

NELCO
NELCO Legal Scholarship Repository

New York University Law and Economics Working
Papers

New York University School of Law

11-1-2010

Product Use Information and the Limits of Voluntary Disclosure

Oren Bar-Gill

NYU School of Law, BarGill@exchange.law.nyu.edu

Oliver Board

NYU School of Law, University of Pittsburgh - Dept. of Economics, ojboard@nyu.edu

Follow this and additional works at: http://lsr.nellco.org/nyu_lewp

 Part of the [Consumer Protection Law Commons](#), [Contracts Commons](#), and the [Law and Economics Commons](#)

Recommended Citation

Bar-Gill, Oren and Board, Oliver, "Product Use Information and the Limits of Voluntary Disclosure" (2010). *New York University Law and Economics Working Papers*. Paper 239.

http://lsr.nellco.org/nyu_lewp/239

This Article is brought to you for free and open access by the New York University School of Law at NELCO Legal Scholarship Repository. It has been accepted for inclusion in New York University Law and Economics Working Papers by an authorized administrator of NELCO Legal Scholarship Repository. For more information, please contact tracy.thompson@nellco.org.

Product Use Information and the Limits of Voluntary Disclosure*

Oren Bar-Gill and Oliver Board
New York University School of Law
40 Washington Square South
New York, NY 10012

June 14, 2011

Abstract

Concern about asymmetric information in markets for consumer goods and services has focused on product attribute information. We highlight the importance of another category of information—product use information. In important markets, sellers have better information about how a consumer will use their product or service than the consumer herself. Moreover, we show that the classic unraveling results do not extend to product use information, and thus sellers are less likely to voluntarily disclose this type of information. Our findings have important policy implications: While most disclosure mandates target product attribute information, our analysis suggests that mandating disclosure of product use information may be more important. Indeed, policymakers are beginning to recognize the importance of product use disclosures.

*We thank Douglas Baird, Omri Ben-Shahar, Kevin Davis, Chaim Fershtman, Barry Friedman, Clay Gillette, Assaf Hamdani, Marcel Kahan, Emir Kamenica, Lewis Kornhauser, Mike Levine, Ariel Porat, Ariel Rubinstein, Alan Schwartz, Rebecca Stone, Doron Teichman, Richard Thaler, Eyal Zamir, the editor, Steve Shavell, an anonymous referee, and workshop and conference participants at The Hebrew University, IDC Hertzelia, Tel-Aviv University, the University of Chicago, NYU, and the 2010 Annual Meeting of the American Law and Economics Association for helpful comments. Oren thanks the Filomen D'Agostino and Max E. Greenberg Research Fund for financial support. We are especially grateful to Nicola Persico for helping us think through various modeling options.

1 Introduction

The efficiency of markets depends on the existence of adequate information. In consumer markets, the question is whether consumers have adequate information. We distinguish between two categories of information: product attribute information and product use information. Consider the credit card market. The interest rate on a credit card is an attribute of the credit card product. Borrowing patterns, i.e., how often and how much the consumer borrows on the card, describe how the product is used. The total benefits and costs associated with a product are a function of both product attributes and use patterns. Total interest paid depends both on the interest rate and on the consumer's evolving balance.

Sellers are generally assumed to have better information about the attributes of their products. On the other hand, consumers are generally believed to have better information about how they will use the product, since product use is a function of consumer preferences. Accordingly, when policymakers impose disclosure mandates on sellers—and this happens very often—they naturally focus on product attribute information. They reason that sellers should be required to disclose their private information, i.e., product attribute information; there is no point in forcing sellers to disclose product use information, since this is where consumers, not sellers, enjoy the informational advantage.

We take issue with this conventional wisdom on two counts. First, while it is often true that consumers have better product use information than sellers, there are important consumer markets where this is not the case. The credit card market is such a market. Duncan McDonald, former general counsel of Citigroup's Europe and North America card businesses, noted:

No other industry in the world knows consumers and their transaction behavior better than the bank card industry. It has turned the analysis of consumers into a science rivaling the studies of DNA . The mathematics of virtually everything consumers do is stored, updated, categorized, churned, scored, tested, valued, and compared from every possible angle in hundreds of the most powerful computers and by among the most creative minds anywhere. In the past 10 years alone, the transactions of 200 million Americans have been reviewed in trillions of different

ways to minimize bank card risks. (MacDonald [19])¹

The cellular service market provides another example. A pricing manager at a top US cellular service provider commented that “people absolutely think they know how much they will use [their cell phones] and it’s pretty surprising how wrong they are.” (Grubb [13]) Presumably, the pricing manager was comparing people’s perceived use patterns to a benchmark of actual use patterns, which the provider, and its employees, knew.²

Second, we argue that the prevalence of rules requiring product attribute disclosure and the relative paucity of mandatory product use disclosure is, in an important sense, exactly the opposite of what economic theory would recommend. As shown by Grossman & Hart [12], in many market settings product attribute information will be voluntarily disclosed by firms. Since firms offering higher-quality products would not wish to be pooled with firms offering lower-quality products, an unraveling dynamic leads to voluntary disclosure by all firms (see also Grossman [11], Milgrom [23]). An implication of this result is that mandatory disclosure of product attribute information is often unnecessary. (Following Grossman & Hart [12], Grossman [11], and Milgrom [22], we focus on the case where sellers can disclose information verifiably.)

We show that this classic result does not extend to product use information. In essence, the unraveling result assumes that the information is firm-specific, while product-use information is consumer-specific. Put differently, product-use information is common to all firms. It follows that disclosure of product use information, unlike product attribute information, cannot help firms to differentiate themselves from their competitors, and hence the unraveling argument fails. Since we cannot count on voluntary disclosure of product use information, it may be necessary to mandate disclosure.

The following numerical example may help demonstrate the underlying intuition. Consider first the product attribute case, and suppose there are two types of cell phone com-

¹See also Duhigg [8] (describing the vast amount of information, especially product use information, that credit card companies collect, and then analyze using sophisticated algorithms informed by psychology research).

²In these and other examples, while consumers may potentially have access to information about their own usage patterns, such information would be prohibitively costly to accumulate and process. The seller is the least-cost information collector/provider (compare: least-cost avoider in tort law). This provides an *a priori* justification for requiring the seller to disclose product use information to consumers, if the seller does not disclose the information voluntarily.

panies: H companies who offer high quality service which is worth 20 to consumers; and L companies who offer low quality service which is worth 10 to consumers. Of all cell phone companies, half are H companies and half are L companies. If no company ever disclosed the quality of its service, consumers would expect any given company to provide a value of 15 (on average). Assuming the companies face zero unit costs, both companies would then set a price of zero and earn zero profit. It follows that an H company is strictly better off disclosing its quality of service, charging a positive price, and making a positive profit. In other words, no disclosure is not an equilibrium. In equilibrium, an H company will always disclose, earning a positive profit if its rival is an L company and a zero profit if its rival is an H company. As a result, consumers can identify L companies as L whether they disclose or not: all information about company quality is revealed in equilibrium.

Now turn to the product use case. Suppose there are two types of consumer: Heavy (h) users who enjoy a benefit of 20 from cell-phone service, and light (l) users who enjoy a benefit of 10 from cell-phone service. Of all consumers, half are h types and half are l types. Companies know the type of a given consumer; the consumer herself does not. If no company ever disclosed, consumers would expect a benefit of 15 from cell-phone service (on average). Assuming that companies face zero unit costs, they would set a price of zero in equilibrium and earn zero profit. Unlike in the product attribute case, however, companies no longer have any incentive to disclose to an h consumer that she is h : if one company did disclose this information, again competition would drive prices to zero and the company would make zero profit.

The intuition captured by the numerical example is robust. We prove two general results about the likelihood of voluntary disclosure. Extending the standard linear city model from the industrial organization literature, we first replicate the standard full disclosure result for product attribute information. We then shift focus to product use information and show that full disclosure is no longer guaranteed.

Although we work with a model where this conclusion is especially sharp, the more general finding that the market provides stronger pressure to disclose in the product attribute case than in the product use case is robust. The intuition is as follows. In the product attribute case, disclosure by one firm conveys no information to consumers about the other firms'

products. Such disclosures therefore have the potential not only to improve expectations of the quality of the firm's product, but also to improve the firm's competitive position vis-à-vis its rivals. In the product use case, on the other hand, only the first effect is present: product use is a characteristic of consumers, and is thus common across firms. The implication of this difference is that a firm's profits will increase more sharply when consumers learn good news about its product attributes than when they learn good news about (their own) product use. Incentives to disclose product attribute information will thus be stronger than incentives to disclose product use information. In the model examined here, the latter can actually be zero, leading to a no-disclosure equilibrium even when disclosure is costless. More generally, when incentives to disclose are pitted against costs of disclosure, we can expect less disclosure in the product use case than in the product attribute case.

As explained above, voluntary disclosure is more likely with respect to product attribute information, because this information is firm specific; and voluntary disclosure is less likely with respect to product use information, because this information is common across firms. The driving force of our results is the analytical distinction between private (or firm-specific) values and common values (i.e., value components that are common across firms). Descriptively, it may have been better to frame our analysis and results around the private value vs. common value distinction, rather than the product attribute vs. product use distinction. In fact, the product attribute vs. product use distinction does not map perfectly onto the private value vs. common value distinction. There are product attributes that are common across firms and there are use patterns that vary from firm to firm and from product to product. Still, we think that there is a high correlation between the attribute-use distinction and the private-common distinction. And, from a policy perspective, the attribute-use taxonomy is likely to gain more traction.

