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Sales Talk, Cancellation Terms and the Role of Consumer Protection

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This article analyses contract cancellation and product return policies in markets in which sellers advise customers about the suitability of their offering. When customers are fully rational, it is optimal for sellers to offer the right to cancel or return on favourable terms. A generous return policy makes the seller's "cheap talk" at the point of sale credible. This observation provides a possible explanation for the excess refund puzzle and also has implications for the management of customer reviews. When customers are credulous, instead, sellers have an incentive to set unfavourable terms to exploit the inflated beliefs they induce in their customers. The imposition of a minimum statutory standard improves welfare and consumer surplus when customers are credulous. In contrast, competition policy reduces contractual inefficiencies with rational customers, but it is not effective with credulous customers.

Key words: Cheap talk, Advice, Marketing, Credulity, Contract cancellation, Refund, Return policy, Consumer protection.

JEL Codes: D18, D83, L15, L51

1. INTRODUCTION

It is often said that insurance plans and annuities are "sold, not bought". In retail as well as business-to-business transactions, buyers of complex service plans and durable products rely on the advice of sellers about the suitability of the offering for their particular needs and preferences. But is this "sales talk" credible?

Serious concerns are commonly voiced that buyers might later regret purchases that turn out to be unsuitable. In an attempt to protect consumers, regulators in a number of markets have set limits on the permissible penalties for cancellation of long-term contracts and have mandated cooling-off periods. At the same time, sellers of consumer products that operate online or in other unregulated markets often voluntarily offer very generous return policies and cancellation terms. In which markets should trade and cancellation terms be regulated, and how?

This article proposes a model to address these questions depending on the strategic sophistication of buyers. After characterizing the sellers' advice strategy as well as the optimal pricing and cancellation terms offered in equilibrium, we contrast the effectiveness of different forms of policy intervention. We show that consumer protection remedies are effective for channels populated by overly credulous buyers, but they can have unintended consequences when (most) buyers rationally understand the seller's strategic incentives for inflated sales talk. By contrast, we find that competition policy increases contractual efficiency when customers are rational, but it is ineffective when customers are predominantly credulous.

Our model features a seller who first commits to a contract specifying a purchase price and a refund for cancellation. After eliciting interest, often through direct marketing techniques such as an unsolicited phone call or a visit at the buyer's doorstep, at the point of sale the seller has access to some pre-sale informative signal about the utility the customer will eventually enjoy from consumption. The seller advises the customer by communicating a "cheap talk" message, on the basis of which the customer decides whether to sign the contract. Following the purchase, the customer experiences the product's utility and decides whether to retain the purchase or to cancel the contract (forgoing the utility but obtaining a refund). Cancellation results in a loss of the setup cost, so that experimentation through purchase and cancellation is costly. Thus, communication of the seller's pre-sale signal allows savings in the setup cost of experimentation.

When the customer is rational and fully understands how the contractual terms affect the seller's incentives for communication, sellers are able to partly align their interests with buyers' interests by granting generous terms for contract termination upon cancellation of the service agreement (or return of the physical product). This result hinges on the following logic. After signing the contract and learning the final utility through usage or experience, the buyer has the option to terminate the service agreement prematurely (or to return the product), according to the contractual terms initially specified by the seller. When this early termination imposes a loss on the seller, taking into account the savings in service cost (or the product's salvage value), the contractual terms credibly commits the seller to provide valuable advice.

Formally, the commitment value is based on the fact that the cheap talk equilibrium at the advice stage is determined by the incentives for a seller at the margin of indifference to advise for or against a purchase. Given the correlation of the seller's signal with the buyer's utility, the marginal buyer who is advised to purchase must believe that eventual cancellation is more likely than the seller correctly perceives on average. In this sense, in the cheap talk equilibrium, a rational buyer *overestimates* the probability of cancellation compared to the seller.

When setting the contractual terms, the seller trades off *ex post* inefficiency (by inducing the buyer to exercise the option of early termination too often) for *ex ante* inefficiency (so as to be able to communicate information more effectively at the advice stage when purchase is made). At the *ex ante* stage, some buyers are advised to purchase even when the seller *knows* that the expected social surplus from a transaction is negative. At the *ex post* stage, some buyers end up cancelling the contract or returning the product even though, at that point, it would be efficient not to do so. Thus, the seller's optimal policy involves too many early cancellations or returns *both* because too many buyers sign up initially *and* because buyers for whom an initial purchase was efficient end up opting too often for the refund.

In spite of these inefficiencies, we show that simply imposing a binding restriction on the seller's refund policy is counterproductive and further reduces efficiency, provided that buyers rationally anticipate the seller's incentives to inflate expectations. Instead, competition policy is effective. Intuitively, a reduction in the seller's maximum feasible margin reduces the seller's incentives to provide unsuitable advice. Therefore, when the buyer's outside option improves, the seller's need to distort contractual terms to ensure commitment is also reduced.

The logic of the upward distortion in cancellation terms in markets with rational buyers is reversed when buyers are credulous, and thus take the seller's inflated sales talk at face value. When deciding on the initial purchase, credulous buyers are induced to *underestimate* the probability of cancellation compared to the seller. The seller best exploits the buyer's inflated perceptions by offering overly restrictive cancellation terms. When the seller has sufficient market power, the buyer is left with a negative true consumer surplus. For channels populated by credulous buyers, consumer protection policies that impose a minimum statutory right of cancellation become effective by making contractual terms more efficient and lowering consumer exploitation. In contrast, competition policy becomes ineffective because it fails to address the fundamental source of inefficiency.

Broadly consistent with the predictions of our model, policy makers regularly impose "cooling-off rules" for purchases that require an active marketing effort by sellers and for which buyers learn their utility only after purchase, as in the case of doorstep sales.[1] Similarly, "unconditional refund periods" are commonly imposed for the sale of life insurance policies and annuity contracts (typically sold following advice) and are often combined with suitability rules.[2] Finally, regulations of cancellation terms and "free look periods" tend to cover retail channels populated by potentially more credulous or generally less wary buyers who can easily fall prey to aggressive marketing techniques.[3] However, we do not know of any systematic empirical study of existing regulations on cancellation rights.[4]

Even though we present our model mainly in terms of termination for long-term service contracts, our results apply equally to refunds for returns of (durable) physical products. Thus, we contribute to the marketing literature on the option of product returns; see, for example, Davis *et al.* (1995) and Anderson *et al.* (2009).[5] With these models we share the possibility that buyers use refunds to try out new products, but in addition we explore two new roles of refunds: commitment (leading to high refunds with rational customers) and exploitation (leading to excessively low refunds with credulous customers).

The literature has suggested a number of complementary mechanisms to explain the excess refund puzzle. For example, Che (1996) shows that sellers find it optimal to insure risk-averse buyers by offering generous refund policies. When buyers differ in their privately known *ex ante* valuation, Courty and Li (2000) show that a monopolist optimally uses a menu with an inefficiently high refund for all but the highest type.[6] Matthews and Persico (2007) investigate how sellers can use refunds to screen buyers with different costs of early information acquisition and to affect the buyers' costs of learning products' values. Instead, in our model buyers have no pre-existing private information and are *ex ante* identical, thus sellers use refunds not as a screening device,

1. In the USA, the Federal Trade Commission requires sellers concluding transactions away from their premises to give buyers three days to cancel purchases of $25 or more, with the exception of some goods (such as arts or crafts) or services that are subject to other regulation (such as insurance). In the E.U., the "Doorstep Selling" Directive 85/577/EEC protects consumers who purchase goods or services during an unsolicited visit by a seller at their doorstep (or otherwise away from the seller's business premises). This regulation provides a cooling-off period of seven days, enabling the buyer to cancel the contract within that period and making the contract unenforceable if the buyer is not informed in writing of this right. Similar regulations are in place in most industrialized countries. For additional details see Annex E of Office of Fair Trading (2004) and Howells and Weatherill (2005).

2. Insurance Commissioners in many U.S. states have adopted a model regulation issued by the National Association of Insurance Commissioners that mandates an unconditional refund period (typically of thirty days) for life insurance and annuity replacements.

3. Similarly, New York State Bill A8965 extends the mandatory "free look" period (during which the insured may pull out of an insurance contract and obtain a refund) from thirty to ninety days for contracts that cover an insured who is 65 years of age or older on the effective date of coverage.

4. See Stern and Eovaldi's (1984) Chapter 8 for an introduction to the legal aspects related to sales promotion and personal selling practices. Some European countries also impose restrictions on the clauses governing early cancellation (*e.g.* in the form of a maximum penalty) for some long-term utility contracts, such as electricity. For a comprehensive list of relevant regulations in California, see http://www.dca.ca.gov/publications/legal_guides/k-6.shtml.

5. A seller's incentives to provide buyers with match-specific information is also analysed by Johnson and Myatt (2006), Bar-Isaac *et al.* (2010), and Ganuza and Penalva (2010).

6. Inderst and Tirosh (2012) show that with quality differences, a firm with a lower quality than its rival may, instead, offer excessively low refunds to screen its customers.

but as a tool for self-commitment or for exploitation.[7] Rather than to situations in which sellers price discriminate between privately informed buyers, our model applies to markets with advice where either consumers are not regular buyers or products are sufficiently complex.

In our model, there is scope for saving the setup cost depending on the seller's *ex ante* information and for saving the provision cost depending on the buyer's *ex post* information. Thus, our mechanism is also different from Grossman's (1981) model of signalling of quality through product warranties or from theories of seller moral-hazard in quality provision (*e.g.* Mann and Wissink, 1990).

The role of advice is key throughout our analysis, which builds on a model of strategic information transmission (Crawford and Sobel, 1982; Green and Stokey, 2007; and Pitchik and Schotter, 1987). Here, we embed advice in a trading environment and fully endogenize the advisor's bias through a prior contracting stage. In another paper in this vein, Inderst and Ottaviani (2009) focus on the different problem of optimal provision of incentives for a sales agent who performs the two tasks of exerting sales effort (subject to hidden action) and providing advice (subject to hidden information). While in Inderst and Ottaviani (2009) the seller bears an exogenous penalty when providing unsuitable advice, in the model analysed here the penalty for unsuitable advice is endogenously determined through the cancellation terms specified by the contract.[8]

Finally, we model credulity in the communication game by positing that the customer takes the seller's message at face value, as proposed by Ottaviani and Squintani (2006) and Kartik *et al.* (2007).[9] Spence (1977) provides an early analysis of market outcomes when consumers misperceive quality—in our setting, such misperceptions are induced by the seller rather than being exogenous.[10] Our analysis of pricing with credulous consumers is related to recent work on contracting with boundedly rational agents by DellaVigna and Malmendier (2004); we add an analysis of the interaction of contracting with the incentives to induce (possibly incorrect) beliefs through communication. The rationale for a minimum refund in our model is different from that suggested by models building on buyers' projection bias (Loewenstein *et al.*, 2003). While buyers who are unaware of their own *upward biased* perception at the time of purchasing must be protected from themselves, only credulous buyers must be protected from the seller in our model.

