Creating and Sharing Surplus when Consumer Entitlement Matters*

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December 15, 2017

PRELIMINARY DRAFT

Abstract

This paper shows how a firm can use the price and communication about costs to serve consumers who feel entitled to a share of the surplus created by the transaction. Assuming that costs are common knowledge, we show that consumer entitlement reduces firm profit, while the effect on price is ambiguous. When costs are private information and communication is cheap, we show that profit is higher (lower) than with full information if consumers overestimate (underestimate) costs. Finally, when costs are underestimated, we show that the firm can boost profit by truthfully revealing costs in the marketplace.

Keywords: Dual Entitlement Principle, Price Fairness, Cost Communication.

*We thank Anthony Dukes, Thomas Epper, Dina Mayzlin, and seminar participants at USC Marshall for their helpful comments and suggestions.

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1 Introduction

Market transactions have the potential to create surplus for both firms and consumers. In many markets, however, firms use sophisticated price discrimination strategies to extract surplus from consumers to boost profit. Even though highly sophisticated, these strategies ignore a basic fact: that consumers often care not only about price, but also feel entitled to a share of the surplus created by the transaction (Kahneman, Knetsch, and Thaler, 1986a, b).

This paper develops a model where consumers suffer from a psychological loss if they do not receive their entitlement, and consequently might refuse to purchase from the firm even when they should buy from a purely material perspective (Rabin, 1993). To estimate the surplus of the transaction, consumers must form a belief about the cost to supply the product or service, which introduces a role for communication about cost. Taking consumer attitudes about entitlement as given, the monopoly firm makes profit-maximizing decisions about price and communication about cost.

We derive several key results. First, we show that consumer entitlement reduces firm profit, while the effect on pricing is ambiguous. The latter result implies that the firm should not set the conventional monopoly price when consumers feel entitled to a share of the surplus. Second, when costs are private information and communication is cheap, we show that profit is higher (lower) than with full information if consumers overestimate (underestimate) costs. Third, when consumers underestimate costs, we show that the firm can boost profit by truthfully revealing costs in the marketplace.

These results contribute to the literature in several ways. First, we contribute to the literature on price fairness (Guo, 2015; Rotemberg, 2011; Bolton and Alba, 2006; Xia, Monroe, and Cox, 2004) by showing that consumers are willing to lower their material well-being so as to punish an unfair monopolist (Rabin, 1993)—a widely documented empirical regularity in the literature on ultimatum games (Bolton and Ockenfels 2000, Fehr and Schmidt, 1999). Second, we contribute to the literature on cost transparency (Jiang, Sudhir, and Zou, 2016) and organizational transparency more broadly (Mohan, Buell, and John, 2014) by providing conditions under which the firm communicates private information about production costs to consumers.

The remainder of the paper is organized as follows. Section 2 introduces the model and describes consumer entitlement. Section 3 studies optimal pricing with consumer entitlement when costs are known in the marketplace, and provides an example to illustrate the basic forces at work. Section 4 studies optimal pricing and communication about costs when costs are private information of the firm. Section 5 introduces imperfect competition. Section 6 offers conclusions and directions for future research.

2 The model

We consider a monopoly firm that offers a product (or service) to consumers. The firm chooses the price p at which it sells the product. The constant unit cost to provide the product is denoted by $c \geq 0$ and is the firm's private information. The fixed costs of operation are normalized to zero as they do not affect the choice of the price.

There is a unit measure of consumers who have raw valuation v for the product that is private knowledge and distributed according to the cumulative distribution function $F(v)$ and density $f(v)$, which are private knowledge of the firm. Consumers care not only about the material value from purchasing the product, but also about the share of the surplus that they receive (Bolton and Ockenfels, 2000; Fehr and Schmidt 1999). Since the unit cost c is not known to consumers, they must form a belief μ about c to infer the (expected) surplus $v - \mu$ created by the transaction.[1] Thus, consumers obtain the relative (expected) share

$$\sigma(p; \mu, v) \equiv \frac{v - p}{v - \mu}.$$

Consumers feel entitled to a share $\bar{e} \in [0, 1]$ of the surplus (Kahneman et al., 1986a, b) and suffer from a loss whenever they obtain a share that is smaller

[1] We will study belief formation in Section 4 below.

than their entitlement.[2] The extent to which the discrepancy between σ and $\bar{e}$ matters is measured by the dissatisfaction parameter $\lambda \geq 0$. Specifically, the loss is captured by the (reduced-form) loss function $L(p;\mu,v,\bar{e},\lambda)$. We impose the following assumption.

