any CSO agent is authorized to pay out. The equilibrium outcome demonstrates that these payout limits can be specified in a way that forces a dissatisfied customer through a sequential claims process, akin to "jumping through hoops," to obtain compensation. The firm's choice of these limits implies a tiered, or multilevel, structure that requires any unsatisfied customer to initially voice a complaint with a first-level CSO agent who is limited in his authority to offer redress. Only if the customer finds that offer too low will she incur the hassle cost of escalating her claim to a higher-level CSO representative (e.g., a manager) who is authorized to provide a higher amount redress.[6]

We show that a tiered structure reduces the firm's redress costs by screening out claims that are less severe and illegitimate. For example, some customers with less severe complaints do not find the additional hassle of speaking with a manager worthwhile. By structuring the process to include customer hassles, the tiered CSO screens less severe claims so that some customers stop at the first tier and receive lower levels of redress.

The tiered CSO can also help screen illegitimate claims so that claims without proper justification are less likely to obtain higher redress. For instance, a customer can illegitimately claim that her product failed because of faulty manufacturing when, in fact, it was caused by her own misuse. When initially contacting a CSO, the customer is offered a small amount of compensation without fully verifying the cause of the failure. A larger refund is possible, but only if the customer can legitimize her claim. Demonstrating that the product failure was due to poor manufacturing will be a greater hassle if actually due to misuse. Therefore, customers with illegitimate claims are less likely to escalate the claim to a higher level and, therefore, receive lower payouts. In other words, by exploiting differential rates of hassle costs between illegitimate and legitimate claims, a tiered CSO screens claims even without initially observing the true state of legitimacy.

A collateral benefit of the tiered structure is that it can further control personnel costs if a second-level employee is required to approve higher-level redress payouts. By utilizing less-skilled (and cheaper) employees in the first tier, the CSO can screen some claims from reaching higher-level employees whose time is more valuable. This role may help explain the trend of firms delegating more authorization to offshore call centers or automated online customer support systems.

We further explore the relationship between a tiered CSO and the firm's pricing and quality decisions. A firm's decision regarding product quality determines how often customers claim redress, and its pricing decision affects how much compensation customers expect when filing a claim. Generally, high prices and low product quality raise the firm's redress costs. However, if customers' traits in the firm's target market affect how they interact with the CSO, these traits can be a factor in price and quality decisions. In our case, the degree to which customers experience hassles will affect the trade-offs associated with escalating a claim. Our trait of interest is *unit hassle cost*, which defines the level of annoyance or frustration that an individual experiences should she be inconvenienced. Unit hassle cost can vary across target segments. For instance, navigating a CSO online is generally easier for younger people than for older people (Borowski 2015). Heterogeneity in the degree to which individuals experience hassles is also reflected in survey data from the U.S. Federal Trade Commission, which shows that African Americans and Latinos are less inclined to complain than college-educated whites (Raval 2016). Moreover, women, relative to men, indicate greater levels of annoyance when dealing with a CSO (Consumer Reports 2011). If the firm's target market is more sensitive to hassles, then its customers are less likely to escalate claims when dissatisfied. It is then optimal for the firm to *reduce* the CSO's first-level authorization limit, *raise* prices, and *lower* product quality.

Finally, we extend our model to the case of competition and compare the service levels of a duopolist to that of a monopolist. We show that competition does not necessarily lead to higher redress. Competitive firms use price to acquire market share, which, as discussed previously, affects how much redress a consumer can expect from the claims process. Because competition tends to encourage lower prices, our model indicates that competing firms reduce CSO agents' authorities relative to a monopoly firm. We further compare these service levels in these two market structures by assessing the *relative service ratio*, which measures the CSO's first-level payout authority relative to the price paid by the customer. We find that the relative service ratio is lower with competition, and that the CSO pays out less upon claim escalation as competitive forces push prices downward. Thus, even if a lower authorization induces more escalation for the duopolist, it can afford to squeeze initial claim offers to a greater extent.

The marketing literature provides a rationale for having a CSO by arguing that, despite the costly endeavor of fielding customer complaints, the CSO helps retain profitable customers for future patronage (Bearden and Teel 1983, Knox and van Oest 2014) and mitigates negative word-of-mouth (Hirschman 1970, Ma et al. 2015). From an economic perspective, Fornell and Wernerfelt (1987, 1988) suggest that implementing a CSO program enables a firm to balance the benefits and costs of retaining unsatisfied customers. Other work has reported that a CSO provides valuable firm feedback for improving products and services (Hirschman 1970, Barlow and Møller 2008).[7] Acknowledging this prior work, we aim to provide a novel rationale for the tiered organizational structure seen in practice.

We are not the first to study the organizational incentives in handling customer complaints. Most relevantly, Homburg and Fürst (2005) examine two types of incentive systems for CSO agents to determine which system leads to higher measures of customer satisfaction and customer loyalty. Similar to that work, we are also interested in a better understanding of the relationship between the CSO's organizational structure and customer outcomes. However, our focus is on the outcome of redress costs and payouts rather than on customer assessments. As such, our findings provide an alternative, and unexplored, perspective on the organizational features of the CSO.

It is also important to put our work in the context of the operations literature on the CSO organization—namely, the call center. Gans et al. (2003) and Aksin et al. (2007) provide an overview of this large body of work. In particular, Gans et al. (2003) suggest that a major objective of this literature is to study models of *capacity management*—that is, using routing systems optimization to ensure quality customer responses at low operational costs. Our work, by contrast, takes a marketing perspective to this organizational issue by connecting the CSO organization's function to pricing incentives and overall profitability of the firm. Thus, while the operations literature is focused on reducing customer hassles, our work suggests that some level of caller dissatisfaction can, in fact, be profitable.[8]

Our paper also connects to a large literature in marketing and economics that studies warranties (Cooper and Ross 1985, Matthews and Moore 1987, Padmanabhan and Rao 1993, Lutz and Padmanabhan 1995, Furgeson et al. 2006), product return policies (Wang 2004, Anderson et al. 2009, Shulman et al. 2010, Ofek et al. 2011, Gümüş et al. 2013), and money-back guarantees (Heal 1977, Davis et al. 1995, Moorthy and Srinivasan 1995). A substantial portion of that work examines the forms of redress as a means to either guarantee satisfaction before purchase or reduce the risk of purchase, which is consistent with the CSO role in this paper. Namely, we assume that the CSO is a means of guaranteeing the customer some sort of compensation if she is unsatisfied with her purchase, but we are agnostic to the form of compensation.

Finally, it is important to recognize that other work has considered the impact of hassle cost and firm strategy. In models of organizational economics, Laux (2008) and Simester and Zhang (2014) show how requiring agents to expend hassle costs enables the firm to more efficiently allocate resources. Narasimhan (1984) illustrates how forcing customers to incur hassle costs to redeem coupons facilitates price discrimination. Like those works, our model shows that the firm benefits from exploiting agents' hassle costs. Other works show how hassle costs impede collusion with price matching guarantees (Hviid and Shaffer 1999) and facilitate price discrimination (Lambrecht and Tucker 2012).

The main model, presented in Section 2, demonstrates the screening role of a tiered CSO in a monopoly setting. In Section 3, we further explore the implications of the tiered CSO structure on the marketing strategies of the firm for pricing and product design. Finally, in Section 4, we consider a duopoly model and compare it to the monopoly model to assess the impact of competition on CSO design. Section 5 offers concluding remarks, and the appendix provides proofs of all formal claims in the main text.

2. A Model of the CSO

We demonstrate how a CSO can exploit customer hassle costs to screen claims and reduce redress payouts. By building a model of the CSO's interaction with a customer seeking a claim of redress, we show how the tiered structure minimizes expected payouts subject to any redress policy denoted by $S > 0$. Subsequently, in Section 3, we extend this model in to include pricing and other marketing decisions undertaken by the firm.

We start with a customer who initiates a claim with the CSO. This is typically the result of a product failure. If a consumer purchases the firm's product, there is a probability $q \in (0, 1)$ that the product fails and the consumer obtains 0 utility. We call q the *failure rate*. Even in the event the product does not fail, the customer can make an illegitimate claim. For example, the customer may have violated the terms of the warranty or misused the product. The customer can even lie by saying that the product failed when it did not. Let $\alpha \in [0, 1]$ be the probability of an illegitimate claim given that the product or service does not fail. Therefore, a claim occurs with probability $\alpha(1 - q) + q$. The CSO cannot directly observe the legitimacy of the claim.

The firm designs the CSO structure by specifying the payout authority at each level of the complaint process. There are possibly two CSO levels. For example, a first-tier CSO representative (agent) receives a customer's complaint (e.g., a call to the firm's call center), assesses her claim, and makes an offer of redress. We define R to be the maximum payout to the complaining, or *dissatisfied*, customer at the first level of the CSO. If the customer decides to escalate the claim to the second-tier representative (manager), then the maximum authorization is $S \geq R$.[9]

In our model, we make the distinction between the firm's *redress policy* and the *organizational design* of the CSO. The redress policy is captured by the variable S, which is the maximum realization of redress that is available to a customer. This is observable to the consumer at the time of purchase. For instance, firms often post refund and exchange policies for customers to view before or during purchase. In this section, we focus exclusively on the interaction of a customer seeking a claim and the CSO. Therefore, we treat redress policy $S > 0$ as fixed. Later, in Section 3, when we consider the firm's demand, we endogenize the policy variable S.

The organizational design of the CSO is defined by the variable R, which is not observed by the consumer. Firms' decisions about the internal organization are typically not public information, though they may be inferred. In fact, we suppose that consumers can rationally anticipate R at the time of purchase even if it is not directly observable. The focus of our research is on the organizational design of the CSO *given* a redress policy. Optimal exchange or refund policies have been examined elsewhere (e.g., Matthews and Moore 1987, Padmanabhan and Rao 1993, and others). Therefore, much of this article focuses on the firm's choice of the CSO's organizational structure, as defined by the first-level authorization, R, and its properties in equilibrium.

As elaborated on in Section 2.1, we are agnostic to decision processes of the agents within the CSO. Rather, we suppose that their decisions cannot be fully specified by the firm. In particular, we model their decisions as a random process affected by the subjective judgment of the employee during the interaction with a complaining customer. Therefore, we suppose that the firm is only able to monitor, and therefore contract on, the CSO's payout authorization, R. For instance, the CSO employee may have more sympathy for a complaining customer whom she deems polite than for a rude one, all else equal. How much the CSO offers the complaining customer involves some subjectivity, which the firm cannot fully control.