The article proceeds as follows: Section 2 introduces the model. Section 3 analyses the benchmark case with rational buyers who understand the seller's biased incentives at the advice stage and, consequently, form rational expectations about the quality of advice. Section 4 turns to the case in which all buyers are credulous and put full faith into the seller's advice. Section 5 studies the effectiveness of consumer protection and competition policies. Section 6 concludes.

7. The commitment role of return policies is also key in Hendel and Lizzeri's (2002) and Johnson and Waldman's (2003) models of leasing under asymmetric information. While in those models the redemption price set by the seller affects the quality of products returned and, therefore, the informational efficiency in the second-hand market, in the present model the refund (or price for continuing service) offered by the seller affects the seller's own incentives to report information.

8. In their analysis of how competing sellers strategically set commissions, Inderst and Ottaviani (2012a) consider alternative foundations for the suitability concern; for example, it could derive from losses in future business in a dynamic environment.

9. Inderst and Ottaviani (2012b), instead, analyse the compensation structure for advice when buyers are naïve about the advisor's incentives because they believe the advisor is unbiased. Thus, buyers are subject to a different behavioural biases in the two models; also the two models address different questions.

10. See also Milgrom and Roberts (1986) for a pioneering analysis of the impact of strategic sophistication on information disclosure, in a model where information is instead verifiable.

2. MODEL

The key feature of our baseline model is that at the time of the initial encounter between a seller and a potential customer, the seller has better information about the suitability of the service (or product) for the customer's specific needs and preferences. The efficiency of the initial purchase decision, thus, depends on the quality of the seller's advice. After the contract is signed, the customer learns about the product's suitability. The contract specifies the terms under which customers can ask for a refund upon terminating the contract prematurely. Cancellation or return triggered by early contract termination allows the seller to either avoid the costs of continued service or, equivalently, to realize a salvage value for the product.

Timing: For concreteness, we focus on the provision of a long-term service contract. We envisage a seller that designs a contract at $t=0$ before meeting individual customers, as is realistic in many markets in which advice is given at the point of sale.[11] At the sale stage, the seller (acting often through a sales agent) is frequently committed to a particular contract and termination policy as stipulated, for instance, in the prewritten contractual terms.[12] Hence, in our setting the contact with an individual customer is not used to achieve first-degree price discrimination by subsequently adjusting the contract, but is used only to provide specific advice. While we initially consider a single contract (to be defined shortly), Section 3.3 shows conditions that guarantee that this restriction is without loss of generality.

When encountering a customer at $t=1$, the seller advises the customer. It is then up to the customer to decide whether to sign a given contract. If no contract is signed, the game ends. Otherwise, at $t=2$, the customer can decide to terminate the contract early, according to some specified terms. If the contract is not cancelled, it expires at $t=3$, at which point the customer obtains utility u. There is risk neutrality, no discounting, and utilities of seller and customer are additively separable in money.

The seller bears a cost c to set up the service agreement with the customer at $t=2$. In addition, the seller bears a cost equal to k for continuing the service up to maturity ($t=3$).[13] From an *ex ante* perspective, the customer's utility from the product, u, is distributed according to $G(u)$ over $U:=[\underline{u},\overline{u}]$, with $0\leq\underline{u}<\overline{u}$ and $g(u)>0$ for all $u\in U$. We assume that for low-utility realizations it is inefficient to continue (and, thus, also to initiate) a contract, while for high-utility realizations it is efficient to initiate a contract and serve it until maturity:

$$\underline{u}<k \quad \text{and} \quad \overline{u}>k+c. \tag{1}$$

Contracts: A contract can stipulate separate payments that must be made if the contract is terminated early (at $t=2$) and if the contract is served to maturity ($t=3$). It is convenient to

11. A game of signalling would result if, instead, the contract was offered only at $t=1$, after the seller had privately obtained the pre-sale signal s on which advice is based. As discussed at the end of this section, we consider two types of customers. With credulous customers, the analysis would be unchanged if the timing was altered in this way. Instead, while we could still support the characterized (pooling) outcome for a signalling game with rational customers, additional (perfect Bayesian) equilibria would also emerge. The application of standard refinement criteria would fail because our model does not satisfy the single-crossing property, as explained in Section 3.3.

12. The seller could hire an agent to meet and advise customers. The results we derive below clearly apply immediately to the case in which the agent has the same payoff function as the seller, so that there are no agency distortions. We conjecture that this model can be extended to allow for agency distortions by applying Inderst and Ottaviani's (2009) analysis of optimal incentive provision for a sales agent with limited wealth.

13. To keep expressions simple, we stipulate that the customer realizes utility from the long-term contract only at maturity ($t=3$). If part of this utility accrues already at $t=2$, the expressions for profits and consumer utility would contain an additional term, but our qualitative results would not be affected.

specify a payment, p, that is due for the whole contractual period and that the customer must make upon signing the contract (at $t=1$), and a refund q that is paid to the customer in the case of early termination (at $t=2$).

As noted above, our setup applies equivalently to return policies for physical products and to provision contracts for services. In our baseline application to supply service agreements, the initial payment is $p-q$, the setup cost is c, the completion payment is q, and the service cost is k. Thus, if the contract terminates early, the customer's net payoff is $q-p$ and the seller's net payoff is $(p-q)-c$. If the contract is completed, the customer's net payoff is $u-p$ while the seller's net payoff is $p-(c+k)$. The seller's *total margin* for sale and retention, $p-(c+k)$, can be split into an *initial margin* of $(p-q)-c$ (for sale at $t=1$) and a *retention margin* of $q-k$ (for retention at $t=2$).

Equivalently, in the application to product returns, the seller incurs total production costs equal to $c+k$, and the product is sold at price p at $t=1$; following a return at $t=2$, the seller pays a refund q to the customer and realizes a salvage value of k. If the product is retained, the customer's net payoff is $u-p$ and the seller's net payoff is $p-(c+k)$. If the product is returned, the customer's net payoff is $q-p$ and the seller's net payoff is $(p-q)-c$. In this formulation, c is equal to the difference between the product's full cost and its salvage value and, therefore, measures the loss in surplus when the product is returned. The net payment to the seller following a return, $p-q$, can be re-interpreted as the restocking fee.

Note that our contractual game grants the buyer the final choice between entering into a contractual relationship or not. In particular, we do not allow for a mechanism that would require the customer to make payments that are not conditional on provision of the good or service and that are made before the seller makes a recommendation. Such payments, akin to entry fees, are rarely observed; they could also give rise to additional agency problems (for example, because non-serious sellers could earn strictly positive profits without providing any good). See Section 3.3 for a further discussion and a more general mechanism design approach.

Information and Game of Advice: At $t=2$, provided a contract has been initiated, the customer observes u, though our results extend to the more general case in which the customer receives only a noisy signal that satisfies standard monotonicity properties.[14] Recall that at this stage the customer can decide whether to terminate the contract early, thereby being refunded the sum q from the initial price p.

At $t=1$, the seller privately observes a signal $s\in S:=[\underline{s},\overline{s}]$. The signal is generated from the continuous distribution $H(s|u)$, which for simplicity has full support for all $s\in S$ and satisfies the Monotone Likelihood Ratio Property (MLRP): a higher signal, s, indicates a higher consumption value, u. As is well known, this implies that the seller's posterior belief distributions, $\Psi(u|s)$, with densities derived from Bayes' rule

$$\psi(u|s)=\frac{h(s|u)g(u)}{\int_U h(s|\widetilde{u})g(\widetilde{u})d\widetilde{u}}, \tag{2}$$

are ranked by First Order Stochastic Dominance (FOSD). From an *ex ante* perspective, the probability density of signal s is $f(s):=\int_U h(s|u)g(u)du$, with distribution $F(s)$.

To reduce case distinctions and to focus on the most revealing case, we stipulate that the signal s is perfectly informative at the boundaries. The posterior distributions following the most extreme signals, $\Psi(u|\underline{s})$ and $\Psi(u|\overline{s})$, are then degenerate and assign probability mass one to $\underline{u}$ and $\overline{u}$, respectively. This property is ensured when the conditional signal distributions are themselves

14. Cf. also footnote 16.

degenerate at the boundaries:

$$H(\underline{s}|\underline{u})=1 \quad \text{and} \quad H(s|\overline{u})=0 \quad \text{for } s<\overline{s}. \tag{3}$$

We model advice as a game of cheap talk. After observing s, the seller can send any message $\widehat{s}\in S$ to the customer. The customer then decides whether to initiate a contract.

Efficiency Benchmark and its Implementation: For the purpose of our welfare analysis, the efficiency criterion is the maximization of social surplus, defined as the sum of the seller's profits and the consumer surplus realized by the customer. The first-best benchmark is described as follows. Provided a contract has been initiated, it is efficient to continue at $t=2$ if and only if $u\geq k$. When, instead, $u<k$ holds, the customer's utility from continuation is strictly below the seller's costs of servicing the customer. Thus, the first-best continuation rule is characterized by the cutoff k. When this cutoff rule is applied at $t=2$ so that the *ex post* cancellation decision is efficient, it is *ex ante* efficient at $t=1$ to initiate a contract if at the available signal s it holds that

$$\int_k^{\overline{u}} (u-k)\,\psi(u|s)du \geq c. \tag{4}$$

The left-hand side represents the *option value* of the information obtained from a purchase, given that at $t=2$ the contract will be terminated when $u<k$.[15] The right-hand side represents the cost of experimentation due to the setup cost for the service (or, equivalently, the difference between the product's full cost and its salvage value).