Assumption 1. *The loss function $L(p;\mu,v,\bar{e},\lambda)$ satisfies $L_p \geq 0$, $L_\mu \leq 0$, $L_v \leq 0$, $L_{\bar{e}} \geq 0$, and $L_\lambda \geq 0$.*

Assumption 1 assures that the loss increases due to a higher price (as σ decreases), that the loss decreases due to higher expected cost (as σ increases), and that the loss decreases due to a higher raw valuation (as σ increases). In addition, a higher $\bar{e}$ (larger discrepancy between share and entitlement) and a higher λ (larger dissatisfaction from the discrepancy) increase the loss. To simplify exposition we suppress the parameters of the loss function from now on.

Consumers observe the price p and form the belief μ when deciding whether to purchase the product or choose an outside option, the utility of which is normalized to zero. A consumer with valuation v has the indirect utility function

$$V(p;\mu) = \max\{v - p - L(p;\mu), 0\},$$

where $v - p - L$ is the expected utility when purchasing the product. Consumers therefore purchase the product if their valuation v exceeds the cutoff value $\bar{v}(p)$—the valuation of the consumer who is indifferent between purchasing and choosing the outside option—defined by

$$\bar{v}(p;\mu) = p + L(p, \bar{v}(p;\mu)). \tag{1}$$

Note that $\bar{v}(p;\mu)$ can therefore be interpreted as a "generalized price." Assumption 1 implies that the cutoff value $\bar{v}(p;\mu)$ is uniquely defined for given p and μ as the expected utility $v - p - L$ is strictly increasing in v.

The firm and the consumers play the following game: In the first stage, the firm sets the price p knowing L and $F(v)$ (from market research). In the second stage, consumers make their purchase decision based on the observed price p and their belief μ.

[2] Following Rotemberg (2008, 2005), one can interpret $\bar{e}$ as an "anger threshold."

3 Pricing with known cost

This section studies optimal pricing when consumers know the unit cost—our benchmark case. We first study optimal pricing and follow with an example to illustrate.

3.1 Optimal pricing

The firm chooses the price by maximizing profit subject to the participation constraint and therefore solves

$$\max_{p} \quad \pi(p) = \int_{\bar{v}(p;c)}^{\infty} (p-c) f(v) dv = (p-c) \left[1 - F(\bar{v}(p;c))\right].$$

To put additional structure on this problem, we impose the following assumption.

Assumption 2. *The demand function* $1-F$ *is log-concave.*

This assumption implies that the profit function $\pi(p)$ is strictly quasi-concave, which ensures the existence of a unique global maximizer of $\pi(p)$ (Caplin and Nalebuff 1990). The necessary and sufficient first-order condition for profit maximization is

$$1 - F(\bar{v}(p^*;c)) - (p^* - c) f(\bar{v}(p^*;c)) \bar{v}_p(p^*;c) = 0. \tag{2}$$

This first-order condition has an intuitive interpretation. A marginal increase in the price p directly increases profit by $1-F$. The resulting revenue reduction from the inframarginal units is distorted by the factor $\bar{v}_p(p^*;c)$ due to consumer entitlement: Raising the price changes the loss, which in turn distorts the direct effect of a price change on consumer demand (given by $f(p)$ absent consumer entitlement). Our first result shows the impact of consumer entitlement on price and profit (the proof of this and all other results is relegated to the Appendix).

Proposition 1. *Suppose Assumptions 1 and 2 hold. Then, (i) the optimal monopoly price* p^* *satisfies*

$$p^* = c + \frac{1 - F(\bar{v}(p^*;c))}{f(\bar{v}(p^*;c)) \bar{v}_p(p^*;c)},$$

where $\bar{v}_p(p^*;c) = \frac{1+L_p}{1-L_v}$; and (ii) consumer entitlement forces the optimal price and profit down compared to standard monopoly if $L_p > |L_v|$. If the inequality is reversed, the price may increase but profit goes down.