2.1. The Customer Claims Process

Here, we specify the microeconomic trade-offs of a dissatisfied customer when interacting with a customer service center to claim a refund. The customer contacts the CSO and presents her case for a refund. Depending on the CSO's first offer of redress, the customer may choose to escalate the claim for a greater refund. Customers' claims differ in two dimensions: the *severity* of the claim and the *legitimacy* of the claim. The severity of a claim is the degree of compensatory redress it is due, and the CSO assesses it through a discussion with the customer. The legitimacy of a claim relates to whether it is covered by the firm's redress policy.

Formally, the severity of a claim is specified by a random variable $r_1 \sim U[0, R]$, which represents the monetary offer of redress provided at the first level of the CSO after a representative agent assesses the claim. The customer may seek a higher amount by escalating her claim to the second level (e.g., a manager). Doing so, however, involves a unit hassle cost, $c_i > 0$. The *unit hassle cost* represents time, frustration, or additional effort making the case for a better redress amount.[10] Illegitimate claims, which occur when the product does not fail, have larger hassle costs than legitimate claims, which are denoted by c_L and c_I, respectively, with $c_I > c_L$.

An example illustrates the two properties of a claim. Suppose a traveler initially contacts the CSO to complain about a recent flight, claiming a flight attendant spilled coffee on her. She calls and speaks to an agent who initially assesses the severity of the claim. The agent could, for instance, apologize for the inconvenience and the stained clothing then offer a portion $r_1 \in [0, R]$ of the airfare. Unhappy with this payout, the traveler might, either legitimately or illegitimately, seek additional redress by arguing that she suffered skin burns. The agent, unable to verify the legitimacy, explains the terms required for a better payout, which is a letter from a medical doctor testifying that the traveler was actually injured from the hot coffee. The customer who, in fact, was burned has a legitimate claim and can acquire such a letter at a cost of $c_L > 0$. By contrast, the customer who has no injury knows it will be more difficult to find a doctor to produce the required letter. Thus, escalating the claim will require higher hassle costs: $c_I > c_L$.

Suppose the customer escalates the claim and presents her case at the second level. We assume that she receives a draw $r_2 \sim U[r_1, S]$. The upper bound on the support of r_2 is now fixed at $S > 0$, which could be, for example, a full refund of the price paid. The lower bound of the support depends on the first offered refund r_1. This assures that a customer obtains a weakly better payout on escalation, which fits the reality.

Consider the customer's optimal escalation strategy. For any customer who contacts the CSO and is offered r_1, she needs to decide whether to incur the hassle cost to escalate her claim in the hope of obtaining a better refund. The expected incremental benefit from escalation is $\int_{r_1}^{S} r_2 f(r_2)dr_2 - r_1$. Therefore, the customer will not escalate the claim when her expected payoff is lower than the cost c_i. The endogenous variable a_i represents the threshold of the refund value for r_1 that makes the customer indifferent between the current offer and the expected benefit of escalating the claim. The optimal escalation rule defines a_i by the following equation:

$$\int_{a_i}^{S} r_2 f(r_2)dr_2 - a_i = c_i. \tag{1}$$

The left-hand side of this equation represents the expected benefit of escalation, which is the mean payout conditional on securing $r_1 < a_i$. The customer's optimal threshold a_i is implicitly defined by (1), which equates the expected benefit with the cost of escalation. This formulation mimics a sequential search model with firm-match values (e.g., Wolinsky 1986). The only distinction is that the payout draws from escalating a claim depend on r_1. Lemma 1 shows the expression of threshold value a_i that solves (1).

Lemma 1. *The customer's optimal threshold of the refund value is*

$$a_i = S - 2c_i. \tag{2}$$

As the payout cap, S, increases, the customer is more likely to escalate the claim. Higher hassle costs reduce the chance she will do so.[11]

We focus on values of the unit hassle cost that induce some customers to escalate their claims while others are satisfied with the CSO's first offer. This requires the condition $a_i \in (0, R)$, which is equivalent to $c_i \in \left(\frac{S}{6}, \frac{S}{2}\right)$.[12] When c_i is too small, every customer wants to talk to the second-level CSO representative (e.g., a manager). In fact, as can be seen in (2), as $c_i \to 0$, the call threshold $a_i \to S$, which means the customer will always escalate for any $r_1 < S$, as it costs her nothing to seek the highest possible refund. On the other hand, when c_i is too large, no one wants to escalate the claim to the CSO's second tier.

The condition $a_i \in (0, R)$ and the uniform distribution of r_1 mean that customer $i \in \{I, L\}$ escalates her call with probability a_i/R. Therefore, a customer's *expected hassle cost* is $c_i\left(\frac{a_i}{R}\right)$, which is endogenously determined within the model. In other words, the firm has control over the average amount of hassle costs incurred by the customer through its choice of R. Any reduction in R raises the customer's expected hassle costs, which, as shown below, reduces the firm's expected payout.

2.2. The Optimal Authorization Level

For the firm's authorization level R, the expected redress payment to a customer with hassle cost c_i is

$$\begin{aligned} F_i(R, S) = {} & \mathrm{E}[r_1 | r_1 > a_i] * \Pr[r_1 > a_i] \\ & + \mathrm{E}_{r_1, r_2}[r_2 | r_1 < a_i] * \Pr[r_1 < a_i], \end{aligned} \tag{3}$$

$i \in \{I, L\}$. Recall that the firm does not observe the legitimacy of the claim. Therefore, it optimizes with respect to the expected refund across both customer types: $F = \alpha(1-q)F_I + qF_L$. For any fixed policy $S > 0$, the firm chooses R to minimize $\Gamma(F)$, which is equivalent to minimizing F because Γ is monotone. We consider three cases of first-level authorization for the CSO. If the optimal first-level authorization is $\hat{R}$, then we say the optimal structure is *tiered* if $0 < \hat{R} < S$. For the corner solution $\hat{R} = S$, we say that the structure is *nontiered*. In this case, the CSO allows the customer to possibly obtain the highest refund with a single representative. Another possibility of a corner solution is $\hat{R} = 0$, called *extreme tiered*, in which the CSO assures that the initial offer of redress will be unsatisfying and forces any customer to pay $c > 0$ to seek a larger refund. The optimal authorization is specified in the following proposition.

Proposition 1.

(i) *If $R > 0$, then expected refund for customer $i \in \{I, L\}$, is given by*

$$F_i = \frac{1}{2}\left[\left(S + \frac{1}{2}a_i\right)\frac{a_i}{S} + (S + a_i)\left(1 - \frac{a_i}{R}\right)\right]. \tag{4}$$

(ii) *The equation*

$$\hat{R} = \sqrt{\frac{S^2}{2} - 2\left\{x(\hat{R})c_I^2 + \left[1 - x(\hat{R})\right]c_L^2\right\}}, \tag{5}$$

where $x(\hat{R}) \equiv \frac{(1-q)\alpha\Gamma'(F_I)}{(1-q)\alpha\Gamma'(F_I) + q\Gamma'(F_L)}$, has a unique solution $\hat{R}$. The solution $\hat{R}$ defines a threshold $\hat{c} \equiv \sqrt{\frac{S^2 - 2S\hat{R} + 2\hat{R}^2}{4}} \in \left(0, \frac{S}{2}\right)$ with the following properties.

a. *If $c_I \in \left(\hat{c}, \frac{S}{2}\right)$ then $\hat{R} \in (0, S)$ is the optimal first-level authorization for the CSO. The CSO is tiered so that it is optimal for the first-level authorization to be less than that of the second level.*

b. *Otherwise, if $c_I \in (0, \hat{c}]$, then $\hat{R} = 0$. The CSO is extreme tiered so that it is optimal to have the dissatisfied customer always escalate the claim.*

Proposition 1 assures us a unique solution to the firm's optimal choice of the first-level authorization for the CSO. The implicit solution, $\hat{R}$, to (5) is a convex combination of $\hat{R}_L \equiv \hat{R}_{q=0}$ and $\hat{R}_I \equiv \hat{R}_{q=1}$, which are authorization levels *if* the CSO could observe the legitimacy of the claim. Clearly, the firm should set a lower payout for illegitimate claims, so that $\hat{R}_I < \hat{R}_L$. However, because the CSO cannot observe legitimacy, the firm sets the first-level authorization in between these extremes; that is, $\hat{R} \in (\hat{R}_I, \hat{R}_L)$.

The proposition also states that the no-tiered solution, $\hat{R} = S$, is never optimal. If unit hassle is below $\hat{c}$, then the CSO should invoke the extreme-tiered structure, with $\hat{R} = 0$, and force all customers to escalate their claims.[13] Now, consider the case of $c_i \in \left(\hat{c}, \frac{S}{2}\right)$, which implies the optimal tiered structure, with $0 < \hat{R} < S$. Under this scenario, complaining customers are divided into two segments: those who are satisfied with a payout of $r_1 \in [a_i, \hat{R}]$ and those who escalate their claims and incur additional hassle cost c_i. To explore meaningful comparative statics of $\hat{R}$ with respect to other parameters, we shall henceforth focus on the case in which c_i is large enough to induce a tiered structure.

Assumption 1. *The unit hassle cost parameter satisfies*

$$c_i \in \Psi \equiv \left\{c_i \geq 0 \,|\, 0 < a_i < \hat{R} < S\right\} = \left(\hat{c}, \frac{S}{2}\right).$$

Under Assumption 1, it can be verified that the optimal first-level authorization for the CSO and the CSO's expected redress costs decrease with hassle cost: $d\hat{R}/dc_i < 0$ and $dF_i(\hat{R})/dc_i < 0$. As the unit hassle cost increases, the portion of customers who will not escalate the claim to the second level increases. It is then optimal to lower $\hat{R}$ to reduce the compensation offered at the first level. Overall, the expected payment is lower for the firm when consumers have higher hassle costs.

2.3. Screening Roles of a Tiered CSO

The benefit of a tiered CSO structure is best interpreted via its ability to screen customer complaints. For instance, Proposition 1 establishes that the CSO screens out claims with low severity. The condition $\hat{R} < S$ implies that less-severe claims, those with a severity $r_1 \in [0, \hat{R}]$, pay out $\hat{R}/2$ on average. Without a tiered structure, a random customer can complain and obtain $S/2$.