Given (1), and by assumption (3) that the signal is sufficiently informative at the boundaries, condition (4) has an interior solution, $\underline{s}<s_{FB}<\overline{s}$, where it is satisfied with equality. Given that $\Psi(u|s)$ satisfies FOSD and $\max\langle u-k,0\rangle$ is an increasing function of u, s_{FB} is the uniquely optimal *ex ante* cutoff. At s_{FB} the social surplus that is expected *ex ante* from a transaction is equal to zero.

To streamline the exposition further, we focus on the case where the seller's advice is necessary to generate positive social surplus:

$$\int_k^{\overline{u}} (u-k)g(u)du < c. \tag{5}$$

Recalling that $G(u)$ denotes the unconditional distribution of the customer's utility u, the term on the left-hand side of (5) captures the maximum (expected) social surplus that can be realized without advice. Note that this is calculated under the specification that the cancellation decision is efficient.

The model does not allow for *ex ante* private information at stage $t=0$. The first-best outcome is then easily obtained as follows. Take the contract with price $p=c+k$ and refund $q=k$. With this contract, for *all* signals, the seller is indifferent between initiating a contract and not initiating it. The initial price p just covers the costs from serving the contract to maturity, $c+k$. When the contract is terminated prematurely, the refund q exactly matches the cost savings k. Suppose

15. In this sense, the costs c can also be interpreted as a cost of experimentation. As a further alternative, initiating a contract without the option of termination could save on costs, *e.g.* by reducing the initiation costs from c to $c-\Delta$. For high enough s it would then be efficient to trade without the option of termination. However, as will become immediate from our subsequent analysis, provided that the seller makes positive profits, following the seller's advice it would not be incentive compatible for the buyer to choose no experimentation for some signals and no purchase for some other signals.

the indifferent seller truthfully communicates the observed signal: $\widehat{s}=s$. Given that this contract makes the customer the residual claimant of the social surplus, the customer initially signs the contract only when hearing from the seller that $s \geq s_{FB}$; subsequently, the customer does not terminate early only when observing $u \geq k$. Through this contract, the customer extracts the full gains from trade, while the seller makes zero profits.

In what follows, there are two reasons why the outcome obtained in equilibrium fails to be first-best efficient. The first reason is market power, given that at $t=0$ the right to design the contract rests with the seller, not with the customer. We show how this results in inefficient contract initiation and contract termination. The second reason for inefficiency is a possible deviation from customer rationality, to which we now turn.

Customer Rationality: We contrast two specifications for the rationality of the customer. Section 3 considers the case with rational customers, whose expectations correctly take into account the seller's incentives to send different messages. Section 4 turns to credulous customers who have a naïve understanding of the strategic situation and, thus, believe at face value *any* message $\widehat{s} \in S$ that the seller may send.

3. REFUNDS AS COMMITMENT

In this section, suppose that all customers are rational and form correct expectations at the stage of advice. After signing a contract at $t=1$, at $t=2$ the customer optimally chooses to fulfil the contract until $t=3$ whenever the utility is not below the level of the refund for early termination, *i.e.* whenever $u \geq q$.[16] When $\underline{u} < q < \overline{u}$ holds, this decision rule gives rise to a unique cutoff rule: the contract will be terminated early when $u < q$, while it will be served until maturity when $u \geq q$. Note that the outcome $u=q$ is a zero probability event. If $q \geq \overline{u}$, the contract would always be terminated, which would not allow the seller to make positive profits. If $q \leq \underline{u}$, the contract would never be terminated, a case ruled out below.

A customer's expected payoff from signing a contract $\langle p,q \rangle$ when the seller privately observes signal s is equal to

$$v(s;p,q) = \Psi(q|s)q + \int_q^{\overline{u}} u\psi(u|s)du - p = \overline{u} - p - \int_q^{\overline{u}} \Psi(u|s)du. \tag{6}$$

where the last equality follows from integration by parts. Intuitively, this function is strictly increasing in s, which follows formally from FOSD of $\Psi(u|s)$. Note, however, that the signal s is privately observed by the seller.

Given the customer's subsequent termination rule, when a customer signs a contract $\langle p,q \rangle$, the seller's expected profit is equal to

$$\pi(s;p,q) = (p-c) - \Psi(q|s)q - [1-\Psi(q|s)]k.$$

After the contractual payment, p, is made and the initial costs of c are incurred, as captured by the first term in π, the seller either loses the refund, q, upon termination or incurs the additional cost of continued service, k. It is convenient to rewrite profits as

$$\pi(s;p,q) = p-(c+k) + \Psi(q|s)(k-q). \tag{7}$$

16. In a previous draft, we analysed the more general case in which the buyer observed a noisy signal b rather than u. When b is generated from u through a family of conditional distributions satisfying MLRP, and MLRP also holds for the distributions that generate the "earlier" signal s from the "later" signal b, all the results derived in the present study continue to hold.

3.1. *Communication stage*

When there is trade with positive probability, there must exist at least one advice message that induces customers to purchase under the given contract $\langle p,q\rangle$. When $q<k$ holds, we know from expression (7) that the seller's expected profit from a signed contract is strictly decreasing in s. Consequently, when trade takes place after the seller observes some signal s, then by incentive compatibility for the seller trade must also take place for *all* lower signals $s'<s$, provided that $q<k$, as we presently assume. Naturally this cannot be the case in equilibrium because by (5) the conditional expected surplus from trade would be negative. We can thus rule out the case where there is trade with positive probability while $q<k$.

Note that for $q=k$ the seller realizes the same expected payoff π from a contract regardless of the realized signal s. In addition when $p-(c+k)>0$ holds, the sale margin is always strictly positive; once again we cannot have trade in equilibrium because the likelihood of trade would be independent of the signal the seller observes. However, from (5) the resulting realized social surplus would be negative.

We are thus left with the case where $q>k$, so that from (7) the seller's profits from a signed contract are strictly increasing in s. In an equilibrium where there is trade with positive probability, it follows from (5) that there must exist a strictly interior cutoff $\underline{s}<s^*<\overline{s}$ with

$$\pi(s^*)=p-(c+k)+\Psi(q|s^*)(k-q)=0, \tag{8}$$

where for convenience we suppress in (7) the dependence on the contract $\langle p,q\rangle$. That is, the seller strictly prefers to avoid initiating a contract after observing a signal $s<s^*$, but strictly prefers trade to take place when $s>s^*$. Note that existence of an interior cutoff s^* requires, in particular, that

$$p-(c+k)+\Psi(q|\underline{s})(k-q)<0, \tag{9}$$

so that the seller does *not* prefer to initiate a contract after observing the lowest possible signal $s=\underline{s}$. Given condition (3), from which $\Psi(q|\underline{s})=1$ for all $q>\underline{u}$, condition (9) becomes $(p-q)-c<0$. In other words, to ensure that (9) holds, a contract that is surely terminated must result in a loss to the seller.

Suppose now that in an equilibrium with $q>k$ *all* signal-types $s\geq s^*$ pool at the same message $\widehat{s}$; this will indeed hold in an equilibrium of the whole game, as shown below. With rational expectations, the customer's *conditional* expected utility (or consumer surplus) would then be positive if

$$V=\int_{s^*}^{\overline{s}} v(s)\left(\frac{f(s)}{1-F(s^*)}\right)ds\geq 0. \tag{10}$$

Thus, condition (10) must be satisfied to ensure that trade takes place.

For the following Lemma we define an outcome of the communication game to be *informative* when it leads to trade with positive probability and to no-trade with positive probability. Note that from (5) there can be no equilibrium in which the customer, when still holding the prior belief in the absence of additional information, randomizes between signing and not signing the contract. We have established the following results:

Lemma 1 (Advice Equilibrium) *Suppose that a single contract $\langle p,q\rangle$ is offered to rational customers in $t=0$. Then there are two cases to distinguish:*
(i) If $q>k$ and condition (9) is satisfied, there exists a single interior cutoff $s^*\in(\underline{s},\overline{s})$ as characterized in (8), and if (10) holds, so that $V\geq 0$, then the communication game at $t=1$ has a unique informative outcome with the following characteristics. When the seller observes

$s \geq s^*$, the customer purchases after the seller's advice, while when the seller observes $s < s^*$, the customer does not purchase after the seller's advice. The seller makes positive profits.
(ii) Otherwise, the seller makes zero profits. Unless $p = c+k$ and $q = k$ hold jointly, there is no trade.

Given that this is a cheap talk game, there are well-known issues with multiplicity of equilibria. First, whenever there is an informative equilibrium, as in part (i), it is always possible (from (5)) to also support a pooling (also known as babbling) equilibrium outcome in which the message is uninformative and there is no trade. In what follows, when an informative equilibrium outcome exists for a given contract $\langle p,q \rangle$, we will select this outcome, which the seller clearly prefers to the babbling equilibrium. As asserted in Lemma 1, the outcome of the informative equilibrium is then unique. Second, for any given equilibrium outcome the messages that are sent are not uniquely pinned down. For example, the informative equilibrium outcome characterized in case (i) obtains whenever all signal-types $s \geq s^*$ pool at *some* message, while all signal-types $s < s^*$ pool at *some* other message, regardless of the identity of these messages.[17] When condition (10) holds exactly with equality, which will be the case in the equilibrium of the whole game, there is no further scope for multiplicity, so that all signal types $s \geq s^*$ pool at the same message.[18]

3.2. *Optimal commitment*

Through the choice of the contract $\langle p,q \rangle$ at the first stage, $t=0$, the seller determines the payoffs at the communication stage, $t=1$. From Lemma 1 we know that the seller can only make positive profits when $q > k$, so that there is a strictly interior cutoff s^*. When trade takes place, the seller's *ex ante* profits are given by

$$\Pi = \int_{s^*}^{\overline{s}} \pi(s) f(s) ds. \tag{11}$$

The seller's optimal single contract maximizes Π, subject to the constraints that the pair $\langle p,q \rangle$ gives rise to a cutoff s^* from (8) and that, for this cutoff, (10) holds.

As is intuitive, the customer's participation constraint (10) must bind by optimality for the seller, so that all seller types $s \geq s^*$ must then pool at the same message. After substituting $V = 0$ into the seller's profits (11), and thereby canceling out the expected refund payments made to the customer at $t=2$ with the corresponding increase in the customer's willingness to pay at $t=1$, we obtain

$$\Pi = \Omega = \int_{s^*}^{\overline{s}} \left[\int_{q}^{\overline{u}} (u-k)\psi(u|s) du - c \right] f(s) ds. \tag{12}$$

Here, Ω denotes total social surplus, given the respective decision rules $s \geq s^*$ for initiating a contract and $u \geq q = q$ for *not* terminating a contract. Profits are equal to the social surplus because the seller becomes the residual claimant, and so aims to design a contract $\langle p,q \rangle$ that maximizes the social surplus. We next present an auxiliary result.