Proposition 1 shows that consumer entitlement reduces profit. Intuitively, the firm is limited in its ability to extract surplus because of consumer resistance against surplus divisions that differ from the entitlement. This result shows that the determinants of the optimal price are the unit cost c, the (inverse) semi-elasticity of demand $(1-F)/f$, and the sensitivity of the cutoff value with respect to a price change $\bar{v}_p(p^*;c)$—the key driver of the deviation from the standard monopoly price.[3] The price necessarily decreases if $\bar{v}_p(p^*;c) > 1$, which makes demand more elastic than in standard monopoly. A lower price and lower demand (since $\bar{v}(p^*;c) > p$) imply that profit necessarily goes down. Instead, if $\bar{v}_p(p^*;c) < 1$, demand is less elastic, which may increase the price. That profits go down can be seen by using a revealed-preference argument: the monopolist could have set the higher price at a higher demand in the absence of consumer entitlement.

The next result shows that consumer entitlement can force profit down to zero:

Corollary 1. *Consumer entitlement may force the firm to set price at cost and leave the entire surplus to consumers.*

This result is unexpected in a monopoly market: Corollary 1 shows that consumers are able to appropriate the entire surplus when they feel entitled to it ($\bar{e} = 1$) and when they suffer from a large reduction in expected utility if they do not receive their entitlement ($\lambda \to \infty$). Such preferences make demand perfectly elastic ($\bar{v}_p(p^*;c) \to \infty$) and thus force the firm to sell at cost. Note that Corollary 1 provides a behavioral explanation for pricing patterns in digital markets, where it is often a good approximation to assume that $c = 0$: Consumer entitlement may then drive the price down to zero—the "culture of free."

[3]Note that the case $\bar{v}_p = 1$ represents one of three settings: (i) consumers do not feel entitled to obtain a share of the surplus, (ii) consumers receive at least their entitlement, or (iii) the loss function satisfies $L_p = -L_v$.

3.2 Example

Consider a market with a unit mass of homogeneous consumers who have unit demand and valuation $v > c$ for the product.[4] The loss function is given by

$$L(p;c,v,\bar{e},\lambda) = \max\left\{0, \lambda\left(\bar{e} - \frac{v-p}{v-c}\right)\right\}, \tag{3}$$

which satisfies Assumption 1. The next result illustrates how consumer entitlement affects pricing.

Corollary 2. *The optimal price p^* is given by*

$$p^* = v - \frac{\lambda(v-c)\bar{e}}{v-c+\lambda}.$$

When consumers feel entitled to the surplus ($\bar{e} = 1$) and suffer from a large disutility if they do not obtain it ($\lambda \to \infty$), it is optimal for the firm to price at cost, that is, set $p^* = c$.

Corollary 2 leads to several insights. First, if $\bar{e} = 0$ (consumers do not feel entitled to a share of the surplus), then the firm prices to value and sets $p^* = v$—the standard monopoly price. Second, if $\lambda = 0$ (consumers do not care about deviations from the entitlement), then the firm likewise sets $p^* = v$. Third, if $\bar{e} > 0$ and $\lambda > 0$ (consumer entitlement matters), then the price p^* is distorted downwards compared to the standard monopoly price, where the extent of the downward distortion is given by

$$L^* = \frac{\lambda(v-c)\bar{e}}{v-c+\lambda},$$

the loss imparted on consumers due to "unfair pricing." Finally, Corollary 2 implies that ignoring consumer entitlement may lead to market failure: pricing at value to extract the entire surplus from trade induces angry consumers to abstain from consumption.

Corollary 2 helps to illustrate the welfare implications. The optimal profit can be derived as

$$\pi^* = p^* - c = (v-c)\left[\frac{v-c+\lambda(1-\bar{e})}{v-c+\lambda}\right],$$

[4]The simplifying assumption of homogenous consumers implies that the profit-maximizing price can be derived from the consumers' participation constraint.

and the consumer surplus is given by $CS^* = v - p^* - L^* = 0$. This shows that the firm does not leave money on the table when consumers feel entitled to a fraction of the surplus—it simply compensates them for the loss in utility from receiving less than the entitlement and appropriates the residual surplus.

3.3 Alternative loss functions

Many companies in real-world markets use some form of cost-plus pricing. Let $\bar{x}$ denote a consumer's "anger threshold" (Rotemberg 2008, 2005) and consider the following alternative forms of consumer resistance:

$$L(p;c,\bar{x},\lambda) = \max\{0, \lambda\,(p - c - \bar{x})\}$$

and

$$L(p;c,\bar{x},\lambda) = \max\left\{0, \lambda\left(\frac{p-c}{c} - \bar{x}\right)\right\}. \tag{4}$$

These examples mirror resistance against constant markups and proportional markups, respectively. Note that these loss functions have the same properties as $L(p;c,v,\bar{e},\lambda)$ but that they are simpler in the sense that they do not depend on v (and thus the total surplus). Instead of expressing the markup in terms of the unit cost c as in (4), one could alternatively consider the markup measured in terms of price—the standard Lerner index (the properties of L continue to hold).