Another screening role of the tiered CSO structure implied by Proposition 1 regards the legitimacy of claims. Even though the CSO is unable to directly observe the legitimacy of a claim, the tiered structure exploits differences in hassle costs to ensure that illegitimate claims receive less in redress. Corollary 1 formalizes this finding.

Corollary 1. *For any $c_i \in \Psi$, the optimal tiered CSO structure defined in Proposition 1 has the following properties.*

(i) *The probability that an illegitimate claim is escalated is lower than that of a legitimate claim. Illegitimate claims receive lower redress than legitimate claims.*

(ii) *Legitimate claims receive less redress and more expected hassle costs as the portion of illegitimate claims increases: $dF_L(\hat{R})/d\alpha < 0$ and $d\left(c\frac{a_L}{\hat{R}}\right)/d\alpha > 0$.*

The CSO's role in screening illegitimate claims is expressed by part (i). The tiered CSO structure exploits the difference in unit hassle costs to make it harder for the illegitimate claim to pass the first level. Part (ii) identifies a negative spillover effect from illegitimate claims to legitimate claims. The negative spillover can be seen in both the lower authorization $\hat{R}$ and the increase in expected hassle cost for customers with legitimate complaints. As the portion of illegitimate claims increases, it is optimal to reduce the first-level authorization to reduce redress costs.

Screening out less-severe claims can have an additional value to the firm if the time of second-level CSO employees (e.g., a manager) is more valuable than that of the first-level employees (e.g., an agent). The manager typically has higher-level responsibilities that she cannot attend to when fielding an escalated claim. The CSO, therefore, incurs an opportunity cost when allocating the manager's time to a complaint. Without loss of generality, we normalize the agent's wage cost to be unity and denote the relative wage cost of the manager to be $w \geq 1$. The expected redress and wage cost to the CSO are then $\alpha F_I + (1 - \alpha) q F_L$, where

$$F_i(R; w) = \frac{1}{2}\left[\left(S + \frac{1}{2}a_i + w\right)\left(\frac{a_i}{R}\right) + (R + a_i)\left(1 - \frac{a_i}{R}\right)\right], \quad (6)$$

for $i \in \{I, L\}$ is modified from (3) by inserting w as an additional cost term for the escalated claim. For any relative manager's wage $w \geq 1$, denote $\hat{R}(w)$ as the optimal authorization of the CSO agent. Corollary 1 shows how the relative wage affects $\hat{R}(w)$.

Corollary 2. *For any $c_i \in \Psi$ and manager's relative wage $w \geq 1$, the optimal authority given to the CSO agent 1 is increasing in w: $\frac{d\hat{R}(w)}{dw} > 0$.*

If the manager's time is more valuable ($w > 1$), then the CSO can protect her from too many calls by screening some of the claims. As her time becomes increasingly valuable, the CSO responds by giving more payout authority to the agent so that the manager responds to fewer complaints.

The result of Corollary 2 may also provide an additional explanation to an observed trend in the customer care industry. For example, some firms delegate more authorization to offshore call center representatives, while many other firms adopt automated online systems to handle a large portion of customer redress requests (e.g., Amazon). Cost pressure may drive this trend as the domestic employees become more expensive.

3. Marketing Decisions and the Tiered CSO

In this section, we explore the implications of the tiered CSO structure on the marketing strategies of the firm related to pricing and product design. We then assess the conditions under which a tiered CSO is more profitable than no CSO at all. A few simplifications are made to arrive at tractable solutions. First, we assume all claims in customer segments are legitimate so that $\alpha = 0$ and the customer's unit hassle cost $c = c_L \in \Psi$. Second, we invoke a simplification on the redress policy such that $S(P) = P$,[14] for any price $P > 0$ paid by the customer. Such a policy simply guarantees the customer no more than a full refund when dissatisfied.[15] Third, we adopt a fixed demand setting such that all consumers obtain a fixed value, $V > 0$, from the initial purchase.[16] Under these assumptions, we specify that the utility from purchasing for a given price P and a CSO design $\hat{R}(S = P)$ is

$$u = \begin{cases} V - P & \text{No Claim } (1-q) \\ F - \dfrac{a}{\hat{R}}c - P & \text{Legitimate Claim } q. \end{cases}$$

All consumers will buy if and only if $u \geq 0$, which is equivalent to

$$P \leq q\left[F(\hat{R}(P)) - \frac{a}{\hat{R}}c\right] + (1-q)V. \tag{7}$$

We make a restriction on V so that (7) holds strictly in equilibrium:

Assumption 2.

$$V > \underline{V}(q, c).$$

The lower bound $\underline{V}(q, c)$ is specified in the appendix. Assumption 2 implies a fixed market size and greatly simplifies the pricing problem in this monopoly model and in the duopoly model of Section 4.

We restrict our attention of the redress cost function to be strictly convex, so that marginal cost Γ' increases at least quadratic in R. We impose convexity to guarantee an interior solution in P when demand is fixed and not downward sloping.[17]

Assumption 3.

$$\Gamma''/\Gamma' \geq 1/F.$$

One can interpret this assumption to mean that the marginal redress cost increases because of additional internal authorizations, repackaging, or liquidation expenses associated with a physical return.

The model has the following timing. Stage 1: The firm chooses price P, followed by R. Stage 2: Consumers observe $S = P$ and then make purchasing decisions by rationally anticipating R. Stage 3: Customers contact the CSO if dissatisfied and claim redress.

3.1. Pricing

The firm chooses P to maximize $\Pi(P; q, c) = P - q\Gamma[F(P, c)]$, where redress payout $F(P, c)$ embeds the optimal authorization $\hat{R}(P) = \sqrt{P^2/2 - 2c^2}$ from Proposition 1 for $c = c_L$ and $S = P$. Assumptions 2 and 3 imply that the firm's pricing problem has a tractable solution. Specifically, Assumption 2 assures that price determines the revenue of the firm, not the number of sales. Assumption 3, along with the microfoundations of our claims-process model in Section 2, together ensure that $\Pi(P; q, c)$ is strictly concave and therefore has a unique interior maximizer P^*. Therefore, the optimal price balances the marginal revenue from the consumer with the expected marginal redress cost, which is increasing in P. Proposition 2 describes some additional properties of P^*.

Proposition 2. *Under Assumptions 1, 2, and 3 we have the following.*

(i) *There is a unique price P^* that maximizes $\Pi(P; q, c)$. Furthermore, P^* is decreasing in q and (weakly) increasing in c.*

(ii) *The corresponding equilibrium payout authorization $\hat{R}(P^*)$ is decreasing in q and c.*

(iii) *Firm's equilibrium profit Π^* is decreasing in q and increasing in c.*

Proposition 2 indicates how the CSO's tiered structure interacts with the firm's pricing decision. As the failure rate q increases, the firm optimally reduces its price to avoid higher expected payouts. Correspondingly, as the price decreases, the firm reduces the refund authorization to keep redress costs down, as indicated in part (ii). Now, consider the impact of unit hassle cost c. As a customer's hassle cost increases, the firm can charge a higher price because the firm is more certain that dissatisfied customers will be less inclined to seek a large refund. This permits the firm to raise its price, knowing that expected refunds could be lower, as indicated in part (i) of the proposition. Less direct is the impact of unit hassle cost on the CSO's first-level authorization. There are two counteracting effects. Although from Section 2.2 we know that for any given price, the optimal $\hat{R}(P)$ decreases with c, from part (i) we also see that a higher hassle cost increases the optimal price, which subsequently raises the CSO's first-level authorization. But the impact through price is of second order so that the downward effect of unit hassle cost on $\hat{R}(P^*)$ dominates the upward effect.

The envelope theorem applied to $\Pi^*(P^*; q, c)$ shows part (iii) of Proposition 2. Increasing q lowers the equilibrium price as a stronger chance of product failure exists, which raises the firm's redress costs ($d\Pi^*/dq < 0$). When hassle costs are increasing, however, the firm sees an increase in profit ($d\Pi^*/dc > 0$), because the firm pays out less in redress and charges higher prices.

Finally, we note that the weak inequality condition in Assumption 3 does not rule out that P^* may be invariant to c. This happens precisely when

Assumption 3 holds with equality; otherwise, P^* is strictly increasing in hassle costs. To obtain tractable results in the following analysis, we specify a functional form[18] for the cost function $\Gamma(R)$ by modifying Assumption 3.

Assumption 3′.

$$\Gamma(F) = F^2/2.$$

The specification in the above assumption implies that Assumptions 1 and 2 have closed-form equivalents.

Assumption 1′.

$$c \in \Psi = \left(\frac{1}{\sqrt{2}q}, \frac{1}{q}\right),$$

for $q \in (0, 1)$.

Assumption 2′.

$$V > \underline{V}(q, c) \equiv \frac{2}{q(1-q)} - \frac{1}{1-q}\sqrt{\frac{2-2cq}{1+cq}}.$$

The implied forms of Assumptions 1 and 2 are established in the appendix (Lemmas A1 and A2) and will be useful for the remainder of the analysis. Recall that Assumption 1′ asserts that unit hassle costs are not too small, which guarantees that all customers escalate claims, and not too large that no customer escalates a claim. In other words, Assumption 1′ implies that the optimal CSO is tiered. Assumption 2′ assures that a consumer's expected value of the product exceeds the equilibrium price and all costs associated with product failure.

3.2. Failure Rate

We now consider the case in which the firm has some control of the failure rate, q. For instance, the firm can invest in R&D or quality control to design the product with a lower likelihood of failure. We want to understand how the role of unit hassle costs affects the firm's product design. The game timing in this section is the following. Stage 1: The firm chooses the failure rate q, followed by the price P, and then R. Stage 2: Consumers observe q and P, then make their purchasing decisions. Stage 3: Customers contact the CSO if dissatisfied.

Extending the model of Section 3.1, we add a "design" stage of the start of the game in which the firm can invest $G(q)$ into reducing the failure rate. Specifically, let $G(q) = \beta\left(\frac{1}{q^3} - 1\right)$, where $\beta > 0$ is the parameter affecting the rate at which production costs decrease in q. In this formulation, a product that never dissatisfies ($q = 0$) is infinitely costly, while a product that always fails ($q = 1$) costs nothing. Furthermore, the more reliable the product (lower q), the marginally more expensive it is to produce it; thus, $G''(q) > 0 > G'(q)$.

The firm chooses the q to maximize $\Pi^*(q) - G(q)$. The cubic specification provides enough curvature to guarantee an interior solution to this optimization.