Lemma 2 (Commitment Effect of Refund) *Take some refund $q \in (k, \overline{u})$. Then, there is a unique cutoff $\underline{s} < s^* < \overline{s}$, as determined by (8), and a unique price, $p > c+k$, at which $V = 0$*

17. Also, to support the informative outcome, types $s < s^*$ clearly need not pool at some common message.

18. When condition (10) is slack, so that the customer's expected payoff conditional on $s \geq s^*$ is strictly positive, there is additional scope for multiplicity. That is, when condition (10) is slack, not all signal-types $s \geq s^*$ need to pool at the same message in equilibrium, even though for all messages that are used by some $s \geq s^*$ the corresponding conditional payoff for the customer must be positive.

holds from (10) with equality, so that p corresponds to the customer's willingness to pay given $s \geq s^*$ *and, for given q, this choice of p is uniquely optimal for the seller. In addition, as the refund is increased to* $\widetilde{q} \in (q, \overline{u})$*, a new such pair* $\widetilde{p}, \widetilde{s}^*$ *results satisfying* $\widetilde{p} > p$ *and* $\widetilde{s}^* > s^*$.

Proof See Appendix. ‖

What is key for the equilibrium characterization that follows is the comparative result in the refund in the second part of Lemma 2. For the determination of s^* the seller takes into account the expected costs at the higher refund, computed on the basis of the information available to the seller when advising the *marginal* customer to sign up, $s = s^*$. The customer's willingness to pay is instead determined by the *expected* use that the customer will make of the higher refund, where this expectation is taken conditional on the information available to the customer when making a purchase, $s \geq s^*$. Recall now that following a lower signal s, lower realizations of u become more likely. Thus, the seller (with signal s^*) correctly expects the (marginal) customer to cancel more often than the (average) customer believes when advised to purchase (*i.e.* for signals $s \geq s^*$, for which the seller pools at the same message). When the refund is increased, the incremental cost for the seller at $s = s^*$ increases by more than the customer's willingness to pay, leading ultimately to a higher cutoff s^*, even after taking into account the joint increase in p, which by itself alone would make the seller more willing to trade.[19]

Lemma 2 is of separate interest because it shows how sellers who give advice based on private information can use contractual means to commit to reduce their bias. By choosing $q > k$, sellers impose on themselves inflated costs following early terminations or returns; in order to avoid the resulting increase in the refund bills, sellers are disciplined not to pretend that the good or service is highly valuable to the customer.

While s_{FB} is determined conditional on subsequently taking the efficient *ex post* decision (based on the cutoff $q = k$), it is useful to characterize what the efficient *ex ante* cutoff would be when the termination cutoff is distorted from the first-best level, as it will be in equilibrium. For given $q > k$ define now the unique cutoff for the seller's signal, $s_{CB}(q)$, such that, *conditional* on the subsequently applied cutoff q for the customer's utility u, initiation of a contract is *ex ante* efficient if and only if $s \geq s_{CB}(q)$.[20] When $q = k$, s_{CB} becomes equal to s_{FB}. When interior, note that $s_{CB}(q)$ is strictly increasing in $q \geq k$. Intuitively, the application of an inefficiently high *ex post* cutoff, $q > k$, implies a reduction in the social surplus that results from a sale for any s, and thus leads to an increase in the conditional efficient *ex ante* cutoff, $s_{CB}(q)$.

Proposition 1 (Equilibrium Inefficiency with Rational Customers) *The contract* $\langle p, q \rangle$ *optimally offered by the seller in equilibrium leads to two types of inefficiencies:*
(i) Ex post *inefficiency as too many contracts are terminated early* ($q > k$)*;*
(ii) Ex ante *inefficiency as too many contracts are signed initially* ($s^* < s_{CB}(q)$)*.*

Proof See Appendix. ‖

19. The proof of Lemma 2 reveals that there is an additional effect at work that goes in the same direction. When $q > k$ is further increased, an additional reduction in *interim* efficiency results. Holding s^* constant and adjusting p so as to make the customer indifferent, the resulting loss in surplus (for any given $s \geq s^*$) is borne by the seller, which further induces the seller to reduce s^*. This effect, however, vanishes as $q \to k$, while the effect discussed in the main text still survives.

20. Uniqueness of a cutoff $s_{CB}(q)$ still follows because the posterior distributions $\Psi(u|s)$ are ranked by FOSD and because $q > k$. Note that the conditional surplus is equal to the difference between the right-hand side and the left-hand side of (4), where the lower bound of integration is q instead of k.

When $q = k$ holds, we know that the seller cannot make positive profits. This is because the seller would then want to indiscriminately advise the customer to sign a contract for any price $p > c + k$, according to Lemma 1. But in this case, the customer's willingness to pay, given by the left-hand side of (5), is in fact strictly below the seller's overall costs. Instead, by setting $q > k$, the seller can commit to provide valuable advice, albeit at the cost of reducing *ex post* efficiency. Using the observation that, at $q = k$, a marginal increase in q creates only a second-order loss in *ex post* efficiency, we show in the proof of Proposition 1 that the seller can strictly increase profits by raising q above k, according with assertion (i).

It remains to comment on assertion (ii) of the equilibrium characterization. In principle, based on the observations in Lemma 2, it would be possible to raise the refund (and, consequently, the price) until the *ex ante* cutoff reaches the respective conditional efficient level, $s_{CB}(q)$. However, when trading off *ex post* for *ex ante* efficiency, it is never optimal for the seller to raise the refund all the way to this level. On the one hand, an increase in q above k reduces the sellers's profits by leading to an inefficiently high request for refunds (*i.e.* increase in *ex post* inefficiency). On the other hand, such an increase in q raises the seller's profits by inducing a higher s^*, and therefore reducing the number of inefficiently signed contracts (*i.e.* decrease in *ex ante* inefficiency). As s^* approaches the conditionally efficient cutoff $s_{CB}(q)$, the beneficial effect of a further increase in s on *ex ante* efficiency, and therefore on profits, tends to zero. At the same time, since q is strictly above k, an additional increase in the refund always reduces profits, thereby increasing *ex post* inefficiency. This implies that s^* must always be less than $s_{CB}(q)$ in equilibrium.

According to the first-order condition reported in the proof of the Proposition 1, the resolution of the trade-off between *ex post* and *ex ante* inefficiencies depends on local properties of the signal's distribution. An interesting general comparative statics result can be obtained with respect to c, the cost incurred by the seller to set up the contract (or, equivalently, the loss in *ex post* surplus from returning the product). As c increases, q decreases.[21] Intuitively, as initiating a contract becomes less profitable for the seller, there is less need to inefficiently choose $q > k$ so as to commit to less-biased advice.

3.3. *Menu of contracts*

Our game is one of strategic information transmission. After the seller sends a message, $\widehat{s}$, it is up to the customer to choose whether to initiate a contract or not. So far we have restricted the seller to offer a single contract $\langle p, q \rangle$ to the customer. We will now relax this assumption and show how our previous results remain valid when initially, at $t = 0$, the seller is allowed to offer a menu of contracts, $\{\langle p_i, q_i \rangle\}_{i \in I}$. Again, at $t = 1$ the seller sends a message $\widehat{s}$; at $t = 2$ the customer can choose any contract $\langle p_i, q_i \rangle$ from the menu, or elect to make no purchase.

For the following, we restrict to an equilibrium of the cheap talk game where any observed signal $s \in S$ leads to one of two outcomes: (1) the customer selects and signs one contract from the menu, or (2) the customer makes no purchase. This allows us to characterize an equilibrium by a partition $\{S_i\}_{i \in I \cup \{\varnothing\}}$, where $S_\varnothing$ represents the set of signals for which ultimately no purchase takes place, while a contract $\langle p_i, q_i \rangle$ is chosen for the respective signals $s \in S_i$ with $i \in I$. Note that without further assumptions these sets need not be convex because the problem may not satisfy everywhere a standard single-crossing property. That is, for the seller the marginal rate of

21. Formally, this follows from the first-order condition (A.4) in the proof of Proposition 1, after noting that ds^*/dq does not depend on c.

substitution between the price p and the refund q

$$\frac{dp}{dq} = \Psi(q|s) + \psi(q|s)(q-k) > 0$$

is not necessarily monotonic in the "type" s. The following result applies independent of whether this single-crossing property is satisfied everywhere or not.

Proposition 2 (Robustness to Menu of Contracts) *There is no equilibrium in which a menu of contracts, offered in $t=0$, leads to an outcome where one contract (p_i, q_i) is signed for one s_i and another contract (p_j, q_j) for another s_j.*

Proof See Appendix. ‖

The intuition for Proposition 2 is rather immediate. Our game of cheap talk lets the customer make the final choice from the menu of contracts. This implies that incentive compatibility across the contracts in the menu must hold *both* for the privately informed seller *and* for the customer. To then align their preferences over contracts, the total surplus of one contract must be larger than the total surplus of the other, which in our setting requires setting a strictly lower refund, given that $q_i \geq k$ always holds. This rules out the possibility of offering a non-degenerate menu. Given that it is not incentive-compatible to offer a menu with more than one contract (once we require that all contracts in the menu are picked for some s), we conclude that our initial restriction to a single contract is without loss of generality.

Here, as well as throughout the preceding analysis, a critical assumption is that the customer retains the right to choose and, thereby, also retains the option of walking away without making any payment (cf. the motivation for this assumption in Section 2). If this restriction did not hold, it would be easy to obtain the first-best outcome. Essentially, the parties could then commit to *delegate* the purchase decision to the seller and the cancellation decision to the customer, which would both be efficient when $p = c + k$ and $q = k$, while an *up-front transfer* unconditional on sale or termination would allow the seller to extract all surplus. In our game, instead, the seller and the customer can only transfer surplus through a price conditional on purchase, p, and a refund conditional on termination, q. With this contract, a seller with market power who privately observes s finds it optimal to induce the inefficiencies characterized in Proposition 1.