Indeed, after decades of focusing almost entirely on product attribute disclosures, academics and, more importantly, policymakers are starting to recognize the need to mandate disclosure of product-use information. For example, the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 imposes a general duty, subject to rules prescribed by the new Consumer Financial Protection Bureau, to disclose information, including usage data in markets for consumer financial products (Pub. L. 111-203, Title X, Sec. 1033).

Similarly, in August 2009 the Federal Communications Commission released a Notice of Inquiry seeking comment on ways to improve disclosure in telecommunication service markets, including disclosure of information on usage (FCC [9]). Academics have gone further, proposing mandatory disclosure of product-use information for credit cards, mortgages, payday loans, cell-phones, subscription services and more (Bar-Gill & Ferrari [2]; Bar-Gill & Stone [3]; Bar-Gill [1]; Nalebuff & Ayres [24]; Lynch & Zauberman [18]; Sovern [27]; Thaler & Sunstein [28]; Kamenica *et al.* [15]).

This paper is organized as follows. Section 2 elaborates on the distinction between product-attribute information and product-use information. Section 3 contains the formal model and presents our main results about the likelihood of voluntary disclosure of product-attribute information and of product-use information. Section 4 discusses three extensions: (1) the case where disclosure combines both product-attribute information and product-use information (e.g., total cost of ownership (TCO) disclosures, which are sometimes referred to as product life-cycle cost disclosures); (2) the case where one firm has better product use information than others (e.g., because the firm has already been serving the customer for a period of time); and (3) the issue of incentives to acquire product use information. Section 5 describes the limited landscape of existing use pattern disclosure mandates, as well as policy initiatives and academic proposals to expand mandatory product use disclosures. Section 6 offers concluding remarks.

2 Two Categories of Information

Informed choice assumes two distinct categories of information: information about product attributes and information about how the product will be used. One way to view the distinction between product-attribute information and product-use information is by tracing the source of the information. Product attribute information, like the product itself, is created by the manufacturer. The manufacturer is the source of the information. Product use, on the other hand, is a function of three different factors: (1) product attributes, (2) consumer preferences, and (3) external forces that affect the benefit to the consumer from using the product. Correspondingly, product use information has three sources: (1) the

manufacturer, (2) the consumer, and (3) nature.

Consumer protection law is concerned with imperfect information on the part of consumers. Traditional consumer protection analysis and policy focus on lack of information about product attributes and, correspondingly, on mandatory disclosure of product-attribute information (Bar-Gill and Ferrari [2]). This emphasis on product attribute information stems from an assumption that consumers know, or can easily predict their use patterns, and, that, in any event, sellers do not have an informational advantage vis-à-vis consumers with respect to product use information (so that disclosure of use information by sellers is superfluous).

To better understand this assumption, and its limits, recall the three factors that determine a consumer's use patterns: (1) product attributes, (2) consumer preferences, and (3) external forces that affect the benefit to the consumer from using the product. The manufacturer initially has better information about product attributes, but this information asymmetry is eliminated through the disclosure of product attribute information. This leaves consumer preferences and external forces. If both parties are similarly informed (or not informed) about external factors and the consumer has better information about her own preferences, then the consumer is also better informed about use patterns.

We now see the limits of the assumption that consumers are better informed about product use. First, it may well be that sellers have better information than consumers about external factors that affect the benefits to consumers from using the product. If so, sellers may be able to predict a consumer's use patterns better than the consumer herself. Moreover, even with respect to preferences, it is not clear that consumers have better information, especially when the relevant information includes the potentially complex interactions between preferences, product attributes and external forces. In practice, consumers often learn about their use patterns through experience—from past use. The question thus becomes a question of recall. A consumer suffering from imperfect recall may well be at an informational disadvantage as compared to a seller that collects, in large databases, and analyzes prior use information of consumers and, in certain markets, even of this specific consumer. (We realize that we are pushing the boundaries of the rational choice model here and perhaps even crossing these boundaries.)

The following examples may help make things more concrete. Consider a lawnmower.

The value of a lawnmower to a consumer depends on attributes of the lawnmower and on how frequently the consumer will want or need to mow her lawn. How often the lawnmower will be used depends, in turn, on attributes of the lawnmower, on consumer preferences, and on external factors influencing the consumer's need to mow the lawn. The attributes of the lawnmower matter, because, for example, a better lawnmower is less burdensome to operate and thus will be used more often. Consumer preferences matter, because a consumer who cares more about her lawn will use the lawnmower more often. And external forces, like rainfall and soil condition, matter, because they affect the speed with which grass grows. To make a fully-informed decision whether to purchase a lawnmower and which lawnmower to purchase the consumer must have information on all of these factors. Yet consumer protection law, with its focus on product attribute information, pays insufficient attention to other factors affecting product use.

Or consider a credit card. Focusing on the financing component of the credit card product, the value of a credit card depends on product attributes, specifically the interest rate. The value of the product depends also on how it will be used—on how much the consumer will borrow. The extent of borrowing, in turn, depends on: (1) product attributes such as the interest rate, (2) the consumer's intertemporal consumption preferences, and (3) external forces affecting the consumer's desire to borrow or need to borrow such as present and expected available income and conditions affecting the demand for funds, e.g., illness or divorce. Policymakers have been concerned about mistakes in the credit card market. Their response, however, has largely been targeted at product attribute information. The Truth-in-Lending Act, for example, mandates conspicuous disclosure of credit card interest rates. Use pattern mistakes that are not caused by imperfect information about interest rates have received less attention.

The importance of product-use information should be evident. It should also be evident that consumers will often have imperfect information about how they will use a product. But these two observations, in and of themselves, are not enough to justify legal rules that mandate disclosure of product-use information. For mandated disclosure to make sense it is not enough that consumers lack information; sellers must possess the information so that they can disclose it to consumers. As suggested in the Introduction, there are important

markets, like the credit card market and the cell-phone market, where sellers do have superior product-use information. But even when sellers have superior product-use information, mandatory disclosure is unwarranted if sellers will disclose the information voluntarily. In the following section, we argue that, at least in certain markets, voluntary disclosure of product-use information is unlikely. Moreover, we show, in Section 3 below, that product use information is less likely than product attribute information to be voluntarily disclosed. These findings suggest that the current regulatory focus on product attribute disclosures and the relative paucity of product use disclosures should be reconsidered.

3 Voluntary Disclosure?

We now turn to a formal analysis of sellers' incentives to voluntarily disclose information. We show that while market forces induce voluntary disclosure of product-attribute information, they are less effective in motivating sellers to voluntarily disclose product-use information. This result provides the impetus for mandating disclosure of product-use information.

As explained in the Introduction, the formal analysis equates product attribute information with private (firm-specific) information and product use information with common information (i.e., information that is common across firms), while acknowledging that this mapping is imperfect. Accordingly, when referring to product use information, we emphasize use patterns that are determined by consumer preferences and external forces (nature)—to use the terminology introduced in Section 2 above. Use patterns that are determined by firm-specific product attributes are considered “product attributes” in the formal analysis.³

3.1 Framework

We use a standard linear-city model. Two firms, firm 1 and firm 2, are located at opposite ends of a line. The distance between the two firms is 1 unit. There is a unit mass of consumers distributed uniformly along the line. Consumers purchase one unit of a good, at most. (They get no additional utility from purchasing more than one unit of the good.)

³There are examples in which sellers voluntarily disclose information about use patterns. In these examples, however, the benefit from the use information that is being disclosed is usually correlated with a specific product attribute and thus would not be considered “product use information” under our definition.

This means that each consumer chooses between (i) buying one unit of the good from firm 1, (ii) buying one unit of the good from firm 2, or (iii) not buying at all.⁴

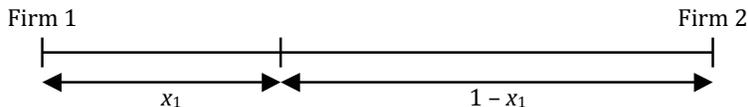


Figure 1: The linear city.

Specifically, a consumer located at a distance x_1 from firm 1 chooses between: (i) not buying and obtaining a (normalized) payoff of zero, (ii) buying one unit from firm 1 at a price p_1 and obtaining a payoff of $V_1 - x_1 - p_1$, and (iii) buying one unit from firm 2 at a price p_2 and obtaining a payoff of $V_2 - (1 - x_1) - p_2$. The values V_1 and V_2 represent the basic utility that consumers get from the good.

In the general case, V_i consists of two components, the product attribute component, v_i , and the product use component, v . The product use component is the same for both firms, capturing the notion that use information is unique to the consumer, not to the firm. To facilitate the exposition, in what follows (and after deriving some preliminary results in section 3.2) we consider first the product attribute case alone (section 3.3), and then the product use case alone (section 3.4), before turning to the general case (in section 4.1).

The distance x_1 can be interpreted as a measure of how the consumer would rank the two products if they were both of the same quality, in the product attribute case; in the product use case, the two products are assumed to be of the same quality, thus x_1 measures how the consumer would rank the two products. From a slightly different perspective, the fact that x_1 varies across consumers represents heterogeneity on a dimension that is orthogonal to the v -dimension.