Proposition 3. *Let $0 < \beta < \frac{1}{12c^2}$. Under Assumptions 1′, 2′, and 3′, suppose the failure rate, q, is chosen by the firm to maximize $\Pi^*(q) - G(q)$.*

(i) *The optimal failure rate, $q^*(c) = \sqrt{\frac{1-\sqrt{1-12c^2\beta}}{2c^2}}$, is increasing in c.*

(ii) *The maximized profit $\Pi^*(q^*) - G(q^*)$ is increasing in c.*

The firm optimally increases the failure rate as the customer's unit hassle costs increase. Because customers are less inclined to escalate calls, the firm's redress payouts are reduced and the firm can afford to cut back its investment in satisfaction (larger q). Part (ii) confirms that overall profit is increasing in c despite the increase in complaints.

3.3. Endogenous CSO and the Necessity of Hassle Cost

When is it profitable to provide a tiered CSO instead of no CSO? In this section, we add a stage 0 to the game in Section 3.1 in which the firm decides whether to provide a CSO. Our objective is to identify conditions on the level of unit hassle costs necessary for the firm to profitably provide a CSO.

We start with the situation in which the firm offers no CSO. In this case, customers will buy if and only if $P \le V(1-q)$. Charging customers their full value, we see that the firm's profit without a CSO is

$$\Pi^N = P^N = V(1-q). \tag{8}$$

The profit to the firm using a CSO is

$$\Pi^* = \frac{1 + c^2q^2}{q}, \tag{9}$$

which is derived from Proposition 2 under Assumption 3′. Comparing (9) with the profit in (8), we generate the following result.

Proposition 4. *Suppose Assumptions 1′, 2′, and 3′ hold and fix $q \in (0, 1)$.*

(i) *If $V \in \left(\underline{V}(q, c), \frac{2}{q(1-q)}\right) \neq \emptyset$ then there exists a $\dot{c} < 1/q = \sup\Psi$ such that: $\Pi^* > \Pi^N$ if and only if $c > \dot{c}$.*

(ii) *Otherwise, $\Pi^* < \Pi^N$ for all $c \in \Psi$.*

This proposition states precise conditions under which the firm implements a tiered CSO. Part (i) shows that offering redress via a CSO is profitable if and only if customers' unit hassle costs are sufficiently large. This holds when consumers are rational and therefore know their hassle cost can be exploited by the firm. When hassle costs are large enough, $c > \dot{c}$, the consumer buys on the hope that the product satisfies and they will not incur the hassle of pursuing a refund. For small hassle costs, $c < \dot{c}$, the firm does not find it worthwhile to offer redress through a CSO. Thus, Proposition 4 establishes that sufficient hassle costs are a necessary condition for the provision of a tiered CSO. The condition on V can be understood by looking at the opportunity cost of using a CSO. The optimal price P^* with a CSO does not directly depend on V under Assumption 2′. Without a CSO, by contrast, the optimal price P^N depends directly on V. As V increases, the value of the product is sufficiently large that the firm would rather offer no CSO and set the price directly equal to consumer's expected value, $V(1-q)$. Thus, as part (ii) of Proposition 4 confirms, if V is sufficiently large, then implementing a CSO is unprofitable for the firm.

3.4. Goodwill and Customer Retention

It is important to acknowledge the potential impact from exploiting customers' hassles on a firm's long-term customer retention. This is not formally studied in the main text, but its importance deserves discussion. Long-term customer retention is captured in the form of trust, or goodwill, which sustains in repeated play when long-term benefits outweigh short-run betrayals (Fudenberg and Maskin 1986). This could be studied either by incorporating long-run dynamics, or through a reputation model that involves consumers' Bayesian beliefs about the firm's private information about being, say, "reputable" (Kreps and Wilson 1982, Milgrom and Roberts 1982). Unfortunately, our setting does not permit an easy extension of either long-run dynamics or reputation; consequently, it constrains us from saying exactly how either would affect our results.

Nevertheless, to obtain some sense of the impact of these effects, we study a reduced-form model of customer goodwill in the online appendix. We suppose that the firm's goodwill is increasing linearly in its expected payout. That is, if the firm utilizes a CSO to control its redress costs, then it also incurs a hit to its goodwill, which is proportional to the strength of long-term customer retention. We argue that a concern for customer goodwill does not necessarily eliminate the use of a tiered CSO in equilibrium. However, relative to no concern for goodwill, the CSO grants more payout authority to its agents. If the importance of goodwill is large enough, it is then optimal for the firm to abandon the tiered structure and charge a higher price. Thus, even without a full model of long-term customer satisfaction, our reduced-form analysis indicates that the desire to keep customer goodwill moderates the firm's ability to exploit hassle costs.

4. Competition

Do competitive forces hinder the firm's ability to exploit consumer hassle cost in an attempt to control its redress costs? In this section, we consider an extension of the model by incorporating two competing firms, the purpose of which is to study whether competition always leads to a higher redress.

Suppose two firms, A and B, are each located at opposite ends of the unit interval line (i.e., a Hotelling model). A unit mass of consumers are uniformly distributed along the line with the unit transportation cost $t > 0$. Every consumer buys no more than one unit. We also assume that both products have the same failure rate q, for simplicity. Let P_j and R_j denote the price and the CSO's first-level authorization for firm $j \in \{A, B\}$. For a consumer who purchased at firm j, her escalation threshold is given by a_j. The game timing is the following. Stage 1: Firms simultaneously decide whether to provide a CSO and set their prices P_j; if a firm chooses to provide a CSO, it subsequently chooses R_i. Stage 2: Consumers observe P_j and then formalize their expected utility from each firm by rationally anticipating R_i, then make purchase decisions. Stage 3: Customers contact the appropriate CSO if dissatisfied. We maintain Assumptions 1′, 2′, and 3′.

Consider the consumer located at $x \in [0,1]$ deciding which firm to patronize. She compares the expected utility of both firms, each of which has taken over the possibility that a product may fail with probability q. The utility of a consumer buying from A, in all possible situations, is given by

$$u(j,x) = \begin{cases} F(R_j, P_j) - c\dfrac{a_j}{R_j} - P_j - td(j,x) \\ \qquad \text{buy from } j \text{ with a CSO and product fails } (q) \\ -P_j - td(j,x) \\ \qquad \text{buy from } j \text{ with no CSO and product fails } (q) \\ V - P_j - td(j,x) \qquad \text{otherwise } (1-q), \end{cases}$$

where $d(A,x) = x = 1 - d(B,x)$.

Let $W_j = q\left[F(R_j,P_j) - c\left(\frac{a_j}{R_j}\right)\right]{}^*I_{[j \text{ offers } CSO]}$, where $I_{[j \text{ offers } CSO]}$ is an indicator function. The demand and profits for firm j can then be expressed, respectively, by

$$D_j = \frac{(W_j - P_j) - (W_{-j} - P_{-j}) + t}{2t} \text{ and}$$
$$\Pi_j = D_j\left[P_j - q\Gamma(F(R_j,P_j))^*I_{[j \text{ offers } CSO]}\right]$$

for $j, -j \in \{A, B\}$ with $-j \neq j$.[19] These expressions indicate that offering a CSO increases demand for a firm by assuring consumers that some level of redress is available in the event of product failure. Increasing demand in this way comes at the cost $q\Gamma(F)$.

Suppose both firms offer a CSO and that prices (P_A, P_B) were chosen at the beginning of stage 1. As previously noted in the timing of this game, consumers cannot observe the first-level authorization for the CSO at firm j, but they can rationally anticipate R_j in equilibrium. Formally, this implies that firm j's profit maximization of Π_j, with respect to R_j, is equivalent to the minimization of $q\Gamma(R_j, P_j)$. Therefore, for any pair of prices (P_A, P_B), the equilibrium authorization assigned for the CSO's first level is

$$\hat{R}_j = \sqrt{P_j^2/2 - 2c^2}. \tag{10}$$

Turning to the pricing decision, we see that any equilibrium price P_j^{**} must satisfy the firm's first-order condition:

$$\frac{\partial \Pi_j}{\partial P_j} = \frac{\partial D_j}{\partial P_j}\left[P_j - q\Gamma(F_j)\right] + D_j\left[1 - q\Gamma'(F_j)\frac{\partial F_j}{\partial P_j}\right] = 0. \tag{11}$$

We know from the monopoly case in Proposition 2 that the second term of (11) is 0 at the monopoly price P^*. Furthermore, the first term is negative for a downward-sloping demand curve. Hence, in any symmetric equilibrium, the duopoly price P^{**} is lower than the monopoly price P^*.

For brevity, and without loss of insight, we do not examine here the cases in which one or more firms do not offer a CSO. The appendix provides an analysis of these cases to derive a sufficient condition for the equilibrium in which both firms offer a CSO.

Proposition 5. *For the duopoly model, there exists a cutoff point $\ddot{c} > 0$ (defined in the appendix) such that both firms adopt a CSO in equilibrium if $c > \ddot{c}$. The equilibrium CSO structure is tiered, so that $\hat{R}(P^{**}) = \sqrt{\frac{(P^{**})^2}{2} - 2c^2} < P^{**}$. Equilibrium prices and first-level CSO authorizations are lower in a duopoly than in a monopoly: $P^{**} < P^*$ and $\hat{R}(P^{**}) < \hat{R}(P^*)$.*

The condition $c > \ddot{c}$ in Proposition 5 has a similar intuition as the condition $c > \dot{c}$ of Proposition 4. Implementing a CSO is prohibitively costly if all dissatisfied customers can claim a full refund at no cost. Only if the customer's personal effort in seeking redress is sufficiently costly does offering redress become a profitable means to generate value.

Proposition 5 also lets us compare the service levels across the two market structures. For instance, it establishes that the first-level CSO authorizations are lower in a duopoly than in a monopoly. Competitive pressure on prices drives this result. As was the case in the monopoly model, the optimal $\hat{R}(P)$ is increasing in price. This directly implies that the expected redress payment is lower in a duopoly than in a monopoly (i.e., $F^{**} < F^*$). With lower prices, the maximum amount of redress a customer can claim is lower, so firms can afford to squeeze redress payouts to keep costs down.

We can take this the comparison a bit further by evaluating redress levels relative to prices. We use the following measure.

Definition. *The* ***relative service ratio*** *is* $RS(R, P) \equiv \frac{F(R,P)}{P}$.