3.4. *Application: incentives for management of online reviews*

Interpreted literally, our model is applicable to markets in which sellers, either directly or through sales agents, individually advise their buyers after becoming informed about the match between each buyer's preferences and the characteristics of the product offered. The commitment mechanism we highlight is also operational more broadly in markets in which sellers control the information that becomes available to buyers.

Our model sheds light on how return policies affect the incentives for the management of consumer reviews by online retailers of consumer goods. Consider zappos.com, a major internet retailer for shoes and handbags. Suitability is a key issue for the internet sale of these consumer goods. The shoes or handbags a woman selects will depend as much on her personality and tastes as on the product characteristics, which are difficult to judge before the product is shipped. Online retailers are rarely in a position to acquire and communicate match-specific information, but past buyers volunteer their insights and experiences to current buyers through the reviews they post on the retailer's website. In a sense, previous buyers act as impartial advisors to the current buyers with similar preferences.

Recognizing the information value of these consumer reviews, online sellers spend considerable resources to publicize reviews. At the same time, sellers are also tempted to manipulate the reviews by censoring those that are likely to be interpreted negatively; see Dellarocas (2006). Thus, by selectively withholding certain reviews from public view, and even by adding fake favourable reviews, sellers are able to indirectly control and bias what is communicated by past buyers to current buyers.

According to the logic of our model, the return terms to which the retailer commits affect the seller's incentives to censor reviews. The incentives to censor negative reviews are reduced when the refund q for product return becomes more generous, because then more candid reviews (corresponding to a higher cutoff s^*) result in a reduction in the expected costs of refund net of the salvage value. Our commitment mechanism contributes to explaining why generous terms for returns are prevalent in online retailing; our model also predicts that generous return terms are associated with candid consumer reviews.

4. CREDULOUS CUSTOMERS

Recall that a credulous customer accepts at face value any claim (message) $\widehat{s}$ from the seller. Consequently, the customer finds it optimal to sign the contract whenever the resulting expected payoff satisfies $v(\widehat{s};p,q)\geq 0$. It is again convenient to drop p,q from the argument. In what follows, we restrict the analysis to a single contract.

Given that $v(s)$ is strictly increasing in s according to (6), as long as $v(\overline{s})\geq 0$ and $v(\underline{s})\leq 0$, for any true signal s the seller can always ensure that a contract is initiated by asserting that $\widehat{s}=\overline{s}$; similarly, the seller can always ensure that a contract is not initiated by asserting that $\widehat{s}=\underline{s}$. Clearly, the first constraint, $v(\overline{s})\geq 0$, must be satisfied because otherwise there will be no trade with positive probability, and the seller would make zero profits. In what follows, we first ignore the second constraint, $v(\underline{s})\leq 0$. This will hold strictly under the contract that solves the relaxed programme.

Denote now for any $\langle p,q\rangle$ the set of signals s for which $\pi(s)\geq 0$ by S_A. For all $s\in S_A$, the seller prefers that the customer accepts the contract offer. The seller's programme is then to choose $\langle p,q\rangle$ so as to maximize expected profits

$$\Pi=\int_{S_A}\pi(s)f(s)ds$$

subject to $v(\overline{s})\geq 0$. By optimality, the constraint binds, as the seller wants to raise p as high as possible. Solving the binding constraint $v(\overline{s})=0$ for p and substituting this into the seller's profits Π, we have

$$\Pi=\int_{S_A}\left[\int_q^{\overline{u}}u\psi(u|\overline{s})du-(c+k)+\Psi(q|\overline{s})q+\Psi(q|s)(k-q)\right]f(s)ds. \tag{13}$$

It is now convenient to express (13) somewhat differently. For this we calculate the total surplus

$$\Omega=\int_{S_A}\left[\int_q^{\overline{u}}(u-k)\psi(u|s)du-c\right]f(s)ds,$$

which boils down to the Ω previously defined in (12) when $S_A = [s^*, 1]$. After substituting again from the binding constraint $v(\overline{s}) = 0$, we obtain the expected *true* utility for credulous customers

$$V_C = \int_{S_A} [v(s) - v(\overline{s})] f(s) ds = \int_{S_A} \left[\int_q^{\overline{u}} [\Psi(u|\overline{s}) - \Psi(u|s)] du \right] f(s) ds < 0. \tag{14}$$

The last inequality follows immediately from FOSD of Ψ, as long as $\underline{u} < q < \overline{u}$. Thus, credulous customers end up realizing a strictly negative *true* utility, provided that S_A is not restricted to $s = \overline{s}$. We can now express the seller's profits, as obtained in (13), alternatively as

$$\Pi = \Omega - V_C. \tag{15}$$

In other words, the seller obtains a higher profit *either* when total surplus is higher *or* when the true utility of credulous customers is lower.

4.1. *Exploitation*

The seller's unsuitable advice that $\widehat{s} = \overline{s}$ inflates a credulous customer's perception of the overall value of the contract, which results in $V_C < 0$ and thus in higher profits (cf. expression (15)). In addition, the seller's unsuitable advice affects the customer's perceived value of early termination. We now show how this creates an incentive for the seller to choose the refund so as to better exploit customers' misperceptions.

Recall that the probability with which the contract is subsequently terminated, $\Psi(q|s)$, is strictly decreasing in s. Erroneously believing that $s = \overline{s}$ when advised to sign a contract, a credulous customer assigns a probability for the occurrence of cancellation that is strictly lower than the correct probability assigned by the seller. That is, the credulous customer *undervalues* the right of early cancellation. The seller, instead, correctly anticipates the true expected costs of early cancellation and optimally sets the cancellation refund, q, below the efficient level, k (cf. formally the proof of Proposition 3), thereby exploiting the difference in beliefs that result from the customer's credulity.

When $q < k$, we know that the seller's expected profit $\pi(s)$ is strictly decreasing in s. When the seller prefers to initiate a contract for some signal s', this preference becomes strict for all *lower* signals $s < s'$. Thus, once again, the seller optimally applies a threshold rule. However, now the advice ensures that there is trade only when $s \leq s^*$: $S_A = [\underline{s}, s^*]$, with $s^* = \overline{s}$ in case $\pi(\overline{s}) \geq 0$ and $s^* < \overline{s}$ when $\pi(\overline{s}) < 0$.

As s^* is chosen optimally from the seller's perspective, we obtain from (13) that an interior optimal refund $\underline{u} < q < \overline{u}$ must solve the first-order condition

$$\int_{S_A} [\Psi(q|\overline{s}) - \Psi(q|s)] f(s) ds + (k - q) \int_{S_A} \psi(q|s) f(s) ds = 0. \tag{16}$$

The first part of this term captures the "mispricing" of the option to cancel early. This is a function of the difference between the true likelihood of a refund, $\Psi(q|s)$, which is strictly decreasing in s, and the likelihood perceived by the customer after being advised $\widehat{s} = \overline{s}$, $\Psi(q|\overline{s})$. The second term in (16) captures the value created for the seller when the customer exercises the option to return. This value, equal to the expected savings in continuation costs net of the refund, is positive when $q < k$. FOSD of Ψ then implies that the first term in (16) is negative, so that indeed $q < k$.

Proposition 3 (Exploitative Contract with Credulous Customers) *Credulous customers are always advised to initiate a contract, $S_A = S$, and their true expected surplus, V_C, is strictly negative. The optimal refund $\underline{u} < q < k$ solves*

$$k - q = \frac{G(q)}{g(q)}. \tag{17}$$

Proof See Appendix. ‖

The optimal refund, as characterized by (17), is uniquely determined when the reverse hazard rate for G is decreasing everywhere. This is a commonly invoked condition on distribution functions. From Proposition 3, the optimal refund always satisfies $q > \underline{u}$, so that in equilibrium cancellation still occurs with positive probability. As noted in the proof, the simple characterization in (17) rests on our assumption that the signal is fully informative at the boundaries (*i.e.* also at $s = \overline{s}$), so that a credulous consumer, who believes the message $\widehat{s} = \overline{s}$ and thus expects to realize $u = \overline{u}$ for sure, assigns zero value on the option to return the product. In this case, the seller's choice of q is actually analogous to that of a monopsonist. At the optimally specified price q, the seller stands willing to buy back the product from the customer who then, after experimenting with the product or service, is privately informed about the realization of u.

As in the characterization with rational customers (cf. Proposition 1), the outcome with credulous customers exhibits two inefficiencies. However, at the *ex post* stage, the contract is terminated too *infrequently*, as $q < k$, instead of too frequently, as was the case with rational customers. While with rational customers the inefficiency served to commit the seller to provide informative advice, with credulous customers the inefficiency stems from the seller's attempt to exploit customers' misperceptions. At the *ex ante* stage, it is now immediate that contracts are initiated too frequently, namely regardless of the seller's signal s. With credulous customers, advice becomes non-informative.

Secondary Market: With physical and durable products, customers may choose to access a secondary market rather than return the product to the original seller. A customer could sell the product at the seller's own salvage value k or, at least, at a price that is somewhat discounted, namely by some value Δ. Clearly, this possibility does not constrain the seller when the customer is rational, as then the optimal contract specifies a strictly higher refund $q > k$. However, such an option to resell at a price equal to $k - \Delta$ may constrain the seller who faces credulous customers. Then, our characterization in Proposition 3 still applies as long as q does not fall below $k - \Delta$. However, if this is not the case, the characterization is still immediate, given our previously obtained insights. In fact, the proof of Proposition 3 shows that the seller's profits are strictly decreasing in q, at least as long as $q \leq k$. (Note that we always adjust the price p so that the customer's participation constraint still binds, $V = 0$.) Consequently, it becomes uniquely optimal for the seller to set q as low as possible, *i.e.* $q = k - \Delta$. While for all values $\Delta \geq 0$ it still holds that advice is non-informative, the option to resell protects customers by limiting the extent to which their inflated beliefs can be exploited. We return to this point in the next section when we analyse the imposition of a lower bound on q through policy, rather than through a secondary market.

4.2. *Menu of contracts*

Recall that with rational customers, there was no scope to construct a non-degenerate menu of contracts that would satisfy incentive compatibility *both* for the privately informed seller *and* the customer, given that the latter reacts to the seller's cheap talk by making a choice. However, with credulous customers the latter constraint no longer applies, and we show that the seller could make higher profits with a menu.