The timing of the game is as follows: At stage 1, the two firms simultaneously decide whether to disclose the value that they provide to consumers: v_i for firm i ($i = 1, 2$) in the product attribute case; v in the product use case; and either or both in the general case. Disclosure is costless and verifiable (as in Grossman and Hart [12] and Grossman [11], for

⁴We have chosen to work with the linear-city model, since it is used in the literature under the assumption of private values (our product attribute case), and so it is helpful to study the same model to contrast the private values (product attributes) case with the common values (product use) case.

example). At stage 2, the firms simultaneously set prices and consumers make their purchase decisions à la Bertrand.

3.2 The Post-Disclosure Subgame

We analyze the post-disclosure subgames before considering disclosure decisions. As noted above, a consumer located at x_1 chooses between (i) buying one unit of the good from firm 1, (ii) buying one unit of the good from firm 2, or (iii) not buying at all. The consumer will buy from firm 1 if and only if:

$$E[V_1 - x_1 - p_1] \geq 0 \quad \Leftrightarrow \quad x_1 \leq \hat{V}_1 - p_1, \text{ and}$$

$$E[V_1 - x_1 - p_1] \geq E[V_2 - (1 - x_1) - p_2] \quad \Leftrightarrow \quad x_1 \leq \frac{(\hat{V}_1 - p_1) - (\hat{V}_2 - p_2)}{2} + \frac{1}{2}$$

Note that $E[\cdot]$ is the consumer's expectation operator, and $\hat{V}_i = E[V_i]$. The consumer's expectations depend, in equilibrium, on the disclosure strategies of the firms: If firm i discloses, then $\hat{V}_i = V_i$; if not, then \hat{V}_i is equal to the mean of V_i over all the values of V_i for which firm i 's equilibrium strategy specifies non-disclosure.

The consumer will buy from firm 2 if and only if:

$$E[V_2 - (1 - x_1) - p_2] \geq 0 \quad \Leftrightarrow \quad x_1 \geq 1 - (\hat{V}_2 - p_2), \text{ and}$$

$$E[V_1 - x_1 - p_1] < E[V_2 - (1 - x_1) - p_2] \quad \Leftrightarrow \quad x_1 > \frac{(\hat{V}_1 - p_1) - (\hat{V}_2 - p_2)}{2} + \frac{1}{2}$$

The consumer will not buy at all if and only if:

$$E[V_1 - x_1 - p_1] < 0 \quad \Leftrightarrow \quad x_1 > \hat{V}_1 - p_1, \text{ and}$$

$$E[V_2 - (1 - x_1) - p_2] < 0 \quad \Leftrightarrow \quad x_1 < 1 - (\hat{V}_2 - p_2)$$

Firm 1 faces the following maximization problem:

$$\max_{p_1} x_1(p_1, p_2) \cdot p_1,$$

where

$$x_1(p_1, p_2) = \min \left\{ \hat{V}_1 - p_1, \frac{(\hat{V}_1 - p_1) - (\hat{V}_2 - p_2)}{2} + \frac{1}{2} \right\}$$

is the demand function that firm 1 faces, capturing both the participation (or individual rationality) and incentive compatibility constraints for the marginal buyer, as given by the inequalities above.

Similarly, firm 2 faces the following maximization problem:

$$\max_{p_2} x_2(p_1, p_2) \cdot p_2,$$

where

$$x_2(p_1, p_2) = 1 - x_1(p_1, p_2) = \min \left\{ \hat{V}_2 - p_2, \frac{1}{2} - \frac{(\hat{V}_1 - p_1) - (\hat{V}_2 - p_2)}{2} \right\}$$

The solution to these maximization problems is summarized in the following lemma.

Lemma 1

(a) When $\hat{V}_1 + \hat{V}_2 < 2$:

$$p_i = \frac{\hat{V}_i}{2}, \quad x_i = \frac{\hat{V}_i}{2}, \quad \Pi_i = \frac{\hat{V}_i^2}{4}.$$

(b) When $2 \leq \hat{V}_1 + \hat{V}_2 \leq 3$:

$$p_i = \hat{V}_i - \frac{\hat{V}_i}{\hat{V}_i + \hat{V}_j}, \quad x_i = \frac{\hat{V}_i}{\hat{V}_i + \hat{V}_j}, \quad \Pi_i = \frac{\hat{V}_i^2(\hat{V}_i + \hat{V}_j - 1)}{(\hat{V}_i + \hat{V}_j)^2}.$$

(c) When $\hat{V}_1 + \hat{V}_2 > 3$ and $|\hat{V}_i - \hat{V}_j| \leq 3$:

$$p_i = \frac{1}{3} (\hat{V}_i - \hat{V}_j) + 1, \quad x_i = \frac{\hat{V}_i - \hat{V}_j}{6} + \frac{1}{2}, \quad \Pi_i = \frac{1}{2} \left(\frac{1}{3} (\hat{V}_i - \hat{V}_j) + 1 \right)^2.$$

(d) When $\hat{V}_1 + \hat{V}_2 > 3$ and $|\hat{V}_i - \hat{V}_j| > 3$ with $\hat{V}_i > \hat{V}_j$:

$$p_i = \hat{V}_1 - \hat{V}_j - 1, \quad p_j = 0, \quad x_i = 1, \quad x_j = 0, \quad \Pi_i = \hat{V}_i - \hat{V}_j - 1, \quad \Pi_j = 0.$$

The proof of this and all other results can be found in the appendix.

Remark 1

- (a) When $2 \leq \hat{V}_1 + \hat{V}_2 \leq 3$, there are multiple equilibria. We assume a natural equilibrium where demand for each firm's product is proportional to quality—see the appendix for details.
- (b) When $\hat{V}_1 + \hat{V}_2 \geq 2$, the market is covered—every consumer on the line buys either from firm 1 or firm 2. When $\hat{V}_1 + \hat{V}_2 < 2$, the market is not covered, and each firm has local monopoly power.
- (c) Let $\Pi_i^*(\hat{V}_1, \hat{V}_2)$ denote the equilibrium value of firm i 's profit as a function of \hat{V}_1 and \hat{V}_2 . Notice that Π_i^* is continuous in \hat{V}_1 and \hat{V}_2 (across the three ranges: $\hat{V}_1 + \hat{V}_2 < 2$, $2 \leq \hat{V}_1 + \hat{V}_2 \leq 3$, and $\hat{V}_1 + \hat{V}_2 > 3$) and strictly increasing in \hat{V}_i with \hat{V}_j held fixed, as long as $\hat{V}_i \geq \hat{V}_j - 3$.

We now turn to stage 1 of the game—the disclosure stage. We consider first the pure product attribute case, then the pure product use case, and finally (in the next section) the hybrid case.

3.3 Product Attribute Information

Recall that the quality of a firm, V_i , typically consists of both product attribute components v_i that are specific to the firm, and product use components v that are specific to a given consumer but common across firms. Here we consider disclosure of only product attribute components, and let $V_i = v_i$. We assume that v_1 and v_2 are drawn independently from the uniform distribution on $[0, \lambda]$, and further that v_i is private information to firm i . This is essentially the framework analyzed by Levin *et. al* [17], except that they assume $v_i > \frac{3}{2}$, guaranteeing that the market is covered.⁵ Our first result states that there will be full disclosure in this environment:

Proposition 1 *The unique equilibrium in the pure product attribute case exhibits full disclosure.*

⁵See also Board [4], analyzing a related model in which each firm knows the other's quality.

The intuition behind the result is straightforward: Firm 1 will disclose its quality v_1 if and only if, given firm 2's disclosure strategy, its expectation of $\Pi_1^*(v_1, \hat{v}_2)$ is greater than its expectation of $\Pi_1^*(\hat{v}_1, \hat{v}_2)$. As we show in the appendix, firm 1's expectation of Π_1^* must (given firm 2's disclosure strategy) be strictly increasing in its first argument. Thus firm 1 will disclose if and only if $v_1 > \hat{v}_1$. A simple unraveling argument (see e.g. Milgrom [22]) then implies that firm 1 will disclose for all values of v_1 .

3.4 Product Use Information

We next analyze the incentives to voluntarily disclose product use information. As explained above, we conceptualize product-use information as information that is common to all firms. Formally, in the pure product use case we assume that $V_1 = V_2 = v$, and that v is common knowledge among the firms. We further assume that v is drawn from the uniform distribution $[0, \mu]$, with $\mu \geq 3$. As before, we assume that firms choose simultaneously whether or not to disclose before competing in prices. In the pure product use case, however, disclosure by either firm effectively implies disclosure by the other, since they share the same v . Only two extreme outcomes are possible.