The relative service ratio measures satisfaction relative to the price the customer pays. It means for 1 dollar a customer spends on the product, $RS \in [0, 1]$ is the percentage of price this customer is expected to receive if she finds the product unsatisfactory and makes a claim with the CSO. In the following corollary, we compare this measure of service provision across a monopoly and a duopoly.

Corollary 3. *For the equilibrium described in Proposition 5,*
(i) *relative service ratios are lower in a duopoly than in a monopoly; and*
(ii) *customers' expected hassle costs are lower in a duopoly than in a monopoly.*

Thus, our competition model suggests that consumers have a worse CSO in terms of redress payouts relative to price. This result owes to the fact that the optimal authorization level $\hat{R}(P)$ is concave in price, which can be seen in (5) and (10). Recall that, for a given price, both the monopolist and the competitive firms in our model optimize profits by the minimization redress payout, $F(R, P)$. The choice of R controls this payout by balancing the probability of escalating a claim and the amount offered during the initial claim. When price is relatively low, the firm's tradeoff is shifted to the latter incentive. At low prices, the firm's cost of an escalated claim is relatively smaller than at higher prices. By contrast, when price is relatively high, the firm is more inclined to avoid escalated claims and raises R to a greater extent.

5. Conclusion

Though many marketers proclaim a commitment to customer service, frustration with CSOs seems to be a persistent theme in consumer surveys. It has been suggested that some degree of customer frustration is an inevitable part of modern business (Chen et al. 2012). A common explanation for this perpetual occurrence is that logistical and operational difficulties are associated with the elimination of all customer unhappiness. Our research suggests that this frustration could actually be embedded in the CSO design. We posit that a firm may profitably structure its CSO to systematically exploit consumer hassle costs. By requiring a dissatisfied customer to "jump through hoops," the firm pays out less in refunds. The tiered CSO structure screens complaints that are less severe, while simultaneously mitigating illegitimate claims.

Our model allowed us to connect the CSO design with certain traits of a firm's target market. Making such a connection is motivated by studies suggesting that consumers in some segments (e.g., the elderly and minorities) are more adversely affected for a given type of hassle. All else equal, a firm targeting such a segment can charge higher prices, offer poorer quality, and provide less compensation. Of course, price, product design, and redress levels are determined by many factors not considered in our model. Furthermore, we cannot argue that a market segment's unit hassle cost is the only decisive factor for these strategic decisions. Nevertheless, our model is the first to suggest that such a factor may affect prices and product quality, even if to a modest degree.

Finally, we studied the impact of competition on the tiered CSO design. The main goal of this extension was to see whether, under certain scenarios, competition may worsen customer service. Comparing a duopoly model with the monopoly model, we found that competitive pressure on prices induces a firm to restrict the first-level authorization of the CSO to a greater degree. Lower prices not only lower the amount claimed by customers, they also induce the firm to squeeze payouts proportionally more than the monopolist. By construction, our model did not capture the case where a firm can credibly commit on their service level before purchase, which allows a competitive firm to use its CSO to gain market share. More research is thus needed to fully assess the impact of competition on a firm's CSO design.

It is also important to acknowledge that a firm's ability to exploit customer hassle costs is tempered by concerns for customer goodwill and retention in the long run. Given the large literature on customer satisfaction and redress, we have left this analysis out of the main text. An abbreviated analysis provided in the online appendix suggests that the tiered CSO may still be effective at controlling redress costs and screening claims even at the risk of eroding goodwill. However, for brands that rely heavily on long-term customer retention, inducing customer frustration may be suboptimal. In that situation, while the CSO becomes less tiered and provides more redress to consumers, the firm may optimally raise its price.

Acknowledgements
The authors thank Vinod Ganne of IIC Services, India, for helpful discussions about call center operations. For helpful input, the authors thank Mark Bergen, Mary Caravella, Daniel Halbheer, Shijie Lu, and Steve Shugan; participants at the 2016 Berlin IO Day (ESMT) and the 2017 INFORMS Marketing Science Conference; and participants at seminars at Koç University, Eindhoven University of Technology, Tilburg University, the University of Maastricht, the University of Pennsylvania (Wharton), the University of California at Riverside, the Harbin Institute of Technology, Washington University in St. Louis, Texas A&M University, Duke University, the University of Connecticut, Fudan University, the University of Maryland, the London Business School, University College London, the University of Florida, Sun Yat-Sen University, and the University of Texas at Dallas. The authors contributed equally to this research, and their names appear alphabetically.

Appendix

Lemma 1
For $r_2 \sim U(a, S)$, the corresponding pdf is $f(r_2) = \frac{1}{S-a}$. Inserting this into (1),

$$\int_a^S r_2 f(r_2)dr_2 - a = \int_a^S (r_2 - a)\frac{1}{S-a}dr_2 = \frac{1}{2}(S-a) = c,$$

and solving for a gives Equation (2). □

Proof of Proposition 1
First we derive the expression for F_i using (3). We can write the expected payment for the escalation:

$$E[r_2|r_1 < a_i] = \frac{\int_0^{a_i}\int_{r_1}^S r_2 f(r_2)dr_2 f(r_1)dr_1}{\Pr(a_i > r_1)},$$

where $a_i = S - 2c_i$. We break this down into smaller derivations. The expected payment offered by the CSO manager is

$$E[r_2|r_1] = \int_{r_i}^S r_2 f(r_2)dr_2 = \frac{\frac{1}{2}r_2^2|_{r_1}^S * \frac{1}{P}}{1 - \frac{r_1}{P}} = \frac{1}{2}(S + r_1).$$

We can then write

$$E_{r_1,r_2}[r_2|r_1 < a_i] = \frac{\int_0^{a_i}\frac{\frac{1}{2}(S+r_1)}{R}dr_1}{\frac{a_i}{R}} = \frac{1}{2}P + \frac{1}{4}a_i.$$

We also know that the expected refund from the first-level CSO is

$$E[r_1|r_1 > a_i] = \int_{a_i}^R \frac{r_1 f(r_1)dr_1}{\Pr(r_1 > a)} = \frac{\frac{1}{2}r_1^2|_{a_i}^R * \frac{1}{R}}{1 - \frac{a_i}{R}} = \frac{1}{2}(R + a_i).$$

Applying the derivations above and noting that the probability of resolution with the agent is $1 - a_i/R$ and on escalation is a_i/R, (3) implies the expression in (4) and proves part (i).

Next, we solve $\min_R \Gamma(F)$ by taking the first-order condition with respect to R:

$$\frac{\partial\Gamma(F)}{\partial R} = (1-q)\alpha\Gamma'(F_I)\frac{1}{2}\left[1 + \left(-S + \frac{1}{2}a_I\right)\frac{a_I}{R^2}\right] + q\Gamma'(F_L)\frac{1}{2}\left[1 + \left(-S + \frac{1}{2}a_L\right)\frac{a_L}{R^2}\right] = 0. \quad \text{(A1)}$$

After inserting the expression for $a_i = S - 2c_i$ from Lemma 1, we arrive at (5). First, we can see that the right-hand side of (5) resides in $(0, S)$ as long as $c_i \in (0, \frac{S}{2})$, for $i \in \{I, L\}$. It follows immediately that any solution to (5) implies $\hat{c} \in \left(0, \frac{S}{2}\right)$. To complete the proof of part (ii), it remains to show there exists a unique $\hat{R} \in (0, S)$ to solve (5). To do that, first notice that $F_i = \frac{1}{2}\left[\frac{\frac{S^2}{2} - 2c_i^2}{R} + R\right]$. Then, define $\hat{R}_i \equiv \sqrt{\frac{S^2}{2} - 2c_i^2}$ and rewrite (5) as

$$R = \sqrt{x(R)\hat{R}_I^2 + [1 - x(R)]\hat{R}_L^2}. \tag{A2}$$

We now apply a fixed-point argument to show the unique existence of a solution. The order on unit hassle cost $c_I > c_L$ directly implies that $\hat{R}_I < \hat{R}_L$. Now, we show that the right-hand side of (A2) is a monotone decreasing function of R between $(\hat{R}_I, \hat{R}_L)$. To see that, observe that $\hat{R}$ uniquely minimizes F_i (since under Assumption 1 we have $\frac{\partial^2 F_i}{\partial R_i^2} = \frac{2a_i\left(P - \frac{1}{2}a_i\right)}{R_i^3} > 0$). Therefore, F_I is increasing in $(\hat{R}_I, \hat{R}_L)$, while F_L is decreasing. We also have that Γ' is an increasing function, by assumption. Therefore, $x(R) = \frac{(1-q)\alpha\Gamma'(F_L)}{(1-q)\alpha\Gamma'(F_I) + q\Gamma'(F_L)}$ is increasing in R when $R \in (\hat{R}_I, \hat{R}_L)$, but $1 - x(R) = \frac{q\Gamma'(F_L)}{(1-q)\alpha\Gamma'(F_I) + q\Gamma'(F_L)}$ is decreasing. Hence, the right-hand side of (A2) is monotonically decreasing in $R \in (\hat{R}_I, \hat{R}_L)$. This is sufficient to guarantee a unique fixed point $\hat{R}$ that solves (5). This completes part (ii).