4 Dealing with unknown cost

This section studies optimal pricing and communication about costs when consumers do not know the unit cost and therefore must form a belief μ about c. We study three scenarios: no communication, cheap communication (that may or may not be truthful), and persuasive communication (that is truthful and verifiable).

4.1 No communication

In the absence of communication about cost, consumers do not know the true cost level c, which then remains the firm's private information. An equilibrium of the game between the firm and the consumers consists of the following:

1. Firm strategy: Profit-maximizing choice of the price p conditional on the true cost level c.
2. Consumers' strategy: Utility-maximizing purchase decision conditional on the observed price.
3. Consumers' belief: Conditional expectation $\mu(p)$ about the true cost level based on the observed price.

Perfect Bayesian Nash equilibrium requires that each player's strategy is a best response to the other player's strategy, and that the consumers' (posterior) belief is derived from Bayes' rule when applicable.

Consumers form their belief about the true cost level c according to the conditional expectation

$$\mu(p) = \int_0^p c\, z(c|\, p) dc, \tag{5}$$

where $z(c|p)$ denotes the given (posterior) conditional density about the distribution of cost levels. Intuitively, this conditional expectation reflects the belief of consumers about the true but unknown distribution $F(v)$. Note that $\mu(p)$ rules out beliefs about costs that exceed the observed price, because such beliefs would be inconsistent with equilibrium pricing. Given the belief $\mu(p)$, consumers face the loss $L(p; c, v, \bar{e}, \lambda)$, and types with $v \geq \bar{v}(p) \equiv \bar{v}(p, \mu(p))$—the cutoff determined by the participation constraint—purchase. Note that the cutoff value $\bar{v}(p)$ becomes, via the belief $\mu(p)$, a function of p alone.

The firm chooses the price to maximize profit subject to the participation constraint and therefore solves

$$\max_p \quad \pi(p) = \int_{\bar{v}(p)}^{\infty} (p-c) f(v) dv = (p-c)[1 - F(\bar{v}(p)].$$

In equilibrium, the following result holds.

Proposition 2. *Suppose Assumptions 1 and 2 hold. Then, (i) the optimal price p° satisfies*

$$p^\circ = c + \frac{1 - F(\bar{v}(p^\circ))}{f(\bar{v}(p^\circ))\bar{v}_p(p^\circ)}$$

and coincides with the optimal price p^* under full information if consumers have correct point beliefs, that is, if $\mu(p) = c$; and (ii) when consumers overestimate (underestimate) costs, profit is higher (lower) than in the benchmark case with full information, while the price effect is ambiguous.

To illustrate Proposition 2, first consider the case where consumers have correct point beliefs about c. Intuitively, this means that they assign probability one to the distribution $F(v)$ and then, observing the price p°, infer that $\mu(p) = c$ using the conditional expectation in (5). Therefore, consumers make the same purchase decisions as in the benchmark case, and it is optimal for the firm to set $p^\circ = p^*$. Now, suppose that consumers overestimate cost. If $\mu(p) > c$, the loss is smaller than with full information as $L_\mu \leq 0$. This leads to higher sales as $\bar{v}(p) \leq \bar{v}(p; c)$, and thus higher profit compared to the benchmark case. This result has an important implication: When consumers underestimate cost, the firm has an incentive to communicate this to consumers.

4.2 Cheap communication

With cheap communication, the firm not only sets the price p, but also sends a costless message $\tilde{c} \in [0, p]$ about the unit costs c to the consumer. An equilibrium consists of the following:

1. Firm strategy: Profit-maximizing choice of the price p and the cost message $\tilde{c}$ conditional on the true cost level c.
2. Consumers' strategy: Utility-maximizing purchase decision conditional on $(p, \tilde{c})$.
3. Consumers' belief: Conditional expectation $\mu(p, \tilde{c})$ about the true cost level based on the observed price and cost message.

We derive the following result.

Proposition 3. *There is a babbling equilibrium in which the cost message $\tilde{c}$ is correctly ignored by consumers and the optimal price is set at p^*, as in the case with full information.*

To grasp the intuition for this result, note that the consumers' belief cannot depend on the message $\tilde{c}$: if it would, the firm could affect sales and thus profit via the cost message. Consequently, in the Perfect Bayesian equilibrium, consumers must ignore cheap messages about cost and make purchase decisions based solely on the belief $\mu(p)$—as in the case absent communication. Thus, cheap communication does not help the firm to boost profit when consumers underestimate the cost.