Proposition 2 *In the product use case, there are exactly two kinds of equilibria:*

- (a) *A no-disclosure equilibrium, in which neither firm discloses whatever the value of v .*
- (b) *Full disclosure equilibria, in which one or both firms disclose for all v .*

Remark 2 (Intuition)

- (a) *No-disclosure equilibrium: Since value, v , is common to all firms, disclosure provides no competitive advantage to the disclosing firm. Further, in a full information environment, equilibrium prices and profits increase as this common value v increases up to a certain point ($v = 1\frac{1}{2}$), but are constant thereafter as the market becomes fully covered and competitive pressures prevent either firm from raising price. In the absence of disclosure, expectation of the common value is in the constant-profit range ($\hat{v} \geq \frac{3}{2}$ since $\mu \geq 3$). Firms with low quality ($v < 1\frac{1}{2}$) strictly prefer not to disclose, while firms with high quality are indifferent.*

(b) *Disclosure equilibria: If consumers believe that a non-disclosing firm is of sufficiently low value, namely, that we are in the range where profits are increasing in value ($v < 1\frac{1}{2}$), then higher value firms will disclose, reaffirming the consumers' beliefs. In essence, absent disclosure, consumers believe that the firms enjoy local monopoly power, and thus firms disclose for the same reason that a monopolist discloses.*

Remark 3 (Intuition) *As explained in the Introduction, the result that voluntary disclosure is less likely in the product use case is robust. A firm's profits will increase less sharply when consumers learn good news about (their own) product use than when they learn good news about the firm's product attributes. Thus in a more general model, where incentives to disclose are pitted against (positive) disclosure costs, there will be less disclosure in the product use case than in the product attribute case.*

Comparing Proposition 2 to Proposition 1 reveals a sharp difference between the product attribute (private values) case, where full disclosure is the only equilibrium, and the product use (common values) case, where there is also a no-disclosure equilibrium. This difference justifies greater regulatory attention to the product use case. We next elaborate on the welfare and policy implications of Proposition 2.

3.5 Welfare and Policy Implications

Proposition 2 shows that firms might not disclose product use information voluntarily. No disclosure creates welfare costs that could potentially justify regulation. These costs are identified and quantified below. We start by identifying the first-best level of welfare. We then compare this benchmark to the welfare levels obtained under the no disclosure and full disclosure equilibria.

First-Best: First-best welfare is obtained when consumers purchase the good from the closest firm if and only if the value they obtain (v) exceeds the cost of traveling to the firm

(x). It is:

$$\begin{aligned} W^* &= \frac{1}{\mu} \int_0^\mu 2 \int_0^{\min\{v, \frac{1}{2}\}} (v-x) dx dv \\ &= \frac{1}{2\mu} \left(\mu^2 - \frac{\mu}{2} + \frac{1}{12} \right). \end{aligned}$$

No Disclosure: In the absence of disclosure, each firm makes a profit of $\frac{1}{2}$, and thus total firm profits are equal to 1. The consumer surplus is give by:

$$\frac{1}{\mu} \int_0^\mu 2 \int_0^{\frac{1}{2}} (v-x-1) dx dv = \frac{\mu}{2} - \frac{5}{4}.$$

And total welfare is:

$$W^{ND} = \frac{1}{\mu} \int_0^\mu 2 \int_0^{\frac{1}{2}} (v-x) dx dv = \frac{\mu}{2} - \frac{1}{4}.$$

The welfare loss, due to inefficient purchase of low-value products, equals:

$$L^{ND} = W^* - W^{ND} = \frac{1}{24\mu}.$$

Full Disclosure: With full disclosure, each firm makes an expected profit of

$$\frac{1}{\mu} \left(\int_0^1 \frac{v^2}{4} dv + \int_1^{\frac{3}{2}} \frac{1}{2} \left(v - \frac{1}{2} \right) dv + \int_{\frac{3}{2}}^\mu \frac{1}{2} dv \right) = \frac{24\mu - 23}{48\mu}.$$

Total firm profits thus equal $\frac{24\mu - 23}{24\mu}$. Consumer surplus is given by:

$$\begin{aligned} \text{(a)} \quad & 2 \int_0^{\frac{v}{2}} \left(v - x - \frac{v}{2} \right) dx = \frac{v^2}{4} && \text{if } 0 \leq v < 1 \\ \text{(b)} \quad & 2 \int_0^{\frac{1}{2}} \left(v - x - \left(v - \frac{1}{2} \right) \right) dx = \frac{1}{4} && \text{if } 1 \leq v \leq \frac{3}{2} \\ \text{(c)} \quad & 2 \int_0^{\frac{1}{2}} (v-x-1) dx = v - \frac{5}{4} && \text{if } \frac{3}{2} < v \leq 3 \end{aligned}$$

Thus the expected consumer surplus is:

$$\frac{1}{\mu} \left(\int_0^1 \frac{v^2}{4} dv + \int_1^{\frac{3}{2}} \frac{1}{4} dv + \int_{\frac{3}{2}}^{\mu} \left(v - \frac{5}{4} \right) dv \right) = \frac{12\mu^2 - 30\mu + 23}{24\mu}.$$

Total welfare is:

$$\begin{aligned} W^D &= \frac{1}{\mu} \left(\int_0^1 2 \int_0^{\frac{v}{2}} (v-x) dx dv + \int_1^{\frac{3}{2}} 2 \int_0^{\frac{1}{2}} (v-x) dx dv + \int_{\frac{3}{2}}^{\mu} 2 \int_0^{\frac{1}{2}} (v-x) dx dv \right) \\ &= \frac{2\mu - 1}{4}. \end{aligned}$$

The welfare loss—deadweight loss from monopoly pricing—equals:

$$L^D = W^* - W^D = \frac{1}{24\mu}.$$

We can now state the following result:

Proposition 3 *The two possible equilibria in the product use case entail the following welfare costs, as compared to the first best:*

- (a) *In the no-disclosure equilibrium, the welfare loss is $L^{ND} = 1/24\mu$;*
- (b) *In the full disclosure equilibria, the welfare loss is $L^D = 1/24\mu$.*

Remark 4 (Intuition)

- (a) *Under our assumption that v is distributed uniformly, we get: $L^D = L^{ND}$. On the one hand, for low values of v , with no disclosure some consumers are “tricked” into purchasing goods for which their transportation costs exceed gross surplus resulting in a welfare loss that would not occur under full disclosure. This effect is present whenever v lies between 0 and $\frac{1}{2}$, because the market is covered under no disclosure, while consumers located near the center of the line should not be purchasing the good. On the other hand, under full disclosure some consumers are priced out of the market by sellers charging monopoly mark-ups; with no disclosure, the market is always covered, so there is no welfare loss resulting from this monopoly distortion. For the functional forms we have chosen, these two effects exactly cancel out.*

(b) *The relative force of the two effects varies with v as follows:*

- (i) *In the $[0, \frac{1}{3}]$ range, $L^{ND} > L^D > 0$, since the loss from the consumers who buy but shouldn't under no disclosure exceeds the loss from the consumers who don't buy but should under full disclosure.*
- (ii) *In the $[\frac{1}{3}, \frac{1}{2}]$ range, $L^D > L^{ND} > 0$, since the loss from the consumers who don't buy but should under full disclosure exceeds the loss from consumers who do buy but shouldn't under no disclosure.*
- (iii) *In the $[\frac{1}{2}, 1]$ range, $L^D > L^{ND} = 0$, since the market is covered under no disclosure (and should be from a welfare standpoint), while monopoly pricing scares off some consumers under full disclosure.*
- (iv) *In the $[1, \mu]$ range, $L^D = L^{ND} = 0$, since the market is covered in both cases.*

Remark 5 (Regulation)

- (a) *A no disclosure equilibrium generates a welfare cost. Therefore, there is room to consider regulatory intervention to reduce this welfare cost. Specifically, since voluntary disclosure may fail, regulators should consider mandatory disclosure of product use information.*
- (b) *Mandatory disclosure would, if it works well and costs little, lead to the full disclosure equilibrium. But the preceding analysis shows that full disclosure imposes welfare costs of its own—costs that may be similar in magnitude to those imposed by no disclosure. We nevertheless believe that our analysis provides the impetus for serious consideration of disclosure mandates (for product use information). First, the welfare costs of full disclosure are standard monopoly costs and can be addressed through other means that are designed to police monopolistic behavior (e.g., antitrust law). Second, as explained above, the result that welfare costs under no disclosure equal welfare costs under full disclosure is an artifact of our simplifying assumption that possible v -values are uniformly distributed. Under alternative assumptions the welfare costs under no disclosure may well exceed the welfare costs under full disclosure. For example, consider a distribution with a mass at a very low v level and a thick tail at high v levels (suppose that this tail is*

sufficiently thick to ensure that, in the absence of any disclosure, $\hat{v} = \mu/2$ and thus that a no disclosure equilibrium exists). Remark 4 suggests that, with such a distribution, welfare costs under no disclosure exceed the welfare costs under full disclosure.

- (c) Mandatory disclosure that replaces a no disclosure outcome with a full disclosure outcome may also be justified on distributional grounds, since the consumer surplus is larger (and firm profits smaller) under full disclosure.

4 Extensions

4.1 Combining Product-Attribute and Product-Use Disclosures

In some real-world cases, firms can issue a single disclosure that combines both product attribute information and product use information. For example, a firm that sells ink-jet printers can disclose the life-cycle cost of the printer (sometimes referred to as a total cost of ownership (TCO) disclosure), which combines product use information—estimates of ink usage—with product attribute information about the printer’s price, the price of ink and the number of pages that the printer prints per ink cartridge.