Finally, we establish parts (iii) and (iv). If $\hat{R}$ satisfies (A1), then we know it minimizes $\Gamma(F)$ because

$$\frac{\partial^2\Gamma(\mathrm{F})}{\partial R^2} = (1-q)\alpha\left[\Gamma''(F_I)\frac{\partial F_I}{\partial R} + \Gamma'(F_I)\left(\frac{\partial F_I}{\partial R}\right)^2\right] + q\left[\Gamma''(F_L)\frac{\partial F_L}{\partial R} + \Gamma'(F_L)\left(\frac{\partial F_L}{\partial R}\right)^2\right] > 0.$$

Next, we specify the sufficient conditions for the tiered ($\hat{R} > 0$) and the extreme-tiered CSO. If the CSO is tiered, $\hat{R} > 0$ and the expected redress cost $\Gamma_{\hat{R}>0}(F) = (1-q)\cdot \alpha\Gamma(F_I) + q\Gamma(F_L)$; and when CSO is extreme-tiered, $\hat{R} = 0$, the expected redress cost $\Gamma_{\hat{R}=0}(F)(1-q)\alpha\Gamma\left(\frac{P}{2}\right) + q\Gamma\left(\frac{S}{2}\right)$. We first see that $F_I(\hat{R}) < F_L(\hat{R})$ for any R because $F_i(R) = \frac{1}{2}\left[\frac{\frac{S^2}{2} - 2c_i^2}{R} + R\right]$ is decreasing in c_i. Hence, $\Gamma(P/2) < \Gamma[F_I(\hat{R})]$. Immediately, we can see that $\hat{R} = 0$ is optimal since $\Gamma_{\hat{R}>0}(F) > \Gamma_{\hat{R}=0}(F)$. That profit ordering translates to the inequality

$$\frac{1}{2}\left[\frac{\frac{S^2}{2} - 2c_I^2}{\hat{R}} + \hat{R}\right] > \frac{P}{2},$$

and yields the condition $c_I < \hat{c}$. Thus, the condition given in part (iv) is sufficient for the optimality of $\hat{R} = 0$, the extreme-tiered solution. A necessary and sufficient condition for the tiered structure to be optimal is $\Gamma(S/2) > \Gamma[F_I(\hat{R})]$, which yields the condition $c_I > \hat{c}$, as given in part (iii). □

Proof of Corollary 1

The first claim in part (i) follows from the fact that $a_I > a_L$, which is directly implied by Lemma 1 and the ordering $c_L < c_I$. The second claim of part (i) is a direct result of $F_I < F_L$ as shown in the proof of Proposition 1. Part (ii) follows directly from evaluating the derivatives expressed in the corollary. □

Proof of Corollary 2

The result follows from the fixed-point argument used to prove Proposition 1 and observing that $\hat{R}_I$ and $\hat{R}_L$ are both increasing in $w \geq 1$, which can be seen by inspection of (6). □

Proof of Proposition 2

Part (i) is established directly. The solution P^* to the firm's first-order condition,

$$\frac{d\,\Pi}{dP} = 1 - q\Gamma'\left(\frac{\partial\hat{R}}{\partial P}\right) = 0, \tag{A3}$$

is unique if $\frac{d^2\Pi}{dP^2} < 0$. We can show this using Assumption 3 and noting that $\frac{\partial^2\hat{R}_1}{\partial P^2} < 0$:

$$\frac{d^2\,\Pi}{dP^2} = -q\left\{\Gamma''\left(\frac{\partial\hat{R}}{\partial P}\right)^2 + \Gamma'\left(\frac{\partial^2\hat{R}}{\partial P^2}\right)\right\} < -q\Gamma'\left\{\left(\frac{\partial\hat{R}}{\partial P}\right)^2\left(\frac{1}{\hat{R}}\right) + \left(\frac{\partial^2\hat{R}}{\partial P^2}\right)\right\} = -q\Gamma'\left\{\frac{1}{2\hat{R}}\right\} < 0.$$

Part (ii) can be shown using the Implicit Function Theorem applied to the first-order condition (A3). For the variable q, we have

$$\frac{\partial P^*}{\partial q} = -\frac{\frac{\partial^2\,\Pi}{\partial q\partial P}}{\frac{\partial^2\Pi}{\partial P^2}}.$$

We know from part (i) that the denominator is negative. Therefore, the sign of $\partial P^*/\partial q$ has the same sign as

$$\frac{\partial^2\,\Pi}{\partial q\partial P} = -\Gamma'\left(\frac{\partial\hat{R}_1}{\partial P}\right),$$

which is negative. For the variable c, we have

$$\frac{\partial P^*}{\partial c} = -\frac{\frac{\partial^2\,\Pi}{\partial c\partial P}}{\frac{\partial^2\,\Pi}{\partial P^2}}.$$

Knowing that the denominator is negative, we can establish the claim by showing that the numerator is negative:

$$\frac{\partial^2\Pi}{\partial c\partial P} = -q\left\{\Gamma''\frac{\partial\hat{R}}{\partial c}\frac{\partial\hat{R}}{\partial P} + \Gamma'\left(\frac{\partial^2\hat{R}}{\partial c\partial P}\right)\right\} < -q\Gamma'\left\{\frac{\partial\hat{R}}{\partial c}\frac{\partial\hat{R}}{\partial P}\left(\frac{1}{\hat{R}}\right) + \left(\frac{\partial^2\hat{R}}{\partial c\partial P}\right)\right\} = -q\Gamma'\{0\} = 0,$$

which uses Assumption 3 and the fact that $\frac{\partial\hat{R}}{\partial c} < 0$ to obtain the inequality and the explicit functional form of $\hat{R}$ to obtain the subsequent equality. Finally, part (iii) is confirmed by the Envelope Theorem:

$$\frac{\partial\Pi^*}{\partial q} = -\Gamma < 0 \text{ and } \frac{\partial\Pi^*}{\partial c} = -q\Gamma'\left(\frac{\partial\hat{R}}{\partial c}\right) > 0. \quad \square$$

We now establish a set of intermediate results needed for Proposition 3.

Lemma A.1

The set Ψ defined in Assumption 1′ is equivalent to $\Psi = \left(\frac{1}{2\sqrt{q}}, \frac{1}{q}\right)$ under Assumption 3′.

Proof of Lemma A.1

From Assumption 1, $\Psi \equiv \{c \geq 0 | 0 < a < \hat{R}(P^*)\}$. Using equilibrium solutions from Proposition 2 and the simplification $P^* = 2/q$ (implied by Assumption 3′), we can derive the bounds on c such that $0 < a < \hat{R}(P^*)$. The condition $0 < a = P^* - 2c$ requires

$$c < \frac{P^*}{2} = \frac{1}{q} \Leftrightarrow cq < 1,$$

which holds under Assumption 1. The condition $a < \hat{R}(P^*)$ requires

$$P^* - 2c < \sqrt{\frac{P^{*2}}{2} - 2c^2} \Leftrightarrow \frac{P^*}{6} < c < \frac{P^*}{2} \Leftrightarrow \frac{1}{3} < cq < 1.$$

We now derive the bounds on c that guarantee an interior optimum to the CSO's design: $0 < \hat{R}$. This condition follows from the optimality of $\hat{R}$: $F(0, P^*) > F(\hat{R}, P^*)$, equivalently,

$$F(\hat{R}, P^*) = \sqrt{\frac{(P^*)^2}{2} - 2c^2} < \frac{P^*}{2} = F(0, P^*) \Leftrightarrow c > \frac{1}{\sqrt{2}q}.$$

Because $\sqrt{2} < 3$, this latter condition is the lower bound for c. Thus, $\frac{1}{\sqrt{2}q} < c < \frac{1}{q}$ precisely defines the conditions of Ψ. □

Lemma A.2

Define the bound on V as follows:

$$\underline{V}(q, c) \equiv \frac{2}{q(1-q)} - \frac{1}{1-q}\sqrt{\frac{2-2cq}{1+cq}}. \tag{A4}$$

(i) *If $V > \underline{V}(q, c)$, then condition* (7) *holds in equilibrium for all $c \in \Psi$.*

(ii) *$\underline{V}(q, c) < \frac{2}{q(1-q)}$ for all $c \in \Psi$.*

Proof of Lemma A.2

By definition $\underline{V}(q, c) = \frac{P^*}{1-q} - \frac{q}{1-q}\left[F(\hat{R}(P^*), P^*) - \frac{a}{\hat{R}(P^*)}c\right]$. We notice that $F(\hat{R}(P^*), P^*) = \hat{R}(P^*) = \sqrt{\frac{(P^*)^2}{2} - 2c^2}$. Submit $\hat{R}(P^*)$ and $P^* = \frac{2}{q}$ into $\underline{V}(q, c)$ and simplify the expression, we have (A4). Therefore, for all $c \in \Psi$ such that $V > \underline{V}(q, c)$, (7) is satisfied. For part (ii), when $c \in \Psi = \left(\frac{1}{\sqrt{2}q}, \frac{1}{q}\right)$, $(2 - 2cq)$ is strictly positive; therefore, $\underline{V}(q, c) < \frac{2}{q(1-q)}$. □

Proof of Proposition 3

The maximization of $\Pi^*(q) - G(q) = \frac{1+q^2c^2}{q} - \beta\left(\frac{1}{q^3} - 1\right)$ with respect to q implies the first-order condition

$$1 - c^2q^2 - \frac{3\beta}{q^2} = 0,$$

with the two positive solutions:

$$q_1 = \sqrt{\frac{1 - \sqrt{1 - 12c^2\beta}}{2c^2}}$$

and

$$q_2 = \sqrt{\frac{1 + \sqrt{1 - 12c^2\beta}}{2c^2}}.$$

The second-order condition is simply $q^2 < 6\beta$. Therefore, any optimum must satisfy the condition $0 \leq (q^*)^2 \leq 6\beta$. This condition is impossible for q_2 but holds for q_1 under the proposition's condition that $0 < \beta < \frac{1}{12c^2}$. To show part (i), that $q^* \equiv q_1$ is increasing, directly take the derivative:

$$\frac{\partial q^*}{\partial c} = \frac{1 - 6c^2\beta\sqrt{1 - 12c^2\beta}}{c^2\sqrt{2 - 24c^2\beta}\sqrt{1 - \sqrt{1 - 12c^2\beta}}},$$

the denominator of which is positive. The sign of the numerator is also positive under the condition $0 < \beta < \frac{1}{12c^2}$. Hence, q^* increasing in c. Part (ii) follows from the Envelope Theorem:

$$\frac{\partial[\Pi^*(q) - G(q)]}{\partial c} = \frac{\partial}{\partial c}\left[\frac{1 + q^2c^2}{q} - \beta\left(\frac{1}{q^3} - 1\right)\right] > 0. \quad \square$$

Proof of Proposition 4

Offering the CSO is more profitable than not if and only if $\Pi^* = \Pi(P^*; c, q) > \Pi^N$, or equivalently

$$\frac{1 + q^2c^2}{q} > (1-q)V \Leftrightarrow c > \dot{c} \equiv \frac{\sqrt{(1-q)qV - 1}}{q}.$$

Because we know $\underline{V}(q, c) < \frac{2}{q(1-q)}$ by Lemma A.2, there exists values $V \in \left(\underline{V}(q, c), \frac{2}{q(1-q)}\right)$. For such V, we see that $\dot{c} \equiv \frac{\sqrt{(1-q)qV - 1}}{q} < \frac{1}{q}$. Hence, there exists a $\dot{c}$ such that when $c \in \left(\dot{c}, \frac{1}{q}\right) \cap \Psi \neq \emptyset$, $\Pi^* > \Pi^N$. Otherwise, if $q(1-q)V > 2$, we have $\dot{c} > c$ for all $c \in \Psi$, which means $\Pi^* < \Pi^N$. This establishes part (ii). □