In equilibrium, as we show, the seller still communicates $\widehat{s}=\overline{s}$, regardless of the privately observed signal s, but can now rely on the customer's indifference to choose from the menu the (incentive-compatible) contract that is profit-maximizing from the seller's perspective, given the signal that the seller truly observes. Recall that the seller, when setting the return transfer q for the credulous customer, essentially faces a monopsony problem. For the case with a single contract offer, in Proposition 3 we obtained the first-order condition (17) by using the *ex ante* distribution over utilities, given that there is only a single contract and that trade always occurs. Now that the seller can implement a different contract for all observed signals, this condition intuitively transforms into its pointwise equivalent

$$k-q=\frac{\Psi(q|s)}{\psi(q|s)}. \tag{18}$$

We assume that, for a given s, this equation has a unique solution, which clearly satisfies $q<k$ for all $s<\overline{s}$, while $q=k$ at $s=\overline{s}$ because the signal is perfectly informative by assumption (3), so that $\Psi(q|\overline{s})=0$ as long as $q<\overline{s}$. The proof of Proposition 4 shows that the MLRP for the signal-generating distribution $H(s|u)$ implies that the reverse hazard rate on the right-hand side of (18) is strictly decreasing in s, for given q, so that the relationship between q and s is monotonic.

Proposition 4 (Menu with Credulous Customers) *With credulous customers, it is feasible for the seller to offer a menu. Under the optimal menu, the seller untruthfully communicates $\widehat{s}=\overline{s}$ for all observed signals but uses the customer's indifference to induce the choice of a different refund for each signal. The respective choice $q(s)$ solves condition (18) for each s, so that $q(s)$ is strictly increasing in s.*

Proof See Appendix. ||

While with credulous customers the seller could benefit from offering a menu, realistically it may not always be feasible to have two customers buy under a different refund policy. The seller would have to ensure that a customer who bought under a less generous refund policy could not claim a higher refund by returning a product that was bought by another customer under a more generous refund policy. That is, with physical products the seller would have to ensure that product-customer matches remain uniquely identified as, otherwise, a "grey market" for second-hand products could allow returning customers to always use the most generous refund policy available. While retailers often make product returns contingent on holding a valid receipt, such a "plain receipt policy" would not be sufficient for this purpose. Letting customers choose between different contracts, specifying different prices and refunds, may also be unprofitable when it consumes too much valuable assistance time at the point of sale.

5. POLICY

We now explore policy instruments targeted at the two sources of inefficiency in our model: market power and customer credulity. We also discuss the impact of policy on both social efficiency and consumer surplus. From the perspective of consumer protection, the latter measure should be more important, even though a consumer surplus standard is also frequently applied in competition policy.[22]

5.1. *Statutory right of minimum refund*

Consider a statutory right of a minimum refund: $q \geq \overline{q}$. It is now convenient to suppose that the seller's programme to choose q at $t=0$ is strictly quasiconcave, both with rational customers and with credulous customers.[23] Denote the respective values by q_R and q_C. The assumption of strict quasiconcavity allows us to rule out the case where the imposition of even a *non-binding* constraint could affect the equilibrium outcome simply by affecting the seller's choice of contract in case of indifference.

From Proposition 3 the seller offers credulous customers an inefficiently low refund and, in addition, advises all credulous customers to purchase. While the perceived surplus of credulous customers is always zero, recall that their true surplus is always negative. We can show that the surplus is also strictly increasing in the minimum refund, $\overline{q}$. This is intuitive, as the minimum refund restricts the seller's ability to exploit customers' misperception, when they are made to believe that $\widehat{s}=\overline{s}$. In fact, there are two different channels through which exploitation may be reduced. First, the more immediate channel works directly through the increase in $q=\overline{q}$, given that the true likelihood of termination is strictly higher than the likelihood that is misperceived by the credulous customer. Second, an increase in the refund can also affect the advice incentives. When the minimum refund is sufficiently large so that from $q=\overline{q}>k$, the seller's profits increase in s. The seller now advises customers not to purchase after observing a sufficiently low signal s by choosing a strictly interior cutoff $s^* > \underline{s}$. This cutoff, s^*, strictly increases in $\overline{q}$. As a result, the difference between the true likelihood of subsequent termination and the misperceived likelihood also decreases. As long as the minimum refund satisfies $\overline{q} \leq k$, with credulous customers it also strictly increases *ex post* efficiency, while we know from $q_R > k$ that contracts are unaffected when consumers are rational. In fact, any restriction solely on q that would constrain the seller when consumers are rational would necessarily decrease surplus. This follows immediately from the fact that rational consumers always realize $V=0$ and that, consequently, the seller's profits in (12) are equal to the social surplus.

Proposition 5 (Mandatory Minimum Refund) *Imposing a mandatory minimum refund $q \geq \overline{q}$ that is* binding *in equilibrium has the following implications:*
(i) When customers are credulous, customer surplus is everywhere strictly increasing in $\overline{q}$, while social surplus is strictly increasing in $\overline{q}$ as long as $\overline{q}$ is not too large (but surely for all $\overline{q} \leq k$).
(ii) When customers are rational, customer surplus is unaffected by the imposition of $\overline{q}$, while social surplus is strictly lower.

Proof See Appendix. ‖

Given that with rational customers the unconstrained optimal choice of the refund satisfies $q_R > k$, Proposition 5 suggests imposing a minimum mandatory refund of (at least) $\overline{q}=k$. For long-term contracts, sellers would then be required to refund customers who terminate early an

22. Interestingly, the EU's competition law contains the notion of "excessive pricing", which could warrant interference even when the underlying market power was acquired without impeding competition.

23. With credulous customers, a sufficient condition is that the reverse hazard rate for G is everywhere decreasing. With rational customers, recall that the respective programme is to maximize (12), where p is determined jointly with s^* according to the first part of Lemma 2.

amount that is at least equal to the costs of continued service, which they save through termination. In the case of physical products, upon returning the product the customer would receive a refund that is at least equal to the seller's salvage value.

5.2. *Competition policy*

The consumer protection policy of imposing a minimum mandatory refund does not constrain the seller's pricing power.[24] In this section, we consider, instead, policies that would restrict the seller's scope to extract consumer surplus. We capture this through an increase in the customers' reservation value, which so far has been set equal to zero. Denote now, more generally, the reservation value by $\overline{V}$. Consequently, the only modification to the seller's programme is through the participation constraint: $V \geq \overline{V}$ with rational customers and $v(\overline{s}) \geq \overline{V}$ with credulous customers. Note that these participation constraints are still defined conditional on receiving the advice to purchase.

Recall that with *rational* customers the contract $\langle p=c+k, q=k\rangle$ leads to the first-best efficient outcome and to zero profits for the seller. This outcome is also obtained when we set the customers' reservation value as high as possible, namely equal to

$$\overline{V} = \int_{s_{FB}}^{\overline{s}} \left[\int_U \max\{u-k, 0\}\, \psi(u|s) du - c \right] f(s) ds, \tag{19}$$

which corresponds to the maximum social surplus that can be realized. In this case, as is intuitive, the programme to maximize the seller's profits Π subject to the modified participation constraint (10), where now $V \geq \overline{V}$, results in the same unique outcome as the solution to the dual programme of maximizing V. When $\overline{V}$ is set at the highest level, equal to the boundary in (19), both the price and the refund are strictly lower than in our previous analysis. The outcome is also unambiguously more efficient. A less generous refund is a sign of a more constrained seller, at least when customers form rational expectations about the value of advice. Then, contracts are less frequently terminated prematurely. When we now increase $\overline{V}$ gradually, *i.e.* from $\overline{V}=0$ to the upper boundary, we are able to show that the outcome becomes gradually more efficient. This is starkly different when customers are credulous.

For the analysis with *credulous* customers, note first that it would be unreasonable for them to expect to obtain a utility higher than $\overline{u}-c-k$, which is the maximum true social surplus that is realized when a customer has the highest utility. Thus, we now set the upper bound

$$\overline{V} \leq \overline{u} - c - k. \tag{20}$$

Then, a change in the credulous consumers' reservation value has no effect on contractual efficiency. To see this, note first that the seller will always advise customers to purchase, $S_A = S$. In fact, this is where condition (20) comes into play. Take the case where (20) holds with equality, so that $\overline{V} = \overline{u} - c - k$. Then, the seller is just indifferent with regards to initiating a contract when the true signal is $s = \overline{s}$. Given that we have that $S_A = S$ when (20) applies, the next step is to show that also the optimal refund, as characterized by (17) in Proposition 3, remains unchanged

24. An alternative policy that would target both the refund and the price could be to specify that they must follow a particular functional relationship such that that customers must be able to obtain a full refund. If $q=p$ applies, however, the market in our model would break down because then the customer would always find it optimal to purchase regardless of the advice obtained. To see this, note that initiating a contract would grant the customer a valuable option of $\max\{0, u-q\}$ at zero costs. From condition (5), however, the expected surplus is negative when all customers initiate a contract.

as we vary $\overline{V}$. This holds because, irrespective of the customer's reservation value, the optimal choice of q solves the same trade-off between maximally exploiting the customer's endogenous misperception and ensuring that the subsequent termination decision is more efficient (cf. the first-order condition (16) with $S_A = S$). With credulous customers, a higher reservation value then affects only the price p, which decreases one-for-one with an increase in $\overline{V}$.

Proposition 6 (Competition Policy) *When customers' reservation value $\overline{V}$ increases, with rational customers both consumer surplus and social surplus are strictly higher. Instead, with credulous customers, only the prevailing initial price is reduced one-for-one, but the refund and the social surplus are not affected.*

Proof See Appendix. ||

6. CONCLUSION

When sellers try to convey their information about the suitability of a product or service to customers, they face a credibility problem. If the seller does not bear any cost for providing misleading information or giving unsuitable advice, and if customers rationally see through the seller's incentives, sales talk is completely uninformative. The seller can gain credibility by granting customers generous cancellation rights, which the customer has the discretion to exercise after becoming better informed through initial usage or experimentation. The margin lost from early cancellations (or returns) then disciplines the seller to initially advise on a purchase only when observing a sufficiently favourable signal about the product's suitability.