Thus far, we have studied the product attribute case separately and the product use case separately. We now extend our model and allow the basic utility that the consumer gets from purchasing a good to consist of both product attribute and product use components, and allow for disclosures of one component or both. Formally, we assume that the basic utility the consumer obtains from good i is given by the sum of the two components: $V_i = v + v_i$. Thus if a consumer located at a distance of x_i from firm 1 buys from firm 1, her utility is $v + v_1 - x_1 - p_1$, and if she buys from firm 2, her utility is $v + v_2 - (1 - x_1) - p_2$. We assume that v_1 and v_2 are drawn independently from the uniform distribution on $[0, \lambda]$, while v is drawn from the uniform distribution on $[0, \mu]$, with $\mu \geq 3$ (independently from v_1 and v_2). Finally, we assume that firm i can (verifiably and costlessly) disclose the value of v , v_i , $v + v_i$, or any combination thereof. As before, all disclosure decisions are made simultaneously before the firms compete in price.

Our analysis of the “combined case” affirms the previous results, specifically that there

is an equilibrium in which product use information will not be disclosed—neither separately nor in combination with product attribute information.

Proposition 4 *For all v , v_i , and $i = 1, 2$:*

- (a) *In every equilibrium, firm i discloses the value of either v_i or $v + v_i$.*
- (b) *There exists an equilibrium in which each firm discloses only the value of v_i .*

Remark 6 (Robustness) *Proposition 4 assumes that v and v_i are additively separable. These results, however, can be generalized to the case where V is any strictly increasing function of v and v_i , as long as v and v_i are independently distributed.*

4.2 Asymmetrically Informed Firms

We have thus far assumed that the two firms are symmetrically informed. Focusing on the product use (common value) case, we assumed that both firms know v . This assumption is realistic when the information pertains to average use, e.g., how many pages the average consumer (or average consumer of a certain demographic) prints in a year. In other cases, where the information pertains to individual use patterns, the symmetry assumption is unrealistic. For instance, if a cellular service subscriber has been on the Verizon network for the past 3 years, Verizon will have better information on this subscriber's use patterns than AT&T.

We extend our analysis of the product use (common value) case to allow for asymmetrically-informed firms. For simplicity, we assume that firm 1 knows v , while firm 2 knows only the distribution of possible v values. The results stated in Proposition 2 extend to the case of asymmetrically-informed firms. In particular, there is an equilibrium where the informed firm does not disclose v , for all v . Similarly, the results stated in Proposition 4 extend to the case of asymmetrically informed firms: In particular, there is an equilibrium where the informed firm discloses only v_i , and does not disclose v , for all v .

4.3 Incentives to Acquire Information

Our analysis assumed that sellers have the product use information and need only decide whether or not to disclose it to consumers. We now examine the plausibility of this assumption and the implications of relaxing it. In particular, we address the concern that imposing a duty to disclose product use information may deter sellers from collecting the information in the first place.⁶ Our initial response to this concern is twofold. First, in important consumer markets, including the credit card market and the cellphone market, sellers have a strong business reason to collect product use information. Also, the information is often collected in the seller's usual course of business, so that the marginal cost of collecting the information is minimal. It is, therefore, unlikely that a duty to disclose will induce sellers to stop collecting the information. (Compare: Kronman [16], distinguishing between casually acquired information and deliberately acquired information.) Second, if sellers collect product use information mainly to exploit an informational advantage vis-à-vis consumers, then we are not so worried about deterring the collection of information. In fact, if the information has no social value, then deterring costly efforts to acquire the information is socially desirable. (Compare: Cooter and Ulen [5], p. 357, distinguishing between productive information and redistributive information. See also Hirshleifer [14], Shavell [26].)

These responses notwithstanding, the question of how a duty to disclose affects incentives to acquire product use information is an important one, and a possible adverse effect should be acknowledged. In a more general model, which we do not develop here, a seller invests in collecting and processing product use information and this investment generates both efficiency gains and redistributive gains. In the absence of a duty to disclose, the seller's investment can be too low from a social perspective, when the seller does not capture all of the efficiency gains, or too high, when the redistributive gains do not increase social welfare. Forcing disclosure will reduce the seller's incentive to invest in acquiring product use information. This reduction can either increase or decrease social welfare. (See Shavell [26].) When mandated disclosure inefficiently reduces the incentive to acquire product use information, this adverse effect needs to be balanced against the gains from disclosure (described

⁶See, e.g., Matthews and Postlewaite [21].

above).⁷

5 Policy: Existing and Proposed Product Use Disclosures

The vast majority of current disclosure mandates focus on product-attribute information (for a survey—see Bar-Gill and Ferrari [2]). Product use disclosures are relatively rare. As discussed in Section 5.1, current law does require the disclosure of proper-use information for many consumer products. While useful, these disclosures have obvious limits. Specifically, many products do not have a single, well-defined proper use. As an alternative, sellers could be required to disclose average use information. There are several examples of disclosure mandates that combine average- or typical-use information with product attribute information. We discuss these examples in Section 5.2, together with several proposals for additional average use or combined average-use-plus-product-attribute disclosures. But average use disclosures also have well-known limits, due to the heterogeneity of consumers. We thus argue, in Section 5.3., for the disclosure of individualized product-use information or, even better, for the combined disclosure of individualized product use information and product attribute information.

5.1 Proper-Use Information

Use information is provided through disclosures that specify the proper use of a product. The Consumer Products Safety Commission (CPSC) has general authority to promulgate “requirements that a consumer product be marked with or accompanied by clear and adequate warnings or instructions” (15 U.S.C. § 2056). The purpose of this provision is to provide information on how to use the product properly. Under this authority the CPSC has issued regulations requiring the disclosure of proper-use information for numerous products.⁸

⁷In these cases, regulators may want to consider a duty to collect information in addition to a duty to acquire information.

⁸CPSC regulations are listed on the CPSC’s website, available at <http://www.cpsc.gov/cgi-bin/regs.aspx> (last visited March 12, 2010).

The FTC, in its trade regulations, also requires disclosure of proper-use information. For example, the FTC requires clothes manufacturers to provide information on proper care (16 C.F.R. § 423). The FDA requires disclosure of proper-use information on drug labels. In particular, drug manufacturers must provide dosage and other proper-use information for non-prescription drugs (21 U.S.C. § 352 (n); 21 C.F.R. § 201.66 (c)). Moving on to real estate, the EPA and HUD require sellers, landlords and agents to provide purchasers and tenants with an EPA-approved lead hazard information pamphlet, which contains proper-use information on ways to minimize lead-based paint hazards (24 C.F.R. § 35.8; 40 C.F.R. § 745).

And tort law, through its “duty to warn,” provides strong incentives for the disclosure of proper-use information. The failure to provide reasonable instructions and warnings is considered a product defect (Restatement (Third) of Torts: Product Liability § 2 (1998)). And on the flip side, adequate warnings often provide an effective shield against liability (Restatement (Third) of Torts: Products Liability § 2, cmt. f (1998)). The subject of these instructions and warnings is commonly proper-use information (Restatement (Third) of Torts: Products Liability § 2, cmt. i (1998)).⁹

Disclosure of proper-use information is clearly important. But proper-use information also suffers from an important limitation. Although it is appropriate for use dimensions that have a single, well-defined proper use, not all use dimensions have a single, well-defined proper use. There is one proper way to wash a pair of jeans. There is no single, well-defined way to use a credit card.¹⁰ When proper use is not well defined, and even when it is well-defined, sellers can disclose another type of product-use information—actual-use information. We next consider statistical actual use information, i.e., average-use information.

5.2 Average-Use Information

Pure average use disclosure mandates are hard to find in current law. There are, however, several examples of disclosure mandates that combine average use or typical use information with product attribute information. For example, the EPA’s miles-per-gallon ratings, cal-

⁹On the difficulty of designing effective warnings, see Schwartz ([25]).

¹⁰General statements like “Do not borrow too much” or “Use your card prudently” will not be very helpful.

culated for two different use assumptions—“city driving” and “highway driving”—combine product use information (where you drive) with product attribute information (technical information on the car’s engine, weight, etc.) (42 U.S.C. § 6201).

The energy-efficiency feature of home appliances is similarly disclosed using a typical use benchmark. A major cost of home appliances is energy cost. The energy cost depends on product attributes, i.e., on technical features of the appliance, and on the consumer’s use patterns. The FTC constructed an energy efficiency index for appliances, based on typical use, and required manufacturers to disclose their product’s Energy Efficiency Rating’ (16 C.F.R. § 305).

Nutrition information listed on food labels provides another example. Information on the quantity of nutrients *per-serving* combines product attribute information with assumptions about typical use (the assumption is that the average consumer consumes one serving or, alternatively, that the per-serving information will be used by the consumer to calculate total value). Food labels also provide “percent daily value” information for the included nutrients. Food product manufacturers must include the statement “Percent Daily Values are based on a 2,000 calorie diet.” And, in some cases, a more detailed disclosure of daily values based on both a 2,000 calorie and a 2,500 calorie diet is required (21 C.F.R. § 101.9(d)(9)). The percent daily value information adds further assumptions about typical use—moving from assumptions about the typical use of the specific food product to assumptions about the consumer’s overall diet.

Disclosures pertaining to the risks associated with cigarette smoking also make certain assumptions about use patterns. In addition to mandated warnings, tobacco companies voluntarily provide information about the risks of smoking. Specifically they provide information about the levels of tar and nicotine produced by the cigarette. This information, while voluntarily disclosed, is certified by the FTC. Tar and nicotine levels depend on product attributes as well as on use patterns. The FTC developed a machine-based test to objectively measure tar and nicotine levels, and the tar and nicotine measures provided by the FTC test assume a certain intensity of smoking—a 2-second, 35-milliliter puff every minute (FTC 1997).