Proof of Proposition 5

We first establish that when firms offer a CSO, demand D_j is downward sloping for all $c \in \Psi$. Start by expanding the terms W_j:

$$W_j = q\left[F(R_j, P_j) - \frac{a_j}{R_j}c\right] - P_j = \frac{1}{2}q\left[\frac{1}{2}\frac{a_j^2}{R_j} + R_j\right] - P_j,$$

which uses the substitution that $a_j = P_j - 2c$ and the corresponding simplification of

$$F(R_j, P_j) - \frac{a_j}{R_j}c = \frac{1}{2}\left[\left(P_j + \frac{1}{2}a_A\right)\frac{a_j}{R_j} + (R_j + a_A)\left(1 - \frac{a_j}{R_j}\right)\right] - \frac{a_j}{R_j}c.$$

$$= \frac{1}{2}\left[\left(P_j - \frac{1}{2}a_j - 2c\right)\frac{a_j}{R_j} + R_j\right] = \frac{1}{2}\left[\frac{1}{2}\frac{a_j^2}{R_j} + R_j\right].$$

Therefore, with some simplification, we have an expression for D_j:

$$D_j = \frac{W_j - W_{-j} + t}{2t}$$
$$= \frac{\frac{1}{2}q\left[\frac{1}{2}\frac{a_j^2}{R_j} + R_j\right] - P_j - \frac{1}{2}q\left[\frac{1}{2}\frac{a_{-j}^2}{R_{-j}} + R_{-j}\right] + P_{-j} + t}{2t}$$
$$= \frac{\frac{1}{2}q\left[\frac{2P_j^2 - 4P_jc}{2R_j}\right] - P_j - \frac{1}{2}q\left[\frac{1}{2}\frac{a_{-j}^2}{R_{-j}} + R_{-j}\right] + P_{-j} + t}{2t}.$$

Now we can assess the slope of demand by evaluating the sign of

$$\frac{\partial D_j}{\partial P_j} = -1 - \frac{\sqrt{2}cq}{\sqrt{-4c^2 + P_j^2}} + \frac{\sqrt{2}P_j q}{\sqrt{-4c^2 + P_j^2}} - \frac{P_j^2 q}{\sqrt{2}(2c + P_j)\sqrt{-4c^2 + P_j^2}}. \tag{A5}$$

We show that the maximum value of (A5) is negative for all $c \in \Psi$. The partial derivative with respect to c is

$$\frac{\partial^2 D_j}{\partial P_j \partial c} = \frac{2\sqrt{2}c^2(4c - P_j)q}{(2c - P_j)(2c + P_j)^2\sqrt{-4c^2 + P_j^2}}. \tag{A6}$$

Because the denominator is positive for $c < P_j/2$, we can see that the sign of $4c - P_A$ determines the sign of (A6). Furthermore, $c > \frac{P_j}{4}$ implies $\frac{\partial^2 D_j}{\partial P_j \partial c} < 0$ and $c < \frac{P_A}{4}$ implies $\frac{\partial^2 D_j}{\partial P_j \partial c} > 0$. Therefore, $\frac{\partial D_j}{\partial P_j}$ is maximized at $c = \frac{P_j}{4}$. Hence,

$$\frac{\partial D_j}{\partial P_j} < \frac{\partial D_j}{\partial P_j}\Big|_{c = \frac{P_A}{4}} = -1 - \frac{\sqrt{2}cq}{\sqrt{12c^2}} + \frac{\sqrt{2}4cq}{\sqrt{12c^2}} - \frac{16c^2 q}{\sqrt{2}6c\sqrt{12c^2}}$$
$$= -1 + \frac{3q}{\sqrt{6}} - \frac{4q}{3\sqrt{6}} = \frac{-3\sqrt{6} + 5q}{3\sqrt{6}} < 0,$$

which demonstrates the claim that D_j is downward sloping.

The remainder of the proof proceeds as follows. We first prove the proposition's claims on equilibrium prices and CSO structure if both firms offer a CSO. Subsequently, we establish that if c exceeds a threshold, then each firm offers a CSO in equilibrium. Suppose both firms offer a CSO and that prices (P_A, P_B) were chosen at the beginning of stage 1. The logic in the main text before the proposition's statement establishes that the equilibrium authorization for the CSO's first level minimizes $q\Gamma(F_j)$, which is equivalent to minimizing

$$F_j(R_j, P_j) = \frac{1}{2}\left(\frac{\frac{P_j^2}{2} - 2c^2}{R_i} + R_i\right),$$

and yields the solution given in (10). This is a minimizer because $\partial^2 F_j/\partial R_j^2 > 0$. The subsequent text establishes that the solution to (10) is less than the optimal price P^* for the monopoly firm, which is the solution to (A3) from the proof of Proposition 2. Symmetry of the game implies that the solution P^{**} to (11) is the same for both firms. Thus, we have $P^{**} < P^*$, which implies that $\hat{R}(P^{**}) < \hat{R}(P^*)$ because $\hat{R}(P)$ is increasing in P. Finally, this price maximizes profits for each firm if the second-order condition is satisfied. The second derivative of profits, expressed as

$$\frac{\partial^2 \Pi_j}{\partial P_j^2} = \frac{\partial^2 D_j}{\partial P_j^2}\left[P_j - q\Gamma(F_j)\right] + 2\frac{\partial D_j}{\partial P_j}\left[1 - q\Gamma'(F_j)\frac{\partial F_j}{\partial P_j}\right] - D_j q\left[\Gamma''\left(\frac{\partial F_j}{\partial P_j}\right)^2 + \Gamma'\left(\frac{\partial^2 F_j}{\partial P_j^2}\right)\right], \tag{A7}$$

is shown to be negative for $c \in \left(\frac{P}{4}, \frac{P}{2}\right)$. The first term is negative under this condition on c because

$$\frac{\partial^2 D_j}{\partial P_j^2} = \frac{2c^2(4c - P)q}{(2c - P)(2c + P)^2\sqrt{P^2 - 4c^2}} < 0.$$

The second term of (A7) is negative because demand is downward sloping and the bracketed expression is positive, which can be seen from (11). Finally, it was shown in the proof of Proposition 2 that the bracketed expression of the third term in (A7) is positive. This completes the first part of the proof.

We now show that there exists a $\ddot{c} > 0$ such that offering a CSO is the equilibrium outcome for any $c > \ddot{c}$. Consider an outcome with both firms setting symmetric prices, P. If firm A offers a CSO and B does not, then firm A's demand is

$$\tilde{D}_A = \frac{1}{2} + \frac{\tilde{W}_A}{2t} > \frac{1}{2},$$

where $\tilde{W}_A = q\left[F(\hat{R}) - c\left(\frac{a}{\hat{R}}\right)\right] = \frac{qaP}{2\hat{R}} > 0$. Firm A's profit is then $\tilde{\Pi}_A = \tilde{D}_A[P - q\Gamma(F)]$ or

$$\tilde{\Pi}_A = \left[\frac{1}{2} + \frac{qaP}{2\hat{R}}\right]\left[P - \frac{q\hat{R}^2}{2}\right] = \frac{P}{2} + \frac{qaP^2}{2\hat{R}} - \frac{q\hat{R}^2}{2}\left(\frac{1}{2} + \frac{qaP}{2\hat{R}}\right).$$

Firm B's profit is bounded by $P/2$ because $\tilde{\Pi}_B = (1 - \tilde{D}_A)P < P/2$. We can show that as $c \uparrow P/2$, we have $\tilde{\Pi}_A > P/2$. That is,

$$\tilde{\Pi}_A > \frac{P}{2} \Leftrightarrow P^2 > 2t\frac{\hat{R}^3}{a}\left[\frac{1}{2} + \frac{qP}{2}\left(\frac{a}{\hat{R}}\right)\right].$$

The expression on the right-hand side in the above condition converges to zero as $c \to P/2$. This is verified by applying L'Hôpital's Rule to the following limits:

$$\lim_{c \to P/2}\frac{\hat{R}^3}{a} = \lim_{c \to P/2}\frac{6c\hat{R}}{2} = \lim_{c \to P/2} 3c\sqrt{\frac{P^2}{2} - 2c^2} = 0,$$

and

$$\lim_{c \to P/2}\frac{a}{\hat{R}} = \lim_{c \to P/2}\frac{-2}{-2c\hat{R}^{-1}} = 0.$$

Therefore, by continuity, there exists a $\ddot{c}(P)$ such that $\tilde{\Pi}_A > \frac{P}{2} > \tilde{\Pi}_B$ for any symmetric prices $P > 0$ and $c > \ddot{c}(P)$. This implies that for any symmetric prices, offering a CSO is a dominant strategy. Define $\ddot{c} \equiv \max\left\{\frac{P^{**}}{4}, \ddot{c}(t), \ddot{c}(P^{**})\right\} < \frac{P^{**}}{2}$, which collects the condition on (A7) above as well as the two symmetric equilibrium prices when both firms offer a CSO ($P = P^{**}$) and both not offering a CSO (the subgame of which is the simple Hotelling model without a CSO and has equilibrium prices of t). □

Proof of Corollary 3

To show part (i), simply apply the definition at an arbitrary price:

$$RS(\hat{R}(P), P) = \frac{F(\hat{R}, P)}{P} = \frac{\sqrt{\frac{P^2}{2} - 2c^2}}{P},$$

which uses the fact that $F(\hat{R}, P) = \hat{R}(P)$ in equilibrium of the duopoly and monopoly. This is clearly an increasing function of P. The claim is established by the ordering $P^{**} < P^{*}$.

To show part (ii), we differentiate the expected hassle cost, $c\frac{a_j}{\hat{R}_j}$ with respect to price, P:

$$\frac{d}{dP}\left\{c(P-2c)\left[\frac{P^2}{2}-2c^2\right]^{-\frac{1}{2}}\right\} = \frac{2\sqrt{2}c}{(2c+P)\sqrt{P^2-4c^2}}.$$

This derivative is clearly positive, which implies that expected hassle cost is increasing in price. Part (ii) follows directly from the ordering on equilibrium prices. □

Endnotes

[1] Based on interviews with call center managers.

[2] Desmarais (2010) reports that for a typical call center, an average of 1.43 customer calls are needed to resolve a given complaint.

