Economics Letters 122 (2014) 140–143

Contents lists available at ScienceDirect

Economics Letters

journal homepage: www.elsevier.com/locate/ecolet

The social value of information on product quality

Kenneth S. Corts *

Rotman School of Management, University of Toronto, 105 St. George St., Toronto, Ontario M5S 3E6, Canada

HIGHLIGHTS

- Firms have private information on product quality.
- Revelation of information does not have social value in a baseline model.
- It does have social value under two alternative models.
- In those cases, the gross social value increases in fineness of information.
- This helps ground the large literature on signaling, liability, certification, etc.

ARTICLE INFO

Article history:
Received 29 August 2013
Accepted 1 November 2013
Available online 19 November 2013

Keywords:
Social welfare
Private information
Learning

ABSTRACT

In the context of a seller with private information about product quality, I show that revelation of information on product quality is sometimes, but not always, socially valuable. When it is socially valuable, there is generally a tradeoff between the acquisition and revelation of finer, but more costly information and the revelation of coarser, but less costly information. As a result, it can be socially optimal for firms to reveal only coarse private information.

1. Introduction

This note investigates the social value of information by examining possible information revelation by sellers, without attention to the institutional environment that might support that information revelation. It is intended as a foundation for the vast literature that *does* address the institutional environment, which includes papers featuring price signaling (e.g., Bagwell and Riordan, 1991), advertising as a signal (e.g., Nelson, 1974), certification regimes (e.g., Viscusi, 1978), liability rules (e.g., Polinsky and Shavell, 2012), mandatory disclosure policies (e.g., Polinsky and Shavell, 2012), and false advertising penalties (e.g., Corts, 2013, forthcoming). That literature does not typically directly address the social desirability of information revelation. While, in general, the tone of these and related papers suggests that information revelation is rather naturally a good thing (at least ignoring the costs of information acquisition), the formal arguments in this literature are generally focused on the private benefit to firms (Nelson, 1974; Bagwell and Riordan, 1991) or the private benefit to consumers (as in Polinsky and Shavell, 2012). Viscusi (1978) does address the social value of information but emphasizes the social costs of information acquisition rather than the social benefits of information revelation. Implicitly or explicitly, many of these papers appeal to Akerlof's (1970) seminal paper on adverse selection, which demonstrates one way in which information revelation creates social value. In that paper, some desirable sellers (who would engage in value-creating transactions under perfect information) drop out of the market when information is not revealed because they fail to cover their costs when they receive a price reflecting only the willingness-to-pay for a product of uncertain quality. The present note undertakes a complementary analysis that deepens our understanding of the social value of information. I consider a setting in which Akerlof-style adverse selection does not arise and in which sellers may be partially or fully informed about their product. In that context, I show that information on product quality or firm type (where this is private information correlated with initially unobserved product quality) need not have any social value. When it does have value, I show that in general more fine-grained information on quality generates more gross social value; therefore, accounting for the cost of information acquisition, either "weak separation", through revelation of firm type, or "strong separation", through revelation of actual quality, may be socially optimal.[1]

Two considerations that generate a social value of information lie beyond the scope of this paper-endogenous quality and buyer

* Tel.: +1 416 946 8600.
E-mail address: kenneth.corts@rotman.utoronto.ca.

0165-1765/$ – see front matter
http://dx.doi.org/10.1016/j.econlet.2013.11.003

[1] In particular, this paper provides a foundation for the analysis in Corts (2013, forthcoming), in which the assumption that more fine-grained information generates higher gross social surplus plays a central role. The information structure laid out here is largely the same as in those papers, which also include a regulatory authority and endogenous credible revelation of information through signaling.

risk-aversion. With endogenous quality, the revelation of quality information creates at least a possibility that the firm will be rewarded for innovation and therefore may have the incentive to invest in welfare-increasing innovative activity. Without any information revelation, firms offering different qualities are necessarily pooled and receive the same profits, creating no incentive to undertake costly innovative activity. With risk-averse buyers, information revelation directly improves social welfare by mitigating or eliminating the cost of risk borne by buyers, even if qualities and quantities are unchanged by the information revelation. I rule out these considerations and focus on a setting with exogenous quality and risk-neutral buyers.

2. Model

A single price-setting firm offers to potential buyers at a single price a product that may be of either high (H) or low (L) quality. A firm may be one of two types, where the type represents the firm's probability of having a high quality product. The firm knows its type, which may be either 0, meaning that it is certain that it is has a low-quality product, or 1, meaning that it has a $\gamma \in (0, 1)$ probability of having a high-quality product and a $1-\gamma$ probability of having a low-quality product. Firm type is exogenously determined at the beginning of the game, with the type 1 realization occurring a proportion λ of the time. The firm may learn with certainty its product quality at cost $t > 0$; this represents an investment in testing. I also assume for simplicity that the marginal cost is equal to a constant c regardless of type or quality.

$D_i(p)$ denotes the demand for product at price p, where $i \in \{H, L, 1, 0, P\}$ denotes expectations of quality. Because demand is realized ex ante of the revelation of quality to the consumer, only quality *expectations* matter. Expected quality of H or L corresponds to buyer belief that the product is certainly of that particular quality. A subscript of 1 or 0 corresponds to buyer belief that the firm is certainly of that type (1 or 0), and therefore that the product is of quality H with probability γ or 0, respectively. Expected quality of P corresponds to buyer belief that the types are pooled, and therefore that the product is of quality H with probability $\lambda\gamma$. The firm must set a single price; let p_i and q_i denote the firm's profit-maximizing price and quantity for each potential buyer belief i.