Academics have proposed additional disclosures. Relying on evidence that consumers

are too quick to purchase extended warranties, Professors Ian Ayres and Barry Nalebuff proposed to mandate disclosure of the probability that an extended warranty would be invoked (Nalebuff and Ayres [24], p. 181). Or, even better, sellers could be required to provide an estimate of the total repair or replacement costs that a typical consumer would save by purchasing the extended warranty. With this use-pattern information, extended warranties and similar insurance add-ons would likely suffer a sharp decline in sales.¹¹

In the rebates context, Jeff Sovern has recently proposed that sellers offering rebates be required to disclose the low redemption rates.¹² Similarly, to guard against the risk that Hewlett-Packard (HP) customers, when purchasing a home printer, underestimate the number of ink cartridges that they will purchase over the life of the printer, HP could be required to provide the missing use-pattern information, perhaps based on an FTC-designed average-use index. Even better, HP could be required to disclose average Total Cost of Ownership (TCO) information that combines the use-pattern information with ink prices. And health clubs could be required to disclose the effective per-visit fee paid by an average subscription holder. If this effective per-visit fee is eight times higher than the club's actual per-visit fee, some consumers may reconsider their decision to purchase a subscription (DellaVigna and Malmendier [7]).

Average use disclosures could also be effective in the credit card market. Some consumers are sometimes late in paying their credit card bill. And when they are late, they are assessed a "late fee." This late fee is prominently disclosed in credit card solicitations, in accordance with the disclosure regulations issued under the Truth-in-Lending Act (TILA).¹³ But this product attribute disclosure will not be very effective if consumers underestimate the likelihood of paying late. Issuers could be required to disclose the number of late payments that an average consumer makes in a year or the amount that an average consumer pays in late fees in one year.

In a related context, payday lenders make most of their profits from rolling-over (or renewing) loans for their customers and the concern is that the customers underestimate the

¹¹Interestingly, use-pattern information for the insurance add-on is a function of both product attribute information and product-use information for the base good. For example, the likelihood that an extended warranty will be invoked depends on the reliability of the base good and on how the base good is used.

¹²See Sovern [27] at 1703. See also Lynch & Zauberman [18] at 71 (making a similar proposal).

¹³12 C.F.R. 266.18, 226.5a

likelihood, and cost, of these roll-overs. Payday lenders could be required to disclose the average number of roll-overs and, based on the average number of roll-overs, the total fee paid by an average consumer. For example, the disclosure could read: “The fee is \$30 for a two-week, \$200 advance. The average borrower renews her loan three times (namely, takes three consecutive advances) before repaying. Therefore, the total fee on a \$200 loan, is \$90 for an average borrower.”

We argued that proper-use information is appropriate for use dimensions that have a single, well-defined proper use. When there are many proper uses for a product, proper-use disclosure loses its bite. In such cases the alternative is average-use disclosure. But average use disclosure suffers from a similar limitation. When heterogeneous consumers use the same product in many different ways, average-use information might be of little value. The value of average-use information depends (inversely) on the degree of heterogeneity. The degree of heterogeneity is a function of both product characteristics and characteristics of the consumer group. But the degree of heterogeneity is also a function of the disclosure regime. The question is whether the seller discloses average-use information, where the averaging is done across the entire group of consumers, or whether the averaging on which the disclosure is based is done across a smaller, more homogenous subgroup of consumers.

At one extreme, the seller considers the average consumer who enters her store or even the average consumer in the market. Average use, under these assumptions, contains little information. But often the seller has more information—based on demographics, product choice etc. Based on this information the seller can place the consumer in a subgroup of consumers, who share a set of observed characteristics. Now average-use becomes average use within this subgroup. As the subgroup becomes smaller, the consumer heterogeneity problem decreases, and the value of the average-use information increases. Disclosure of average-use information, when averaging is done over smaller subgroups, is advantageous and should be expanded.

5.3 Individual-Use Information

The consumer heterogeneity problem limits the efficacy of average-use disclosure. It also supports individual-use disclosure. In certain markets, where sellers enter long-term rela-

tionships with consumers, sellers can be required to provide the consumer with individualized information on the specific consumer’s use-patterns, preferably in combination with product attribute information. We provide examples of such disclosures—existing and proposed—below. Richard Thaler and Cass Sunstein have forcefully advocated the expansion of this form of disclosure in their recent book, *Nudge* (Thaler & Sunstein [28]).

5.3.1 Credit Cards

As noted in the Introduction, credit card issuers have a lot(!) of individual use information about their customers and they can be required to disclose this information to their customers.

In fact, they are already required to disclose one piece of information—repayment information. Congress was concerned that consumers lack information on the cost of slow repayment of their credit card debt. Specifically, many consumers who make only the minimum monthly payment underestimate the amount of time that it will take them to repay their credit card debt and, consequently, underestimate the total amount of interest that they will end-up paying. In response, Congress required issuers to disclose, on the monthly statement, the length of time it will take them to repay their current balance in full if they makes only the minimum required payment each month (12 C.F.R. 226.7).

But more can be done. Recall the late payment, and late fee, example. We argued that the disclosure of the late fee—a product attribute disclosure—might be less effective, if many consumers underestimate the likelihood of paying late. In discussing average-use disclosures, we suggested mandating disclosure of the number of late payments that an average consumer makes over a one-year period. But the value of such a disclosure will be limited if most consumers optimistically believe that they will pay late less often than the average consumer. A better solution is to require disclosure of individualized late payment information.¹⁴ Issuers keep records on consumers’ late payments. They can be required to disclose the number of late payments made by the specific consumer, or the total amount of

¹⁴There may still be optimism at play, limiting the effectiveness of even individualized disclosure. A consumer might be forced to acknowledge that he, not some average consumer, has paid a lot of money in late fees over the past year, but he may still believe that he will not repeat this behavior in the future. Of course, such optimism will become less likely as the disclosed history reveals year after year of high penalty payments.

late fees paid by the consumer, over the past year.¹⁵

From late fees to overlimit fees: Disclosure of individualized use-pattern information can also be effective when provided at the point of sale. Ronald Mann proposed that issuers be required to disclose, through merchants, when a certain purchase would take the consumer over her credit limit, triggering an overlimit fee. Such a disclosure could help the consumer avoid inadvertently exceeding her credit limit, perhaps by switching to another card or to another payment system (Mann [20], p. 162).

5.3.2 Cell Phones

The cellular service market is another market where the long-term relationship between providers and consumers allows for the provision of individualized use-pattern information. Evidence suggests that consumers have poor information about how they use their cell phones, leading to mistakes in plan choice (Grubb [13]; Bar-Gill and Stone [3]). Individualized disclosure can reduce consumer mistakes about cell phone use. This disclosure could be supplemented by information on alternative service plans that would reduce the total price paid by the consumer, given her current use patterns. See also Sunstein and Thaler [28], pp. 93–94. Moreover, individual-use information can be helpfully provided in real-time. To reduce the incidence of inadvertently exceeding the plan limit and thus incurring high overage fees, sellers could be required to notify consumers, via a recorded message or a text message, when they are about to exceed the plan limit. (Some sellers already provide this information voluntarily.) A consumer receiving such notification may well decide to cut the conversation short, switch to a land line, or postpone the conversation until off-peak hours.

5.3.3 Other Markets

Sellers have individual-use information in many other markets. Some of this information is currently being disclosed to consumers. But enhanced disclosure requirements may be desirable. For example, phone (not cell phone) companies disclose certain use information to

¹⁵Issuers provide year-end summaries with individualized information. These summaries, however, focus more on spending behavior and less on borrowing behavior (see e.g., the “Year End Summary,” a feature offered by several credit card companies that provides an annual itemized list of all charges). Accordingly, the total amount paid in interest charges or late fees is not disclosed.

consumers on the monthly bill. More effective disclosure would include use-patterns averaged across several months, perhaps accompanied by total cost information under the consumer's current plan as well as under alternative plans offered by the phone company.¹⁶ Health clubs could also be required to disclose individualized use-pattern information. Specifically, health clubs could disclose attendance records for the past year and even for the preceding year (or years). They could also calculate and disclose the per-visit fee paid by the individual subscription-holder. Faced with such information when asked to renew the subscription, the consumer may well decide to forgo the subscription and pay on a per-visit basis. Similarly, a retailer asking a consumer to renew a membership card or a discount card, could be required to disclose the total savings enjoyed by the individual consumer over the past year. This information would assist the consumer in making a more informed decision whether to pay the annual fee and renew her membership.

6 Concluding Remarks

In this paper, we identify an important yet understudied category of information—product use information. We show that in comparison to (the more commonly studied) product attribute information, product use information is less likely to be voluntarily disclosed by sellers. These findings suggest that policymakers should consider mandating disclosure of product use information, or disclosures that combine product attribute information with product use information. This proposal runs contrary to much of the current regulatory landscape, which focuses on product attribute disclosures.

We must be careful not to overreach in our policy prescriptions. We recognize that the burden of proof should be on those advocating a new product-use disclosure (or any new disclosure for that matter). Only when there is evidence that the lack of voluntary disclosure generates substantial welfare costs (efficiency costs and/or distributive costs) should we consider adding the new disclosure mandate.