When all customers understand the seller's incentives, in equilibrium there are both excessive purchases (*ex ante inefficiency)* and excessive cancellations (*ex post inefficiency)*. However, policy intervention that prescribes a different refund and cancellation policy would reduce social welfare while having no effect on consumer surplus. The inefficiency results because the seller possesses both private information and pricing power. Consequently, when customers form rational expectations about the quality of the seller's advice, our normative analysis suggests that social efficiency and consumer surplus can be increased more effectively through competition policy, rather than through potentially more intrusive consumer protection policy.

However, a role for consumer protection policy emerges when customers are credulous and, thus, take the seller's advice at face value. The seller is then tempted to target only credulous customers, who have a higher willingness to pay given their inflated expectations. In the offer that is targeted to credulous customers, cancellation terms no longer play the role of a commitment device, but they become instrumental in allowing the seller to better exploit customers' inflated beliefs. As a result, customers are offered very restrictive terms for cancellation or return.

Consumer surplus and social efficiency can then be increased by prescribing minimum statutory rights. A simple and robust policy that cannot result in a reduction in consumer surplus and social efficiency consists of requiring the seller to offer a minimum refund that is equal to either the product's salvage value or the savings in the provision cost of the service. In our model, this minimum statutory refund would not result in a reduction in the efficiency of contracts signed by rational consumers, but it would increase efficiency and reduce exploitation when contracts are signed by credulous customers.

Our simple formulation abstracts from the possibility that customers may have different intensities of service usage. Through the same mechanism at work in our baseline model, the seller might be able to improve credibility by using non-linear pricing schemes that subsidize for low usage (through free samples or free base capacity). When, instead, buyers are credulous, our analysis suggests that the seller would use quantity discounts (with relatively high prices for low consumption volumes) as a way to extract more of the consumer value, again inflated through biased advice.

Finally, while we frame the analysis in terms of the contractually stipulated level of refund, an alternative contractual variable is the length of time over which customers can cancel a contract or return a product without penalty. Extending this period allows customers to obtain more precise information about the utility, but it also reduces the salvage value of the product. Our analysis suggests that market contracts will stipulate a constrained efficient duration when customers are rational, even in the absence of policy intervention. Sellers would, instead, offer inefficiently short trial periods when targeting credulous customers, to exploit better the fact that these customers' expectations are inflated by unsuitable advice.

APPENDIX

Proof of Lemma 2. The binding constraint (10) defines a continuous and strictly increasing mapping $\tilde{p}(s^*)$, with $\tilde{p}(s^*=\underline{s})=q+\int_q^{\overline{u}}(u-q)g(u)du$ and $\tilde{p}(s^*=\overline{s})=q+\int_q^{\overline{u}}(u-q)\psi(u|\overline{s})du$. Define next a mapping $\tilde{s}^*(p)$ with $\tilde{s}^*(p)=\underline{s}$ when (9) holds, $\tilde{s}^*(p)=\overline{s}$ when $p-(c+k)+\Psi(q|\overline{s})(k-q)\leq 0$, and otherwise $\tilde{s}^*(p)=s^*$, as given by (8). Note that $\tilde{s}^*(p)$ is decreasing in p, and strictly so when $\underline{s}<\tilde{s}^*(p)<\overline{s}$. We are looking for a pair (p,s^*) that satisfies $s^*=\tilde{s}^*(p)$ and $p=\tilde{p}(s^*)$. If it exists, then by monotonicity of the two mappings it is unique. Furthermore, from (5) it follows that $s^*>\underline{s}$ must hold strictly. From substitution of $\tilde{p}(\overline{s})$, we have that $s^*<\overline{s}$ is feasible if and only if

$$\int_q^{\overline{u}}(u-k)\psi(u|\overline{s})du>c \tag{A.1}$$

holds. This follows from (1) and (3).

Next, for the comparative statics assertion it is convenient to write out the binding participation constraint (10) as

$$\gamma:=\int_{s^*}^{\overline{s}}\left[\Psi(q|s)q+\int_q^{\overline{u}}u\psi(u|s)du\right]\left(\frac{f(s)}{1-F(s^*)}\right)ds-p=0. \tag{A.2}$$

The result follows by applying the implicit function theorem on the system of equations (8) and (A.2) in s^*,p. Differentiating (A.2), for $q>k$ we have $\partial\gamma/\partial s^*=[p-[\Psi(q|s^*)q+\int_q^{\overline{u}}u\psi(u|s^*)du]]f(s^*)/[1-F(s^*)]>0$ because $\max\{u,q\}$ is an increasing function of u and Ψ are ranked by FOSD order, $\partial\gamma/\partial p=-1$, and $\partial\gamma/\partial q=\int_{s^*}^{\overline{s}}\Psi(q|s)f(s)/[1-F(s^*)]ds>0$. From this we can conclude that the determinant of the Jacobian of this system is negative:

$$D:=\left(\partial\pi/\partial s^*\right)(\partial\gamma/\partial p)-(\partial\pi/\partial p)\left(\partial\gamma/\partial s^*\right)<0. \tag{A.3}$$

Next, $(\partial\pi/\partial q)(\partial\gamma/\partial p)-(\partial\pi/\partial p)(\partial\gamma/\partial q)$ simplifies to

$$\psi(q|s^*)(q-k)+\left[\Psi(q|s^*)-\int_{s^*}^{\overline{s}}\Psi(q|s)\frac{f(s)}{1-F(s^*)}ds\right]>0,$$

where the first term is positive by $q>k$ and the second term is positive by FOSD of Ψ. The intuition for this result is that the increase in expected costs associated with the higher refund for the *marginal* customer type (corresponding to signal s^*) are higher than the increase in the willingness to pay of the *average* customer type (with signals $s\geq s^*$). The result that $ds^*/dq>0$ then follows by Cramer's rule. Similarly, from $(\partial\pi/\partial s^*)(\partial\gamma/\partial q)-(\partial\pi/\partial q)(\partial\gamma/\partial s^*)>0$ we immediately have that $dp/dq>0$. Q.E.D.

Proof of Proposition 1. Define the strictly interior signal $\underline{s}<\tilde{s}<\underline{s}$ at which

$$\int_{\tilde{s}}^{\overline{s}}\left[\int_k^{\overline{u}}(u-k)\psi(u|s)du\right]\frac{f(s)}{1-F(\tilde{s})}ds=c$$

holds, where $\tilde{s}>\underline{s}$ follows from (5). When $s^*=\tilde{s}$, setting p equal to the customer's willingness to pay results in $p=c+k$. After substituting for p, the seller's profits equal *ex ante* social surplus, as given by (12), so that

$$\frac{d\Pi}{dq}=-\frac{ds^*}{dq}f(s^*)\left[\int_q^{\overline{u}}(u-k)\psi(u|s^*)du-c\right]-\int_{s^*}^{\overline{s}}\psi(q|s)(q-k)f(s)ds. \tag{A.4}$$

Note that using $ds^*/dq>0$ from Lemma 2, we have that (A.4) is strictly positive at $q=k$ and $s^*=\tilde{s}$, so that the seller can indeed realize strictly positive profits by choosing a contract with $q>k$. Given that $q>k$, and using again that $ds^*/dq>0$, the first-order condition $d\Pi/dq=0$ requires that

$$\int_q^{\overline{u}}(u-k)\psi(u|s^*)du<c, \tag{A.5}$$

which from FOSD of Ψ implies that $s^*<s_{CB}(q)$. Q.E.D.

Proof of Proposition 2. Take two contracts $\langle p_1,q_1\rangle$ and $\langle p_2,q_2\rangle$ with $q_i \geq k$ for both contracts. We argue now that both cannot be part of a non-degenerate menu (where the respective sets S_i for which these contracts are then implemented are non-empty). Suppose that $s\in S_1$. To ensure that the seller indeed sends the respective message that induces the consumer to choose $\langle p_1,q_1\rangle$ rather than $\langle p_2,q_2\rangle$, it must hold that

$$\pi(s;p_1,q_1)\geq \pi(s;p_2,q_2)$$

and thus that

$$p_1+\Psi(q_1|s)(k-q_1)\geq p_2+\Psi(q_2|s)(k-q_2).$$

Given that this condition must hold for all $s\in S_1$, integrating both sides for all $s\in S_1$ and then dividing through by the respective unconditional probability, we obtain the following weaker condition that must also hold for the conditional expectations

$$p_1+\Psi(q_1|s\in S_1)(k-q_1)\geq p_2+\Psi(q_2|s\in S_1)(k-q_2), \tag{A.6}$$

where the expression $\Psi(q|s\in S_1)$ denotes the conditional probability, given that $s\in S_1$. Consider now the choice problem of the customer, who learns from the seller's message that $s\in S_1$. For the customer to choose the contract $\langle p_1,q_1\rangle$ over $\langle p_2,q_2\rangle$, it must hold that

$$E[v(s;p_1,q_1)|s\in S_1]\geq E[v(s;p_2,q_2)|s\in S_1]$$

and thus that

$$\Psi(q_1|s\in S_1)q_1+\int_{q_1}^{\overline{u}} ud\Psi(q_1|s\in S_1)-p_1\geq \Psi(q_2|s\in S_1)q_2+\int_{q_2}^{\overline{u}} ud\Psi(q_2|s\in S_1)-p_2. \tag{A.7}$$

Adding up (A.6) and (A.7), we obtain the requirement that

$$\Psi(q_1|s\in S_1)k+\int_{q_1}^{\overline{u}} ud\Psi(q_1|s\in S_1)\geq \Psi(q_2|s\in S_1)k+\int_{q_2}^{\overline{u}} ud\Psi(q_2|s\in S_1), \tag{A.8}$$

which compares the total surplus realized with the two contracts, given the conditional distribution restricted to $s\in S_1$. Recall now that we assumed that $q_i\geq k$. Also, note that the total surplus from a purchase conditional on s, $\Psi(q|s)k+\int_q^{\overline{u}} ud\Psi(q|s)$, is strictly quasiconcave in the respective refund q and uniquely maximized when $q=k$. This follows immediately from differentiating and noting that the slope is strictly positive for all $\underline{u}\leq q<k$ and strictly negative for all $k<q\leq\overline{u}$. Consequently, condition (A.8) is equivalent to the requirement that $q_1\leq q_2$.