4.3 Persuasive communication

Persuasive communication has informational content for consumers: the messages are truthful and verifiable (Milgrom 2008). In our context, it makes sense to argue that a firm cannot make manifestly false public statements about its cost. Obviously, if there are no legal or other institutions that sanction the firm for false statements, communication is necessarily cheap.

1. Firm strategy: Profit-maximizing choice of the price p and the cost message $\hat{c} \in \{c, \emptyset\}$ conditional on the true cost level c.
2. Consumers' strategy: Utility-maximizing purchase decision conditional on $(p, \hat{c})$.
3. Consumers' belief: Conditional expectation $\mu(p, \hat{c})$ about the true cost level based on the observed price and cost message.

We derive the following result.

Proposition 4. *There is an unraveling equilibrium in which persuasive communication about costs allows the firm to boost profit when consumers underestimate costs.*

Proposition 4 thus provides a rationale for cost communication and certification—even if this is costly to the firm. Cost certification can either measure true costs or proxy process costs using labels such as "Made in America" or "produced with no child labor."

5 Competition

This section studies optimal pricing with consumer entitlement in a competitive setting. We consider two firms that produce vertically differentiated products and assume that product 2 is the high-quality product, that is, $s_2 > s_1$ (subscripts index firms). We focus on the interesting case where product 2 is sold at a higher "generalized price," which requires that

$$p_2 + L_2(p_2; c_2) > p_1 + L_1(p_1; c_1).$$

This is a natural assumption, as otherwise the low-quality product would be perceived as the more expensive one and therefore never purchased.

To characterize the purchase decisions, let θ denote a consumer's valuation of quality, distributed according to $G(\theta)$, with density $g(\theta)$. Consumers purchase the high-quality product if their valuation exceeds $\bar{\theta}$ defined by the indifference condition

$$\bar{\theta}s_1 - p_1 - L_1(p_1; c_1) = \bar{\theta}s_2 - p_2 - L_2(p_2; c_2), \tag{6}$$

and they purchase the low-quality product if their valuation θ is less than $\bar{\theta}$ and exceeds $\underline{\theta}$ defined by

$$\underline{\theta}s_1 - p_1 - L_1(p_1; c_1) = 0. \tag{7}$$

To determine the optimal price, each firm solves its respective profit-maximization problem:

$$\begin{aligned} \max_{p_1} \quad \pi_1(p_1, p_2) &= (p_1 - c_1)\left[G(\bar{\theta}) - G(\underline{\theta})\right] \\ \max_{p_2} \quad \pi_2(p_1, p_2) &= (p_2 - c_2)\left[1 - G(\bar{\theta})\right] \end{aligned}$$

In the Nash equilibrium, the prices are characterized by

$$p_1^* = c_1 + \frac{G(\bar{\theta}) - G(\underline{\theta})}{g(\bar{\theta})\frac{1+\partial L_1/\partial p_1}{s_2 - s_1} + g(\underline{\theta})\frac{1+\partial L_1/\partial p_1}{s_1}}$$

and

$$p_2^* = c_2 + \frac{1 - G(\bar{\theta})}{g(\bar{\theta})\frac{1+\partial L_2/\partial p_2}{s_2 - s_1}}.$$

The next result summarizes the impact of consumer entitlement on equilibrium prices.

Proposition 5. *Suppose that Assumption 1 holds. Then, consumer entitlement forces the optimal prices p_1^* and p_2^* down if $g'(\theta) \geq 0$. Instead, if $g'(\theta) < 0$, the price p_2^* of the high-quality firm decreases, while the price p_1^* of the low-quality firm may increase.*

Proposition 5 shows that consumer entitlement puts downward pressure on price under competition if $g'(\theta) \geq 0$. Intuitively, this means that the number of consumers with high raw valuation is increasing in θ.[5] Instead, if $g'(\theta) < 0$, the low-quality firm can benefit from the presence of a large number of consumers with low raw valuation by increasing the price.

6 Conclusion

We showed that consumer entitlement changes the pricing power of the firm, and that it provides a rationale for cost certification and cost communication. More broadly, our results can also be used to provide insights why companies such as *Tesla* or *Everlane* engage in cost communication and cost transparency. Such strategies should not affect purchase behavior when consumers make purchase decisions based on price alone.