We are cognizant of justified concerns about information overload. We wish to emphasize

¹⁶Utility companies also provide some individualized use-pattern information on the monthly statement. For instance ConEdison provides information on the individual consumer's average daily use of electricity for previous months.

that our proposal is not intended to exacerbate the information overload problem by simply adding more disclosure mandates. We advocate for better disclosure, not more disclosure. Product use information can be incorporated into existing disclosure regimes without increasing the burden placed on consumers. And to the extent that disclosure of larger amounts of use information is considered, this disclosure should be provided in electronic form to facilitate the work of sophisticated intermediaries who will process the information on behalf of consumers.¹⁷ For example, in the telecommunications market, the Federal Communications Commission has already recognized the potential importance of both electronic disclosure and intermediaries (FCC 2009).

7 Appendix

Proof of Lemma 1. To solve the firms' maximization problems, we consider three (exhaustive) possibilities:

Case 1.

$$\frac{(\hat{V}_1 - p_1) - (\hat{V}_2 - p_2)}{2} + \frac{1}{2} > \hat{V}_1 - p_1 \quad (1)$$

In case 1, firm 1 solves $\max_{p_1} (\hat{V}_1 - p_1) \cdot p_1$. The first-order condition implies: $p_1 = \hat{V}_1/2$. Since

$$\frac{(\hat{V}_1 - p_1) - (\hat{V}_2 - p_2)}{2} + \frac{1}{2} > \hat{V}_1 - p_1 \quad \text{if and only if} \quad \frac{1}{2} - \frac{(\hat{V}_1 - p_1) - (\hat{V}_2 - p_2)}{2} > \hat{V}_2 - p_2,$$

firm 2 solves $\max_{p_2} (\hat{V}_2 - p_2) \cdot p_2$. Analogous calculations thus apply to firm 2, giving a profit-maximizing price of $p_2 = \hat{V}_2/2$. Substituting these prices back into condition (1), we obtain $\hat{V}_1 + \hat{V}_2 < 2$. Quantity sold by firm i is given by

$$x_i = \hat{V}_i - p_i = \frac{\hat{V}_i}{2}.$$

¹⁷Such intermediaries already exist in important consumer markets. See e.g., Billshrink.com. The role of "virtual intermediaries" should also be considered: Software applications on smartphones can collect use information and match it to plans advertised on the Internet. In fact, with such virtual intermediaries, disclosure of use information by sellers may not be necessary.

Firm profits are:

$$\Pi_i = x_i \cdot p_i = \frac{\hat{V}_i^2}{4}.$$

Case 2.

$$\frac{(\hat{V}_1 - p_1) - (\hat{V}_2 - p_2)}{2} + \frac{1}{2} < \hat{V}_1 - p_1 \quad (2)$$

In case 2, firm 1 solves

$$\max_{p_1} \left(\frac{(\hat{V}_1 - p_1) - (\hat{V}_2 - p_2)}{2} + \frac{1}{2} \right) \cdot p_1.$$

The FOC is:

$$\begin{aligned} & \left(\frac{(\hat{V}_1 - p_1) - (\hat{V}_2 - p_2)}{2} + \frac{1}{2} \right) - \frac{p_1}{2} = 0 \\ \Rightarrow \quad p_1 &= \frac{1}{2} \left(\hat{V}_1 - \hat{V}_2 + p_2 + 1 \right). \end{aligned}$$

This is firm 1's reaction function, giving firm 1's profit-maximizing price as a function of the price charged by firm 2. Just as in case 1, analogous calculations apply to firm 2, giving us a reaction function for firm 2 of: $p_2 = \frac{1}{2}(\hat{V}_2 - \hat{V}_1 + p_1 + 1)$. Solving the two reaction functions simultaneously, we obtain unique equilibrium prices:

$$p_1 = \frac{1}{3} \left(\hat{V}_1 - \hat{V}_2 \right) + 1 \quad \text{and} \quad p_2 = \frac{1}{3} \left(\hat{V}_2 - \hat{V}_1 \right) + 1$$

Substituting back into Condition (1), we have: $\hat{V}_1 + \hat{V}_2 > 3$.

The quantity sold by firm i is given by

$$x_i = \frac{(\hat{V}_i - p_i) - (\hat{V}_j - p_j)}{2} + \frac{1}{2} = \frac{\hat{V}_i - \hat{V}_j}{6} + \frac{1}{2}.$$

Firm profits are:

$$\Pi_i = x_i \cdot p_i = \frac{1}{2} \left(\frac{1}{3}(\hat{V}_i - \hat{V}_j) + 1 \right)^2.$$

Note however that these expressions are only valid when $|\hat{V}_1 - \hat{V}_2| \leq 3$; if this condition is not satisfied, one of the non-negativity constraints is violated: $x_1 < 0$ or $x_2 < 0$. In this case, the higher-quality firm (firm i if $\hat{V}_i > \hat{V}_j$) will raise its price to the point where its lower-quality competitor is just unable to enter the market even if it charges a price of zero. If $\hat{V}_i > \hat{V}_j$, then, equilibrium prices are given by:

$$p_i = \hat{V}_i - \hat{V}_j - 1 \quad \text{and} \quad p_j = 0.$$

Quantity sold is given by $x_i = 1$ and $x_j = 0$, and profit by $\Pi_i = \hat{V}_i - \hat{V}_j - 1$ and $\Pi_j = 0$.

Case 3.

$$\frac{(\hat{V}_1 - p_1) - (\hat{V}_2 - p_2)}{2} + \frac{1}{2} = \hat{V}_1 - p_1 \quad (3)$$

In case 3, both the participation constraint and the incentive compatibility constraint are binding. We can derive lower and upper bounds on the price charged by firm 1. First suppose that $p_1 < \hat{V}_1/2$. Then if firm 1 increases its price, demand is given by $\hat{V}_1 - p_1$ since now

$$\hat{V}_1 - p_1 < \frac{(\hat{V}_1 - p_1) - (\hat{V}_2 - p_2)}{2} + \frac{1}{2};$$

and since $p_1 \cdot (\hat{V}_1 - p_1)$ is strictly increasing for $p_1 < \hat{V}_1/2$, firm 1's profit will increase. This establishes a contradiction, and hence it must be the case that $p_1 \geq \hat{V}_1/2$. Similar reasoning gives us $p_1 \leq \frac{1}{2}(\hat{V}_1 - \hat{V}_2 + p_2 + 1)$. Symmetric inequalities hold for firm 2, so if condition (3) is satisfied, we must have:

$$\begin{aligned} \frac{\hat{V}_1}{2} \leq p_1 \leq \frac{1}{2} \left(\hat{V}_1 - \hat{V}_2 + p_2 + 1 \right), \quad \text{and} \\ \frac{\hat{V}_2}{2} \leq p_2 \leq \frac{1}{2} \left(\hat{V}_2 - \hat{V}_1 + p_1 + 1 \right). \end{aligned}$$

Rearranging and using condition (3) to eliminate p_2 , we obtain:

$$\frac{\hat{V}_1}{2} \leq p_1 \leq \frac{\hat{V}_1}{2} + \left(\frac{\hat{V}_1 + \hat{V}_2}{2} - 1 \right), \quad \text{and} \quad (4)$$

$$\frac{2\hat{V}_1}{3} + \left(\frac{\hat{V}_1 + \hat{V}_2}{3} - 1 \right) \leq p_1 \leq \frac{2\hat{V}_1}{3}. \quad (5)$$

Note that (4) is tight when $\hat{V}_1 + \hat{V}_2 = 2$, and (5) is tight when $\hat{V}_1 + \hat{V}_2 = 3$; in both cases, there is a unique value of p_1 . If $\hat{V}_1 + \hat{V}_2 < 2$, (4) cannot hold, and if $\hat{V}_1 + \hat{V}_2 > 3$, (5) cannot hold; thus case 3 is consistent with equilibrium behavior only if $2 \leq \hat{V}_1 + \hat{V}_2 \leq 3$. When $\hat{V}_1 + \hat{V}_2$ lies strictly between 2 and 3, there is a range of possible values for p_1 , and hence multiple equilibria. One natural equilibrium that satisfies inequalities (4) and (5) is where demand for the two firms is proportional to quality:

$$p_i = \hat{V}_i - \frac{\hat{V}_i}{\hat{V}_i + \hat{V}_j}, \quad x_i = \frac{\hat{V}_i}{\hat{V}_i + \hat{V}_j}, \quad \Pi_i = \frac{\hat{V}_i^2(\hat{V}_i + \hat{V}_j - 1)}{(\hat{V}_i + \hat{V}_j)^2}.$$

Henceforth we assume that in any subgame in which $2 \leq \hat{V}_1 + \hat{V}_2 \leq 3$, this equilibrium is played. ■