[3] See Brady (2000) and Spencer (2003) for anecdotal accounts and survey results indicating that more than two-thirds of callers are upset with the way their complaints are handled.

[4] For instance, Delta Airlines, listed as one of the worst companies for customer service by *Business Insider*, claims that “Delta Airlines is committed to the highest standards of customer service” (Nisen 2013).

[5] See Gans et al. (2003) or Aksin et al. (2007) for an overview.

[6] Despite the occasional reference to an agent (at the first level of the CSO) and a manager (at the second level), we do not utilize a principal–agent framework or apply a traditional contract theory approach to organizational design. Instead, our model focuses on the customer’s microeconomic incentives within the complaint process and how the CSO affects this process.

[7] One related work from the economics literature (Liang 2013) shows how the firm can exploit hassle costs to ensure that complaints hold credible information about the level of quality.

[8] Relatedly, Gerstner et al. (2015) suggest that service failure may be optimally embedded in product design to profit from consumers who buy protection from such failures.

[9] We emphasize that our model does not consider the firm’s contracting problem with the CSO, its agents, or its manager. Our notion of organizational design focuses on the customer’s complaint process, as implied by (R, S), and the CSO’s role in screening claims. Furthermore, our occasional use of the “agent” or “manager” is used to help interpret that process and is not studied from a principal–agent framework.

[10] We make a distinction between *unit* hassle costs, which are incurred if and only if the customer escalates her claim, and *expected* hassle costs, which are unit hassle costs times the probability that she escalates the claim. The former is an exogenous parameter and the latter is endogenous.

[11] A customer could be subjected to concerns of fairness when reacting to her received offer of r_1. The economics of fairness would suggest that the customer obtains disutility when receiving an offer such that the split is not deemed equitable. For example, if the customer perceives that the firm is solely at fault for the product failure, she would consider any $r_1 < S$ inequitable. Incorporating this aspect for a given hassle cost $c > 0$ would induce the customer to escalate with a higher probability and induce the firm to raise R higher than that derived in Lemma 1. We thank for an anonymous reviewer for pointing this out.

[12] Using (2), the condition $a \geq 0$ gives $c \leq S/2$. And from (5) and the inequality, $a \leq R$, we have $2c \leq S \leq 6c$, which implies the stated condition.

[13] We consider the hassle cost of the escalation only. There may be hassle costs when making the initial claim as well. This consideration tends to reinforce the tiered structure of the CSO. Specifically, if one incorporates initial hassle costs, then consumers with lower unit hassle cost are more likely to contact the CSO. As long as c is lower than $S/2$, the conditions of Proposition 1 part (ii) imply an extreme-tiered or tiered CSO, respectively.

[14] In the online appendix, we considered the case of endogenous redress policy limit where $S(P) \neq P$.

[15] This restriction does not change any of the results as long as $S(P)$ is an increasing function of the sale price.

[16] The fixed demand assumption is a technical assumption that permits closed-form solutions. In the online appendix, we study the case of a downward-sloping demand curve when the firm chooses price and redress policy, (P, S), before setting the authorization limit R. As we show, under reasonable conditions, the firm maximizes profits by using a tiered CSO (i.e., $\hat{R}(S) < S$).

[17] As is shown in Proposition SA1 of the online appendix, a tiered CSO structure (i.e., $\hat{R} < P$) also arises in equilibrium with a linear cost function Γ and downward-sloping demand curve.

[18] The subsequent results are not reliant on this specification of Γ. Numerical analyses supporting this claim are available in the online appendix.

[19] Proof that demand D_j is downward sloping is given in the appendix.

References

Aksin Z, Armony M, Mehrotra V (2007) The modern call center: A multi-disciplinary perspective on operations management research. *Production Oper. Management* 16(6):665–688.

Anderson E, Hansen K, Simester D (2009) The option value of returns: Theory and evidence. *Marketing Sci.* 28(3):405–423.

Barlow J, Møller C (2008) *A Complaint Is a Gift: Recovering Customer Loyalty When Things Go Wrong* (Barnett-Koehler Publishers, San Francisco).

Bearden WO, Teel J (1983) Selected determinants of consumer satisfaction and complaint reports. *J. Marketing Res.* 20(1):21–28.

Borowski C (2015) The impact of demographics on live chat customer service. Accessed April 2, 2019, https://www.softwareadvice.com/resources/demographics-impact-live-chat-customer-service/.

Brady D (2000) Why service stinks. *Bloomberg* (October 23), https://www.bloomberg.com/news/articles/2000-10-22/why-service-stinks.

Chen RR, Gerstner E, Yang Y(C) (2012) Customer bill of rights under no-fault service failure: Confinement and compensation. *Marketing Sci.* 31(1):157–171.

Consumer Reports (2011) Women get more annoyed than men with aspects of bad customer service. *Consumer Reports* (June 13), https://www.consumerreports.org/cro/news/2011/06/women-get-more-annoyed-than-men-with-aspects-of-bad-customer-service/index.htm.

Cooper R, Ross TW (1985) Product warranties and double moral hazard. *RAND J. Econom.* 2(1):103–113.

Davis S, Gerstner E, Hagerty M (1995) Money back guarantees in retailing: Matching products to consumer tastes. *J. Retailing* 71(1):7–22.

Desmarais, Mike (2010) The call center’s main purpose is to retain customers. *Cost Management* (September–October):29–34.

de Véricourt F, Zhou Y-P (2006) On the incomplete results for the heterogeneous server problem. *Queueing Systems* 52(3):189–191.

Federal Trade Commission (2016) Combating fraud in African American & Latino communities: The FTC’s comprehensive strategic plan: A report to Congress. Report, Federal Trade Commission, Washington, DC.

Ferguson M, Daniel V, Guide R Jr, Souza GC (2006) Supply chain coordination for false failure returns. *Manufacturing Service Oper. Management* 8(4):376–393.

Fornell C, Wernerfelt B (1987) Defensive marketing strategy by customer complaint management: A theoretical analysis. *J. Marketing Res.* 24(4):337–346.

Fornell C, Wernerfelt B (1988) A model for customer complaint management. *Marketing Sci.* 7(3):287–298.

Fudenberg D, Maskin E (1986) The folk theorem in repeated games with discounting or with imperfect public information. *Econometrica*. 54:533–556.

Gans N, Koole G, Mandelbaum A (2003) Telephone call centers: Tutorial, review and research prospects. *Manufacturing Service Oper. Management* 5(2):79–141.

Gerstner E, Libai B (2005) Why does poor service prevail? *Marketing Sci*. 35(6):601–603.

Gerstner E, Halbheer D, Koenigsberg O (2015) The protection economy: Occasional service failure as a business model. Working Paper MKG-2015-1124, HEC Paris, Paris, France.

Gümüş M, Ray S, Yin S (2013) Returns policies between channel partners for durable products. *Marketing Sci.* 32(4):622–643.

Heal G (1977) Guarantees and risk sharing. *Rev. Econom. Stud.* 44(3): 549–560.

Hirschman AO (1970) *Exit, Voice and Loyalty* (Harvard University Press, Cambridge, MA).

Homburg C, Fürst A (2005) How organizational complaint handling drives customer loyalty: An analysis of the mechanistic and the organic approach. *J. Marketing* 69(July):95–114.

Hviid M, Shaffer G (1999) Hassle costs: The Achilles' heel of price-matching guarantees. *J. Econom. Management Strategy* 8(4):489–521.

Knox G, van Oest R (2014) Customer complaints and recovery effectiveness: A customer base approach. *J. Marketing* 78(5):42–57.

Kreps DM, Wilson R (1982) Reputation and imperfect information. *J. Econom. Theory* 27:253–279.

Lambrecht A, Tucker C (2012) Paying with money or effort: Pricing when customers anticipate hassle. *J. Marketing Res.* 49(1):66–82.

Laux V (2008) On the value of influence activities for capital budgeting. *J. Econom. Behav. Organ.* 65(3–4):625–635.

Liang P (2013) Exit & voice: A game-theoretic analysis of customer complaint management. *Pacific Econom. Rev.* 18(2):177–207.

Lutz N, Padmanabhan V (1995) Why do we observe minimal warrantees. *Marketing Sci.* 14(4):417–441.

Ma L, Sun B, Kekre S (2015) The squeaky wheel gets the grease—An empirical analysis of customer voice and firm intervention on Twitter. *Marketing Sci.* 34(5):627–645.

Matthews S, Moore J (1987) Monopoly provision of quality and warranties—An exploration in the theory of multidimensional screening. *Econometrica* 55:441–467.

Milgrom P, Roberts J (1982) Predation, reputation, and entry deterrence. *J. Econom. Theory* 27:280–312.

Moorthy S, Srinivasan K (1995) Signaling quality with a money-back guarantee: The role of transaction costs. *Marketing Sci.* 14(4): 442–466.

Narasimhan C (1984) A price discrimination theory of coupons. *Marketing Sci.* 3(2):128–147.

Nisen M (2013) The 15 worst companies for customer service. *Business Insider* (January 8), https://www.businessinsider.com/15-worst-companies-for-customer-service-2013-1.

Ofek E, Katona Z, Sarvary M (2011) "Bricks and clicks": The impact of product returns on the strategies of multichannel retailers. *Marketing Sci.* 30(1):42–60.

Padmanabhan V, Rao R (1993) Warranty policy and extended customer service contracts: Theory and an application to automobiles. *Marketing Sci.* 12(3):230–247.

Raval D (2016) What determines consumer complaining behavior? Working paper, Federal Trade Commission, Consumer Protection Division, Washington, DC.

Shulman J, Coughlan AT, Canan Savaskan R (2010) Optimal reverse channel structure for consumer product returns. *Marketing Sci.* 29(6):1071–1085.

Simester D, Zhang J (2014) Why do salespeople spend so much time lobbying for low prices? *Marketing Sci.* 33(6):796–808.

Spencer J (2003) Cases of 'customer rage' mount with service problems on hold. *Wall Street Journal* (September 17), https://www.wsj.com/articles/SB106374907777835000.

Tuttle B (2013) You probably spent 13 hours on hold last year. *Time* (January 24), http://business.time.com/2013/01/24/you-probably-spent-13-hours-on-hold-last-year.

Wang H (2004) Do returns policies intensify retail competition? *Marketing Sci.* 23(4):611–613.

Wolinsky A (1986) True monopolistic competition as a result of imperfect information. *Quart. J. Econom.* 101(3):493–512.