We can now undertake the same (incentive compatibility) comparison for signals $s\in S_2$, for which the contract $\langle p_2,q_2\rangle$ should be chosen in equilibrium. Now, however, this implies the requirement that contract $\langle p_2,q_2\rangle$ is more efficient:

$$\Psi(q_2|s\in S_2)k+\int_{q_2}^{\overline{u}} ud\Psi(q_2|s\in S_2)\geq \Psi(q_1|s\in S_2)k+\int_{q_1}^{\overline{u}} ud\Psi(q_2|s\in S_2), \tag{A.9}$$

so that together with $q_i\geq k$ we obtain $q_2\leq q_1$. Combining the two inequalities we obtained from (A.8) and (A.9), we conclude that for any pair of contracts with $q_i\geq k$, it must hold that $q_1=q_2$ and, therefore, also that $p_1=p_2$.

We can now apply the same argument for any pair of contracts with $q_i\leq k$. To see this, note that in the previous case, which applied when $q_i\geq k$, this restriction was only used for the argument that total surplus was strictly quasiconcave over this range (and maximized at $q_i=k$). The same argument applies now when $q_i\leq k$, so that by applying the previous arguments we can conclude that, from incentive compatibility for both the seller and the buyer, it must hold that $q_1=q_2$ and, therefore, also that $p_1=p_2$, whenever $q_i\leq k$.

Summing up, a non-degenerate menu $\{\langle p_i,q_i\rangle\}_{i\in I}$ can thus contain at most two contracts $\langle p_1,q_1\rangle$ and $\langle p_2,q_2\rangle$, for which $q_1<k$ and $q_2\geq k$. Recall now that when $q_i<k$, profits $\pi(s)$ are strictly decreasing in s, while for $q_i>k$ they are strictly increasing. From these observations, together with incentive compatibility for the seller, it follows, in particular, that S_1 and S_2 are non-overlapping and that $S_1=[\underline{s},s_1^*]$. Recall further from condition (5) that total expected surplus is negative for a given contract even if this contract is implemented for all s. Expected surplus conditional on s, $\Psi(q|s)k+\int_q^{\overline{u}} ud\Psi(q|s)$, is also strictly increasing in s. Consequently, the conditional expected surplus from $\langle p_1,q_1\rangle$ when $s\in S_1$ must be strictly negative. This implies immediately that it cannot be incentive compatible for both the seller and the buyer to implement $\langle p_1,q_1\rangle$ for all $s\in S_1$, rather than, in particular, not trading at all. We have thus also ruled out that a non-degenerate menu can contain a contract $\langle p_1,q_1\rangle$ with $q_1<k$. Therefore, we conclude that a non-degenerated menu can indeed only contain a single contract. Q.E.D.

Proof of Proposition 3. Note first that $s^*=\overline{s}$ (so that $S_A=S$) obtains when $p>c+k-\Psi(q|\overline{s})(k-q)$ and thus, after substitution for p and $q=q$, when (A.1) from the proof of Lemma 2 holds. This follows from (1) and (3). With $S_A=S$, the first-order condition (16) becomes

$$\int_{\underline{s}}^{\overline{s}}[\Psi(q|\overline{s})-\Psi(q|s)]f(s)ds+(k-q)\int_{\underline{s}}^{\overline{s}}\psi(q|s)f(s)ds=0, \tag{A.10}$$

which, using $q = q$ and (2), further simplifies to

$$k - q = \frac{G(q) - \Psi(q|\overline{s})}{g(q)}. \tag{A.11}$$

By (3) and $q < \overline{u}$ we have $\Psi(q|\overline{s}) = 0$, so that finally Equation (17) obtains. Q.E.D.

Proof of Proposition 4. We first consider the definition of $q(s)$ in (18). In terms of primitives, note that

$$\frac{\Psi(q|s)}{\psi(q|s)} = \frac{\int_{\underline{u}}^{q} h(s|\widetilde{u}) g(\widetilde{u}) d\widetilde{u}}{h(s|q) g(q)} = \int_{\underline{u}}^{q} \left(\frac{h(s|\widetilde{u})}{h(s|q)} \right) \frac{g(\widetilde{u})}{g(q)} d\widetilde{u}. \tag{A.12}$$

As $H(s|u)$ satisfies MLRP, for any pair $\widetilde{u} < q$ the ratio $h(s|\widetilde{u})/h(s|q)$ is strictly decreasing in s, implying that for given q the whole expression (A.12) is strictly decreasing in s. As we stipulated that (18) has a unique solution, the respective value $q(s)$ must thus be indeed strictly increasing.

We next construct the seller's uniquely optimal menu. For this we first construct an auxiliary menu. Consider a one-to-one mapping of $s \in [\underline{s}, \overline{s}]$ into an interval of messages $\widehat{s}(s) \in S_\varepsilon = [\overline{s} - \varepsilon, \overline{s}]$. Suppose that when observing s, the seller announces $\widehat{s}(s)$. Define now a price $p(s)$ from $v(\widehat{s}(s); p(s), q(s)) = 0$, so that the customer would perceive to realize exactly zero utility when signing the contract with $q(s)$ and $p(s)$ after receiving the message $\widehat{s}(s)$. Note that we have so far not specified the precise nature of the mapping $\widehat{s}(s)$. To ensure global incentive compatibility so that the customer indeed picks the designated contract, note first that $v(s; p, q)$ satisfies a single-crossing property: $v_{sq} < 0$ because the perceived likelihood of obtaining a refund decreases when learning that s is higher. To ensure incentive compatibility, it is thus sufficient that $\widehat{s}(s)$ is strictly decreasing.

Given that this construction applies for all $\varepsilon > 0$ and that the seller's expected profits are clearly decreasing in ε, in equilibrium the seller must offer the menu with $\varepsilon = 0$. Then, the seller always announces $\widehat{s} = \overline{s}$, from $\Psi(q|\overline{s}) = 0$ for $q < \overline{s}$ the customer is indeed indifferent between the various contracts that offer the same price $p(s)$ but different refunds $q(s)$, and the indifferent customer must choose in equilibrium the contract that the seller prefers. Clearly, by construction this menu uniquely realizes the maximum feasible profits that the seller can extract, given the customer's participation constraint. Q.E.D.

Proof of Proposition 5. Consider first the case of credulous customers. Recall that their true expected consumer surplus is given by expression V_C (cf. (14)). First, we argue that when $\overline{q} > q_C$, the constrained optimal choice for the seller is to set $q = \overline{q}$. This follows from strict quasiconcavity. Note also that *both* terms on the left-hand side of (16) are strictly negative when $q \geq k$. Second, we argue that $dV_C/dq > 0$. From (14), together with $S_A = S$, we have

$$\frac{dV_C}{dq} = \int_{\underline{s}}^{\overline{s}} [\Psi(q|s) - \Psi(q|\overline{s})] f(s) ds < 0.$$

Note that this holds whenever $q = k$ or $q < k$ together with the informativeness condition (3). When $q > k$, we have that $S_A = [s^*, \overline{s}]$, as well as $ds^*/dq > 0$. Then, we have that

$$\frac{dV_C}{dq} = \int_{s^*}^{\overline{s}} [\Psi(q|s) - \Psi(q|\overline{s})] f(s) ds - f(s^*) \frac{ds^*}{dq} \int_{q}^{\overline{u}} [\Psi(u|\overline{s}) - \Psi(u|s)] du > 0,$$

as $ds^*/dq > 0$ and as $\Psi(u|s)$ satisfies FOSD. This completes the proof of assertion (i) for credulous customers.

The assertion for rational customers is immediate because their participation constraint always binds and they form rational expectations. Note also for this case that by assumption that the seller's programme is strict quasiconcave we have the constrained optimum $q = \overline{q}$ whenever $\overline{q} \geq q_R$. Q.E.D.

Proof of Proposition 6. Consider first the case with rational customers. The generalized program for the seller is obtained by using the participation constraint $V \geq \overline{V}$, where an upper boundary is given by (19). Substituting for p, given that at the solution the participation constraint is binding for the customer's reservation value, $\overline{V}$, the seller obtains the social surplus minus the customer's reservation value, $\Pi = \Omega - \overline{V}$.

For $\overline{V}_2 > \overline{V}_1$, we show that the respective levels of social surplus attained in equilibrium satisfy $\Omega_1 < \Omega_2$. By contradiction, suppose that $\Omega_1 \geq \Omega_2$, instead. Take an optimal contract $\langle p_1, q_1 \rangle$, which thus leads to Ω_1. From Proposition 1 it holds that $q < k$ and $s_1^* < s_{CB}(q)$. Using that $\overline{V}_2$ is (marginally) higher than $\overline{V}_1$, by continuity of s^* and expected costumer surplus in the contractual variables we can find a price $p < p_1$ such that the customers' expected utility from $\langle p, q_1 \rangle$ equals $\overline{V}_2$, while the new *ex ante* cutoff s_2^* satisfies $s_1^* < s_2^* < s_{CB}(q)$. The resulting social surplus, which we denote by Ω_2', thus strictly exceeds Ω_1. With this contract, $\langle p, q_1 \rangle$, the seller's profits, $\Omega_2' - \overline{V}_2$, are thus strictly higher than $\Omega_2 - \overline{V}_2$, given that by assumption $\Omega_1 \geq \Omega_2$ holds. This contradicts optimality of the original offer $\langle p_2, q_2 \rangle$, which supposedly generated Ω_2. Next, the case in which $V = \overline{V}$ takes on the maximum feasible value is immediate. Then, $q = k$ and $p = k + c$ must hold, given the unique characterization of the contract that maximizes social surplus, which satisfies $s^* = s_{FB}$ and $q = k$.

Turn to the case with credulous customers. With general reservation value $\overline{V}$, the participation constraint of a credulous customer who was advised that $\widehat{s}=\overline{s}$ becomes

$$v(\overline{s})=\overline{u}-p-\int_q^{\overline{u}}\Psi(u|\overline{s})du\geq\overline{V}.$$

As this still binds by optimality for the seller, we can substitute for p to obtain

$$\pi(s)=\left[\Psi(q|\overline{s})q+\int_q^{\overline{u}}u\psi(u|\overline{s})du\right]+\Psi(q|s)(k-q)-(c+k)-\overline{V}.$$

Using further (1) and (3), this simplifies to

$$\pi(s)=\overline{u}-(c+k)+\Psi(q|s)(k-q). \tag{A.13}$$

As long as (20) holds, with $q<k$ we thus have that $\pi(s)>0$ for all $s<\overline{s}$ and thus $S_A=S$. The implication for the optimal q then follows immediately from the the first-order condition (A.10) in the proof of Proposition 3. Q.E.D.

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