Proof of Proposition 1. First note that, for all $v_1 \in (\lambda - 3, \lambda]$, $\Pi_1^*(v_1, v_2)$ is strictly increasing in v_1 for all v_2 . It follows from e.g. Milgrom [22] that firm 1 will disclose for all $v_1 \in (\lambda - 3, \lambda]$. Similarly, firm 2 will disclose any $v_2 \in (\lambda - 3, \lambda]$. Further, if $v_2 \in (\lambda - 3, \lambda - 2]$, then $\Pi_1^*(v_1, v_2)$ is strictly increasing in v_1 for all $v_1 \in (\lambda - 5, \lambda]$. Thus since $\Pi_1^*(v_1, v_2)$ is weakly increasing in v_1 for *all* v_2 , and there is a strictly positive probability, from the point of view of firm 1, that firm 2 will disclose a value of $v_2 \in (\lambda - 3, \lambda - 2]$, firm 1's expectation of $\Pi_1^*(v_1, v_2)$ is strictly increasing in v_1 for all $v_1 \in (\lambda - 5, \lambda]$. From Milgrom [22] again, firm 1 will therefore disclose for all $v_1 \in (\lambda - 5, \lambda]$, as will firm 2. Repeating this argument gives full disclosure. ■

Proof of Proposition 2. Setting $V_1 = V_2 = v$, profits in the post-disclosure subgames are given by:

(a) When $\hat{v} < 1$: $\Pi_i = \frac{\hat{v}^2}{4}$

(b) When $1 \leq \hat{v} \leq \frac{3}{2}$: $\Pi_i = \frac{2\hat{v} - 1}{4}$

(c) When $\hat{v} > \frac{3}{2}$: $\Pi_i = \frac{1}{2}$

First assume that neither firm discloses, whatever the value of v . Then consumer expectations of v in the event of no disclosure are given by $\hat{v} = \frac{\mu}{2}$. By not disclosing, then, each firm will earn profits of $\frac{1}{2}$ (since $\mu > 3$). Firms cannot earn more than this by disclosing, however high the value of v . This proves the existence of a no disclosure equilibrium.

Suppose instead that one (or both) firms disclose whenever v lies in some set S with strictly positive measure. There are two cases to consider:

- (i) There is some $\tilde{v} < \frac{3}{2}$ for which disclosure occurs: Then there must be disclosure for all $v \in [\tilde{v}, \mu]$, since $\Pi_i^*(v) > \Pi_i^*(\tilde{v})$ for all such v . It follows that, in the absence of disclosure, consumers expect $\hat{v} < \frac{3}{2}$. Since this is in the strictly increasing region of the profit function, unraveling occurs and we get full disclosure.
- (ii) There is no $\tilde{v} < \frac{3}{2}$ for which disclosure occurs: Then $S \subset [\frac{3}{2}, \mu]$, and so again, in the absence of disclosure, consumers expect $\hat{v} < \frac{3}{2}$ and we get full disclosure.

■

Proof of Proposition 3. The proof follows from the analysis immediately preceding the statement of the proposition. ■

Proof of Proposition 4.

- (a) Suppose that after non-disclosure of v_i and $v + v_i$, consumer expectations of V_i are given by \hat{V}_i , consumer expectations of V_j are given by \hat{V}_j , and consumer expectations of v are given by \hat{v} . Recall that $\Pi_i^*(\hat{V}_1, \hat{V}_2)$ is strictly increasing in V_i for all $\hat{V}_i \geq \hat{V}_j - 3$. Note that we must have $\hat{V}_j \leq \lambda + \hat{v}$. Disclosing any $v_i > \lambda - 3$, then, guarantees that $\hat{V}_i > \lambda - 3 + \hat{v} \geq \hat{V}_j - 3$, and that we are in the strictly increasing region of Π_i^* . Thus by the same argument as in the proof of Proposition 1, firm i will, in equilibrium, prefer disclosure of v_i to no disclosure, for all v_i . Note that this argument made no mention of whether firm i chose to disclose v or not. It follows immediately that, in equilibrium, firm i will (i) disclose v_i , (ii) disclose v and v_i , or (iii) disclose $v + v_i$.

(b) Suppose firm i discloses v_i for all v_i and $i = 1, 2$. If neither firm discloses v , for all v , we have $\hat{v} = \mu/2 \geq 3/2$ (since $\mu \geq 3$), and hence $\hat{V}_1 + \hat{V}_2 \geq 3$. Consider two (exhaustive) cases:

(i) $|v_i - v_j| \leq 3$. Then $|\hat{V}_i - \hat{V}_j| \leq 3$, and the expression for firm i 's profit is given by:

$$\Pi_i = \frac{1}{2} \left(\frac{1}{3} (\hat{V}_i - \hat{V}_j) + 1 \right)^2 = \frac{1}{2} \left(\frac{1}{3} (v_i - v_j) + 1 \right)^2$$

It is easy to see that disclosing the value of v does not change i 's profit.

(ii) $|v_i - v_j| > 3$. Then $|\hat{V}_i - \hat{V}_j| > 3$. Assume w.l.o.g. that $v_i > v_j$. Then:

$$\Pi_i = \hat{V}_i - \hat{V}_j - 1 = v_i - v_j - 1, \text{ and } \Pi_j = 0.$$

Again, it is easy to see that disclosing the value of v does not change either firm's profit.

■

References

- [1] Bar-Gill, Oren (2004), "Seduction by Plastic," *Northwestern University Law Review*, 98, 1373–1434.
- [2] Bar-Gill, Oren and Franco Ferrari (2010), "Informing Consumers About Themselves," *Erasmus Law Review*, 3, 93–119.
- [3] Bar-Gill, Oren and Rebecca Stone (2009), "Mobile Misperceptions," *Harvard Journal of Law and Technology*, 23, 49–118.
- [4] Board, Oliver (2009), "Competition and Disclosure," *Journal of Industrial Economics*, 57, 197–213.
- [5] Cooter, Robert D. and Thomas Ulen (2011), *Law and Economics* (6th edition), Addison Wesley, New York.

- [6] Craswell, Richard (2006), “Taking Information Seriously: Misrepresentation and Nondisclosure in Contract Law and Elsewhere,” *Virginia Law Review*, 92, 565–632.
- [7] Della Vigna, Stefano and Ulrike Malmendier (2006), “Paying Not to Go to the Gym,” *American Economic Review*, 96, 694–719.
- [8] Duhigg, Charles (2009), “What Does Your Credit-Card Company Know About You?” *New York Times*, May 17, 2009.
- [9] Federal Communications Commission (2009), Notice of Inquiry: Consumer Information and Disclosure, CG Docket No. 09-158, Released August 28, 2009.
- [10] Federal Trade Commission, News Release, FTC Proposes New Method for Testing Amounts of Tar, Nicotine, and Carbon Monoxide in Cigarettes: New System Will Provide Consumers With Improved Info. About Cigarette Tar and Nicotine Yields, Sept. 9, 1997.
- [11] Grossman, Sanford J. (1981), “The Informational Role of Warranties and Private Disclosure about Product Quality,” *Journal of Law and Economics*, 24, 461–483.
- [12] Grossman, Sanford J. and Oliver D. Hart (1980), “Disclosure Laws and Takeover Bids,” *The Journal of Finance*, 35, 323–334.
- [13] Grubb, Michael D. (2009), “Selling to Overconfident Consumers,” *American Economic Review*, 99, 1770–1807.
- [14] Hirshleifer, Jack (1971), “The Private and Social Value of Information and the Reward for Inventive Activity,” *American Economic Review*, 61, 561–574.
- [15] Kamenica, Emir, Sendhil Mullainathan, and Richard Thaler (2011), “Helping consumers know themselves,” working paper, University of Chicago, Chicago IL.
- [16] Kronman, Anthony T. (1978), “Mistake, Disclosure, Information, and the Law of Contracts,” *Journal of Legal Studies*, 7, 1–34.
- [17] Levin, Dan, Jim Peck, and Lixin Ye (2009), “Quality Disclosure and Competition,” *Journal of Industrial Economics*, 57, 167–196.

- [18] Lynch, John G. and Gal Zauberman (2006), “When Do You Want It? Time, Decisions, and Public Policy,” *Journal of Public Policy & Marketing*, 25, 67–78.
- [19] MacDonald, Duncan A. (2007), Viewpoint: Card Industry Questions Congress Needs to Ask, *American Banker*, Mar. 23, 2007.
- [20] Mann, Ronald (2006), *Charging Ahead: The Growth and Regulation of Payment Card Markets*, Cambridge University Press, New York.
- [21] Matthews, Steven and Andrew Postlewaite (1985), “Quality Testing and Disclosure,” *Rand Journal of Economics*, 16, 328–340.
- [22] Milgrom, Paul (1981), “Good News and Bad News: Representation Theorems and Applications,” *Bell Journal of Economics*, 12, 380–391.
- [23] Milgrom, Paul (2008), “What the Seller Won’t Tell You: Persuasion and Disclosure in Markets,” *Journal of Economic Perspectives*, 22, 115–131.
- [24] Nalebuff, Barry, and Ian Ayres (2003), *Why Not?*, Harvard Business School Press, Boston.
- [25] Schwartz, Alan (1988), “Proposals for Product Liability Reform: A Theoretical Synthesis,” *Yale Law Journal*, 97, 353–419.
- [26] Shavell, Steven (1994), “Acquisition and Disclosure of Information Prior to Sale,” *Rand Journal of Economics*, 25, 20–36.
- [27] Sovern, Jeff (2006), “Toward a New Model of Consumer Protection,” *William & Mary Law Review*, 47, 1635–1709.
- [28] Thaler, Richard H. and Cass R. Sunstein (2008), *Nudge: Improving Decisions about Health, Wealth and Happiness*, Yale University Press, New Haven and London.