Future research could examine the impact of relaxing key assumptions of the model. A natural extension is to allow for competition (internally through a product line or externally through rivalry in the marketplace). One could also study how generic cost drivers such as no-child-labor standards or "Made in America" affect consumer entitlement and thus optimal firm behavior.

Appendix

Proof of Proposition 1. (i) The optimal price p^* follows by rearranging the first-order condition (2). Applying the implicit function theorem to the indifference condition (1) yields

$$\bar{v}_p(p;c) = \frac{1+L_p}{1-L_v},$$

[5] Assuming $g'(\theta) \geq 0$ is more stringent than imposing log-concavity of demand, which is not strong enough to assess the impact of consumer entitlement on the price of the low-quality firm.

where $\bar{v}_p$ is strictly positive using Assumption 1. (ii) First, consider the case where $L_p > |L_v|$, which implies that $\bar{v}_p(p^*;c) = \frac{1+L_p}{1-L_v} > 1$. Now suppose, contrary to the assumption, that $L > 0$ and $p^* \geq p^m$, where p^m is the standard monopoly price satisfying

$$p^m = c + \frac{1-F(p^m)}{f(p^m)}$$

(note that this corresponds to the case where $\bar{v}_p = 1$). Since $L > 0$ by assumption, it follows that $\bar{v}(p^*;c) > p^*$, and therefore that $\bar{v}(p^*;c) > p^m$ (as $p^* \geq p^m$). Next, log-concavity of $1-F$ implies that the Mills ratio $\frac{1-F(v)}{f(v)}$ is non-increasing in v. Taken together, this implies

$$p^* = c + \frac{1-F(\bar{v}(p^*;c))}{f(\bar{v}(p^*;c))\bar{v}_p(p^*;c)} < c + \frac{1-F(p^m)}{f(p^m)} = p^m,$$

a contradiction. Profit decreases as both price and demand decreases. Second, consider the case where $L_p < |L_v|$, which implies that $\bar{v}_p(p^*;c) < 1$. Therefore, the price may increase even though the Mills ratio is non-increasing in v, while profit must necessarily go down. □

Proof of Corollary 1. The result immediately follows from Proposition 1 if $\bar{v}_p(p^*;c) \to \infty$, which makes demand perfectly elastic and thus forces the firm to sell at cost. □

Proof of Corollary 2. The optimal price maximizes profit subject to the participation constraint:

$$\max_p \quad \pi(p) = p - c \quad \text{s.t.} \quad p \leq v - L(p;c,v),$$

where the loss function is given in (3). There are two cases: pricing without a loss and pricing with a loss. If the firm eliminates the loss, the optimal price p_n^* (n indexes the case without a loss) satisfies

$$\bar{e} - \frac{v - p_n^*}{v - c} \leq 0.$$

Since the firm does not leave money on table, the optimal price is $p_n^* = v - (v-c)\bar{e}$. Instead, if the firm imposes a loss, the optimal price is chosen such the participation constraint holds with equality:

$$p^* = v - \lambda\left(\bar{e} - \frac{v - p^*}{v - c}\right). \tag{A.1}$$

Solving (A.1) yields

$$p^* = v - \frac{\lambda(v-c)\bar{e}}{v - c + \lambda}.$$

Since $p^* > p_n^*$ for all values of λ, it is optimal for the firm to charge p^*. Clearly, in the limiting case where $\bar{e} = 1$ and $\lambda \to \infty$, it is optimal to price at cost, that is, set $p^* = c$. □

Proof of Proposition 2. (i) The optimal price p° satisfies the first-order condition

$$1 - F(\bar{v}(p^\circ) - (p^\circ - c)f(\bar{v}(p^\circ))\bar{v}_p(p^\circ) = 0, \tag{A.2}$$

From the implicit function theorem, it follows that

$$\bar{v}_p(p) = \frac{1 + L_p + \mu' L_\mu}{1 - L_v}.$$

Clearly, with correct point beliefs, we have $\mu(p) = c$ and thus $\mu' = 0$ by assumption, which implies that the first-order condition (A.2) is equivalent to (2). (ii) If $\mu(p) > c$ and consumers overestimate cost, then $L(p, \mu(p), v) \leq L(p, c, v)$ for all (p, v) by $L_c \leq 0$, and thus $\bar{v}(p) \leq \bar{v}(p; c)$ for all p. Since profit is strictly decreasing in the cutoff value $\bar{v}$, the firm must generate a higher profit than with full information. The price effect is ambiguous since the Mills ratio is non-decreasing and demand becomes more sensitive with unknown costs. A similar argument shows that $\bar{v}(p) \geq \bar{v}(p; c)$ if consumers underestimate cost, such that profit must be lower than with full information. □