I assume throughout that type and quality are exogenous and that buyers are risk-neutral in the following sense. I assume that buyers' willingness-to-pay for a good of some expected quality is equal to the expected value of the willingness-to-pay for the underlying qualities that may be realized (H or L)-that is, the inverse demand $D_i^{-1}(q)$ for $i \in \{P, 1\}$ is the appropriate linear combination of $D_H^{-1}(q)$ and $D_L^{-1}(q)$ for all quantities q. In particular, $D_1^{-1}(q) = \gamma D_H^{-1}(q) + (1-\gamma)D_L^{-1}(q)$ and $D_P^{-1}(q) = \lambda\gamma D_H^{-1}(q) + (1-\lambda\gamma) D_L^{-1}(q)$.

Note that the willingness-to-pay under pooling is necessarily lower than the willingness-to-pay for a product of a firm known to be either high type or high quality. To rule out Akerlof-style adverse selection (in which a desirable firm drops out of the market when information is not revealed), I assume that the marginal cost c (assumed above to be constant across type and quality) is lower than the willingness-to-pay under pooling; this ensures that high type and high quality firms remain active regardless of the amount of information revealed. To be precise, I assume that the marginal cost is lower than the willingness-to-pay for a high quality product, evaluated at the high-quality firm's profit-maximizing quantity under perfect information: $c < D_H^{-1}(q_H)$. This ensures that not only is the high type or high quality firm's *first* unit not priced out of the market under pooling, but neither is its *last* unit (defined as the highest quantity that would be sold under any degree of information revelation).

I examine three scenarios with different levels of information revelation prior to price-setting: pooling, strong separation, and weak separation. Again, this note abstracts from the problem of how this information might be credibly revealed to analyze only the issue of the social value of such information. The pooling regime (denoted by P) is the case in which no information is credibly revealed to buyers, and buyers therefore believe that the product is of quality H with probability $\lambda\gamma$. Strong separation (denoted by S) is the case in which product quality is perfectly known or inferred by buyers. Weak separation (denoted by W) is the case in which firm type, but not product quality, is perfectly known or inferred by buyers. Buyers therefore believe that the product is of high quality with probability γ if and only if the firm is believed to be of type 1. Note that demand depends on buyer expectations about a firm's quality and is therefore indexed by $i \in \{H, L, 1, 0, P\}$. In contrast, welfare measures depend on the regime that prevails; they are therefore indexed by $j \in \{P, S, W\}$. I denote gross total welfare—i.e., not accounting for learning costs—as T_j, while CS_j and PS_j denote consumer and producer surplus, respectively.

3. The social value of information

3.1. When information has no value

I begin by providing an example of a class of demand functions under which information on product quality or firm type has no social value. This class of demand functions is defined by the following condition: the firm's optimal quantity is invariant to buyer beliefs. It will become clear that this embodies both an assumption that demand is highly inelastic over the relevant range and an assumption that marginal costs are low enough that even the low quality product is optimally traded. Note that this includes, but is more general than, a unit demand model with homogeneous buyers and zero marginal cost.

Proposition 1. *Assume that the optimal quantity for the firm is invariant to buyer beliefs about its type and quality: that is, D_i is such that $D_i(p_i) = \overline{q}$ for all $i \in \{H, L, 1, 0, P\}$. Then neither information on product quality nor information on firm type has any value to buyers or society. In addition, such information is of no value ex ante to a firm (that is, it does not change the expected profit of a firm that does not yet know its type).*

Proof. For any buyer beliefs, the optimal price is the price that fully extracts the buyers' willingness-to-pay at $\overline{q}$, given their expectations on realized product quality (note that this need not extract all consumer surplus since some variation in willingness-to-pay over inframarginal units is consistent with the assumptions). The optimal prices are given by: $p_H = D_H^{-1}(\overline{q})$; $p_L = D_L^{-1}(\overline{q})$; $p_1 = \gamma D_H^{-1}(\overline{q}) + (1-\gamma)D_L^{-1}(\overline{q})$; $p_P = \lambda\gamma D_H^{-1}(\overline{q}) + (1-\lambda\gamma)D_L^{-1}(\overline{q})$. Ex ante expected consumer surplus and producer surplus for each regime are given by the following expressions.

$$CS_P = \lambda\gamma \int_0^{\overline{q}} [D_H^{-1}(q) - p_P]dq + (1-\lambda\gamma) \int_0^{\overline{q}} [D_L^{-1}(q) - p_P]dq$$

$$PS_P = [p_P - c]\overline{q}$$

$$CS_S = \lambda\gamma \int_0^{\overline{q}} [D_H^{-1}(q) - p_H]dq + (1-\lambda\gamma) \int_0^{\overline{q}} [D_L^{-1}(q) - p_L]dq$$

$$PS_S = [\lambda\gamma p_H + (1-\lambda\gamma)p_L - c]\overline{q}$$

$$\begin{aligned} CS_W \; = \; & \lambda\gamma \int_0^{\overline{q}} [D_H^{-1}(q) - p_1]dq + \lambda(1-\gamma) \\ & \times \int_0^{\overline{q}} [D_L^{-1}(q) - p_1]dq + (1-\lambda) \\ & \times \int_0^{\overline{q}} [D_L^{-1}(q) - p_L]dq \end{aligned}$$

$$PS_W = [\lambda p_1 + (1-\lambda)p_L - c]\overline{q}.$$