Proof of Proposition 3. With unknown cost and cost message $\tilde{c}$, the loss function is given by $L(p; \mu(p, \tilde{c}), v, \bar{e}, \lambda)$. Therefore, types with $v \geq \bar{v}(p, \tilde{c})$ purchase, where the cutoff value satisfies

$$\bar{v}(p, \tilde{c}) = p + L(p; \mu(p, \tilde{c}), \bar{v}(p, \tilde{c}), \bar{e}, \lambda). \tag{A.3}$$

Equilibrium requires that, for any p, $L_\mu \leq 0$ and $L_v \leq 0$, no deviation by the firm with respect to the message $\tilde{c}$ increases consumer demand $1 - F(\bar{v}(\tilde{c}, p))$. Applying the implicit function theorem to the participation constraint in (A.3), this requires that the change in the cutoff value is zero when the cost message $\tilde{c}$ is being changed, that is,

$$\bar{v}_{\tilde{c}}(p, \tilde{c}) = \frac{\mu_{\tilde{c}} L_\mu}{1 - L_v} = 0,$$

which in turn requires that $\mu_{\tilde{c}} = 0$. That is, in equilibrium the consumer belief is not allowed do depend on the message sent by the firm. The intuition for this result is straightforward: If a change in the message $\tilde{c}$ were able to change the belief (and thereby demand), the seller would always want to deviate, as the seller's profit is strictly increasing in demand (conditional on p and c). Consequently, in equilibrium consumers ignore cheap messages and make purchase decisions based solely on the belief $\mu(p)$, as in the model without cheap communication. □

Proof of Proposition 4. Regarding the consumers, there are two cases. First, consider the case where the firm chooses (p,c) and thus reveals the true cost. Hence, consumers form correct point beliefs $\mu(p,c) = c$. It is then immediate that only consumers with $v \geq \bar{v}(p,c)$ purchase, where the cutoff satisfies

$$\bar{v}(p,c) = p + L(p; \mu(p,c), \bar{v}(p,c), \bar{e}, \lambda),$$

which is the same threshold as under full information. Second, consider the case where the firm chooses $(p,\emptyset)$ and thus does not reveal the cost. Rational consumers infer that a profit-maximizing firm does not want to reveal c if they overestimate the true cost: If $\mu(p,\emptyset) > c$, then $L(p;\mu(p,\emptyset)) \leq L(p;c)$ as $L_\mu \leq 0$, which means that consumers underestimate the loss. This in turn implies that the firm generates higher sales as $\bar{v}(p,\mu(p,\emptyset)) \leq \bar{v}(p,c)$. Rational consumers therefore adjust their belief downward to some strictly lower level $\mu^*(p,\emptyset) < \mu(p,\emptyset)$.

The firm compares the profits associated with the strategies (p,c) and $(p,\emptyset)$, respectively. Firms with costs $c \geq \mu(p,\emptyset)$ always disclose, as consumers overestimate the loss and, consequently, purchase too little. Firms with costs $c < \mu(p,\emptyset)$, in turn, realize that consumers adjust their belief downward to some $\mu^*(p,\emptyset) < \mu(p,\emptyset)$ if they do not reveal their cost level. For firms with cost levels c such that

$$\mu^*(p,\emptyset) \leq c < \mu(p,\emptyset)$$

it is then profitable to disclose c so as to distinguish themselves from firms with costs below $\mu^*(p,\emptyset)$. A similar argument holds for firms with cost levels just below $\mu^*(p,\emptyset)$. This unraveling argument shows that all firm types $c \geq 0$ cannot do better than reveal their true type.

□

Proof of Proposition 5. The indifference condition (6) implies that

$$\bar{\theta} = \frac{p_2 + L_2 - p_1 - L_1}{s_2 - s_1} > 0,$$

while the indifference condition (7) implies that

$$\underline{\theta} = \frac{p_1 + L_1}{s_1}.$$

Demand for the low-quality product is positive if $\underline{\theta} < \bar{\theta}$, that is,

$$\frac{s_2}{p_2 + L_2} < \frac{s_1}{p_1 + L_1}.$$

The first-order condition for p_1 is given by

$$\frac{\partial \pi_1}{\partial p_1} = \left[G(\bar{\theta}) - G(\underline{\theta})\right] + (p_1 - c_1)\left[-g(\bar{\theta})\frac{1+\partial L_1/\partial p_1}{s_2 - s_1} - g(\underline{\theta})\frac{1+\partial L_1/\partial p_1}{s_1}\right] = 0,$$

which can be rearranged as

$$p_1^* = c_1 + \frac{G(\bar{\theta}) - G(\underline{\theta})}{g(\bar{\theta})\frac{1+\partial L_1/\partial p_1}{s_2-s_1} + g(\underline{\theta})\frac{1+\partial L_1/\partial p_1}{s_1}}.$$

Similarly, the first-order condition for p_2 is given by

$$\frac{\partial \pi_2}{\partial p_2} = \left[1 - G(\bar{\theta})\right] + (p_2 - c_2)\left[-g(\bar{\theta})\frac{1+\partial L_2/\partial p_2}{s_2 - s_1}\right] = 0,$$

which yields

$$p_2^* = c_2 + \frac{1 - G(\bar{\theta})}{g(\bar{\theta})\frac{1+\partial L_2/\partial p_2}{s_2-s_1}}.$$

To see that p_2^* is lower than the price absent consumer entitlement, recall that $g'(\theta) \geq 0$ is sufficient for $(1-G)/g$ to be non-increasing. In addition, note that $\partial L_2/\partial p_2 \geq 0$. Taken together, this implies that consumer entitlement forces the price of the low-quality firm down. The argument for p_1^* is more involved: Defining

$$Z(L_1) = \frac{G(\bar{\theta}) - G(\underline{\theta})}{g(\bar{\theta})\frac{1+\partial L_1/\partial p_1}{s_2-s_1} + g(\underline{\theta})\frac{1+\partial L_1/\partial p_1}{s_1}}$$

and differentiating it with respect to L_1 shows that $Z'(L_1) < 0$ if $g'(\theta) \geq 0$ (the analysis is tedious but straightforward). Instead, if $g'(\theta) < 0$, it is possible that consumer entitlement increases the price of the high-quality firm. □

References

Bolton, L.E., & Alba, J.W. (2006). Price fairness: Good and service differences and the role of vendor costs. *Journal of Consumer Research*, 33(2), 258–265.

Bolton, G.E., & Ockenfels, A. (2000). ERC: A theory of equity, reciprocity, and competition. *American Economic Review*, 90(1), 166–193.

Fehr, E., & Schmidt, K.M. (1999). A theory of fairness, competition, and cooperation. *Quarterly Journal of Economics*, 114(3), 817–868.

Guo, L. (2015). Inequity aversion and fair selling. *Journal of Marketing Research*, 52(1), 77–89.

Jiang, B., Sudhir, K., & Zou, T. (2016). Effects of cost-information transparency on intertemporal pricing and innovation (February 1, 2017). Available at SSRN: https://ssrn.com/abstract=2732812.

Kahneman, D., Knetsch, J.L., & Thaler, R.H. (1986a). Fairness as a constraint on profit seeking: Entitlements in the market. *American Economic Review*, 76(4), 728–741.

Kahneman, D., Knetsch, J.L., & Thaler, R.H. (1986b). Fairness and the assumptions of economics. *Journal of Business*, 59(4), S285–S300.

Milgrom, P. (2008). What the seller won't tell you: Persuasion and disclosure in markets. *Journal of Economic Perspectives*, 22(2), 115–131.

Mohan, B., Buell, R.W., & John, L.K. (2014). Lifting the veil: The benefits of cost transparency (September 11, 2016).
Available at SSRN: https://ssrn.com/abstract=2498174.

Rabin, M. (1993). Incorporating fairness into game theory and economics. *American Economic Review*, 83(5), 1281–1302.

Rotemberg, J.J. (2011). Fair pricing. *Journal of the European Economic Association*, 9(5), 952–981.

Rotemberg, J.J. (2008). Minimally acceptable altruism and the ultimatum game. *Journal of Economic Behavior & Organization*, 66(3), 457–476.

Rotemberg, J.J. (2005). Customer anger at price increases, changes in the frequency of price adjustment and monetary policy. *Journal of Monetary Economics*, 52(4), 829–852.

Xia, L., Monroe, K.B., & Cox, J.L. (2004). The price is unfair! A conceptual framework of price fairness perceptions. *Journal of Marketing*, 68(4), 1–15.